SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY, SURAT

SVNIT

No: Dean (Acad.)/IAAC/ 18 /2023-24 Date: 02/04/2024

The minutes of the 66th meeting of the Institute Academic Advisory Committee (IAAC)

The aforesaid meeting was held on 20th March 2024, 03:30 pm onwards in the Institute Conference room, first floor, Administrative Building. The following members attended the IAAC meeting.

Sr. No.	Name	Designation
1	Dr. Anupam Shukla	Director, ***Chairman***
2	Dr. Pramod Mathur	Registrar
3	Dr. C.D. Modhera	Dean (Faculty Welfare)
4	Dr. U.D. Dalal	Dean (Alumni & Resources Generation)
5	Dr. J.K. Parikh	Dean (Research and Consultancy)
6	Dr. S.R. Patel	Dean (Students' Welfare)
7	Dr. M. Chakraborty	Head, Department of Chemical Engineering
8	Dr. R. A. Christian	Head, Department of Civil Engineering
9	Dr. M.A. Zaveri	Head, Department of Computer Science and Engineering
10	Dr. Ritu Tiwari	Head, Department of Artificial Intelligence
11	Dr. P.B. Darji	Head, Department of Electrical Engineering
12	Dr. J.N. Sarvaiya	Head, Department of Electronics Engineering
13	Dr. A.A. Shaikh	Head, Department of Mechanical Engineering
14	Dr. D.R. Roy	Head, Department of Physics
15	Dr. J.M. Dhodiya	Head, Department of Mathematics
16	Dr. B.Z. Dholakiya	Head, Department of Chemistry
17	Dr. Urvashi Kaushal	Head, Department of Humanities and Social Sciences
18	Dr. R. K. Jana	Associate Dean (Academic)
19	Dr. V.K. Patel	Associate Dean (Academic)
20	Dr. P. N. Patel	Associate Dean (Research and Consultancy)
21	Dr. N. D. Jariwala	Associate Dean (Research and Consultancy)
22	Dr. S. N. Shah	Associate Dean (Students' Welfare)
23	Dr. B. Kondraivendhan	Associate Dean (Faculty Welfare)
24	Dr. H. R. Jariwala	Dean (Academic), ***Member-Secretary***

The following members could not attend the meeting.

Sr. No.	Name	Designation
1	Dr. S.S. Arkatkar	Dean (Planning and Development)
2	Dr. K.P. Desai	Head, Department of Management Studies
3	Dr. Y.D. Patil	Associate Dean (Planning and Development)
4	Dr. S. R. Arya	Associate Dean (Planning and Development)
5	Dr. Sushil Kumar	Associate Dean (Faculty Welfare)
6	Dr. H.K. Dave	Associate Dean (Alumni & Resource Generation)
7	Dr. H.P. Bulsara	Associate Dean (Alumni & Resource Generation)
8	Dr. M. K. Rathod	Associate Dean (Research and Consultancy)
9	Dr. R. K. Maurya	Associate Dean (Students' Welfare)

Items and Resolutions

<table>
<tr><th>Item No.</th><th>Agenda Item</th></tr>
<tr><td>Item 66.1</td><td>To consider the application received from Project Co-ordinators for approval of CO and Rubrics of UG Project CE 407. (Res. no. 60.4 of the 60th DAAC meeting held on 03/11/2023) (Annexure – 66.1)</td></tr>
<tr><td>Reso. 66.1</td><td>The COs and Rubrics of UG Project CE 407 of DoCE are recommended for the approval of the Senate.</td></tr>
<tr><td>Item 66.2</td><td>About an 'addition' of External Co-supervisor Dr. M. Parida, Director, CRRI, New Delhi for PhD Student Mr. Bhanu Chaudhary enrolled in the FIR category (D22CE001), currently working under the supervision of Dr. B.N. Tandel (Res. No.60.5 of the 60th DAAC meeting held on 3/11/2023). A consent letter (email) of Dr. M. Parida is submitted with the DAAC recommendation.</td></tr>
<tr><td>Reso. 66.2</td><td>The request is approved.</td></tr>
<tr><td>Item 66.3</td><td>To consider the request received from following students for the category conversion from FIR to PEC (Res. No.60.6 of the 60th DAAC meeting held on 3/11/2023).
<table>
<tr><td>Avni Katariwala</td><td>D20CE028</td><td>Dr. A.K. Desai</td></tr>
<tr><td>Urvashi Malani</td><td>DS20CE022</td><td>Dr. S.M. Yadav</td></tr>
<tr><td>Prajakta Jadhav</td><td>DS19CE004</td><td>Dr. V.L. Manekar & Dr. J.N. Patel</td></tr>
<tr><td>Abhishek Devidas Chaudhari</td><td>DS17AM009</td><td>Dr. S.R. Suryawanshi</td></tr>
</table>
The students have submitted 'No Objection Certificate' from the Employers with the recommendations.</td></tr>
<tr><td>Reso. 66.3</td><td>The requests are approved.</td></tr>
<tr><td>Item 66.4</td><td>To consider a request of Ph.D. student Nishant Sourabh (DS16CE002) enrolled in FIR category, working under the supervision of Dr. P.V. Timbadiya and Dr. P. L. Patel for one year extension to complete Ph.D. work due to his illness during pandemic year 2020-2021. His period of validity of Ph.D. registration seven (07) years got over in December2023. Requirement of Minimum TWO Technical papers in Journals enlisted in</td></tr>
</table>

	SCI/SCI(E) (Clarivate Analytics) / Scopus/Web of Science (non-paid journal) not fulfilled yet. (Res. No.60.9 of the 60th DAAC meeting held on 03/11/2023).
Reso. 66.4	The student has completed the seven year duration in December 2023. The supervisors are requested to verify whether the scholar meets the academic requirements within 7 years from the date of joining the PhD program. If he meets the academic requirements, then the recommendations of the DAAC, DoCE are required for further approval.
Item 66.5	About an 'addition' of External Co-supervisor Dr. S. Velmurugan, Chief Scientist, CSIR-CRRI, New Delhi for PhD Student Mr. Ziauddin Rahimi enrolled in the FRS category (D22CE013) currently working under the supervision of Dr. G.J. Joshi (Res. No.61.1 of the 61st DAAC meeting held on 28/11/2023). A consent letter (e-mail) of Dr. S. Velmurugan is submitted with the DAAC recommendation.
Reso. 66.5	The request is approved.
Item 66.6	To consider the application received from Ph.D. student Ziauddin Rahimi enrolled in the FRS category (D22CE013) (ICCR student) working under the supervision of Dr. G. J. Joshi, to allow him to continue his research work in his country Afghanistan till he gets the visa. (Res. No.64.1 of the 64th DAAC meeting held on 28/02/2024).
Reso. 66.6	It is resolve to stop the fellowship of the student immediately through ICCR. The student may be informed (through Head, DoCE) to complete the VISA formality by 26.07.2024 and to join the Institute by his physical presence on or before that.
Item 66.7	To approve the revised teaching scheme and syllabus for the M. Tech. programme in Instrumentation and Control (IC) and change in the nomenclature of programme's title. The revision in the existing M. Tech. IC programme accounts for its revised contents commensurate with rewording in its title "Control and Automation" to meet the modern requirements and the aspirations of students. (Res. No.1 of the 74thDAAC meeting held on 20/12/2023) **(Annexure- 66.7)**.
Reso. 66.7	The revised teaching scheme and syllabus for the M. Tech. programme in Instrumentation and Control (IC) of DoEE and the renaming of the programme as "Control and Automation" are recommended for the approval of the Senate.
Item 66.8	A request of Ph.D. student Ms. Uttamarani Pati (DS20EL014), working under the supervision of Dr. Khyati D. Mistry, for the category conversion from the FIR to PEC (resolution no. 2 of the 74th DAAC meeting held on 20/12/2023). The student has submitted 'No Objection Certificate' from the Employers with the recommendations.
Reso. 66.8	The request is approved.
Item 66.9	A request of Ph.D. student Upplapati Sudheer Kumar (DS22EL004), working under the supervision of Dr. Sukanta Halder, for the category conversion from the FPS (Full-time Project Staff) to FIR as a special case. (resolution no. 1 of the 75th DAAC meeting held on 28/02/2024). Student has not completed 3rd semester so far. The commencement date as FIR category is to be considered as 01.03.2024. He has qualified GATE examination in June 2017. He has been serving as a JRF in the SERB project. The Principal Investigator of the SERB project Dr. Sukanta Halder from the Institute has joined IIT, Dhanbad so the project is also transferred to IIT Dhanbad. The student has further requested for change of Supervisor. Now onwards his supervisor will be Dr. Basant Kumar Sethi and Co-supervisor will be Dr. Sukanta Halder. Dr. Basant Kumar Sethi has given his consent to act as Supervisor. The recommendation of the DAAC, DoEE is forwarded for the further approval.

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<tr><td>Reso. 66.9</td><td>The requests (i) change in category from FPS to FIR and (ii) change in supervisor are approved. Dr. Basant Kumar Sethi will act as supervisor and Dr. Sukanta Halder will be the Co-supervisor of the student.</td></tr>
<tr><td>Item 66.10</td><td>To change Ph.D. supervisor and Co-supervisor of Ph.D. scholars as listed in the following table working under Dr. Sukanta Halder, Assistant Professor, DoEE, who has joined IIT, Dhanbad. (Resolution no. 2 of the 75th DAAC meeting held on 28/02/24).
<table>
<tr><th>Students' Name</th><th>Reg. No.</th><th>Existing Supervisor(s)</th><th>Proposed Supervisor(s)</th></tr>
<tr><td>Totan Das (PEC)</td><td>D21EL010</td><td>Prof. V.A. Shah
Dr.Sukanta Halder</td><td>Prof. V.A. Shah
Dr.Sukanta Halder</td></tr>
<tr><td>Nilanjan Das (FIR)</td><td>D22EL009</td><td>Dr.Sukanta Halder
Dr. Rakesh Maurya</td><td>Dr. Rakesh Maurya
Dr.Sukanta Halder</td></tr>
<tr><td>S K Bittu (FIR)</td><td>DS22EL003</td><td>Dr.Sukanta Halder</td><td>Prof. V.A. Shah
Dr.Sukanta Halder</td></tr>
<tr><td>V G Murali Krishna (FIR)</td><td>D23EL004</td><td>Dr.Sukanta Halder
Dr. Sanjay Tolani</td><td>Dr. Sanjay Tolani
Dr.Sukanta Halder</td></tr>
<tr><td>Bijay Kumar Mudi (ERS)</td><td>DS23EL003</td><td>Dr.Sukanta Halder
Dr. Sanjay Tolani</td><td>Dr. Sanjay Tolani
Dr.Sukanta Halder</td></tr>
</table>
Prof. V.A. Shah, Dr. Rakesh Maurya and Dr. Sanjay Tolani have given their consent to act as supervisor. The total number of FIR and total no. of research scholars are within the limit of the concerned faculty members.</td></tr>
<tr><td>Reso. 66.10</td><td>The recommendation of the DAAC, DoEE for the change in supervisor of the above Ph.D. students of Dr.Sukanta Halder, who left the Institute on 04/03/2024 is approved. The total number of FIR students of Prof. V.A. Shah, Dr. Rakesh Maurya and Dr. Sanjay Tolani are within limit.</td></tr>
<tr><td>Item 66.11</td><td>To consider a request of Ph.D. student Arvind Singh Rajppot (DS22CS002) enrolled in the FIR category, working under the supervision of Prof. Anupam Shukla, Director, SVNIT and Dr. Alok Kumar, Asst. Prof., DoCSE, discontinue/ relieve Dr. Alok Kumar, Assistant Professor, DoCSE, as his Ph.D.Co-supervisor and add Dr. Rahul Dixit, Assistant Professor, DoAI as Co-supervisor. (Resolution no. 1 of the DAAC meeting held on 09/1/24). A consent letter of Dr. Alok Kumar and Dr. Rahul Dixit submitted with the DAAC recommendation.</td></tr>
<tr><td>Reso. 66.11</td><td>The recommendation of the DAAC is approved.</td></tr>
<tr><td>Item 66.12</td><td>It is proposed that the first year course Fundamental of Computer and Programming (FCP) course should be taught by the respective department only. This is proposed due to the insufficient number of regular faculty members in the DoCSE. It is also observed that the other departments are offering the advanced subjects of CSE like Data Structures, Machine Learning etc. which are taught by that respective department only. (Resolution no. 4 of the DAAC meeting held on 6/3/24).</td></tr>
<tr><td>Reso. 66.12</td><td>The matter was discussed at length. After deliberations, it was decided that now onwards, Fundamental of Computer and Programming subject will be taught by the faculty members of respective department.</td></tr>
<tr><td>Item 66.13</td><td>To change Ph.D. supervisors of Ph.D. scholar under Dr. Rasika Dhavse, Associate Professor, DOEcE, who has taken voluntary retirement from the Institute. (Resolution no. 2 ofthe 83rd DAAC meeting held on 25/01/24).</td></tr>
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<tr><td></td><td><table>
<tr><th>Students' Name</th><th>Reg. No.</th><th>Status of the Doctoral Programme</th><th>Proposed Supervisor(s)</th></tr>
<tr><td>Sudhanshu Janwadkar (FIR)</td><td>DS17EC002</td><td>Thesis submitted</td><td>HOD (Adm. Supervisor)
Dr. Rasika Dhavse</td></tr>
<tr><td>Subham Anjankar (PEC)</td><td>D17EC009</td><td>Pre-synopsis Declared</td><td>Dr. Shivendra Yadav
Dr. Rasika Dhavse</td></tr>
<tr><td>Meet Moradiya (PEC)</td><td>D23EC002</td><td>1st Semester Completed</td><td>Dr. Vivek Garg</td></tr>
</table>
A consent letter of Dr. Shivendra Yadav and Dr. Vivek Garg submitted with the DAAC recommendation.</td></tr>
<tr><td>Reso. 66.13</td><td>The recommendation of the DAAC, DoECE for the change in supervisor of the above Ph.D. students of Dr. Rasika Dhavse, who left the Institute on 28/02/2024 is approved. The total no. of FIR and total no. of PhD students are within the limit of the individual faculty members.</td></tr>
<tr><td>Item 66.14</td><td>To introduce following retrofit electives under the MeitY sponsored Drone Project for B.Tech. III(EC), 5th Semester and B.Tech IV (EC) 7th / 8th Semester (Batch 2022) from July 2024. (Resolution no. 3 of the 83rd DAAC meeting held on 25/01/24). (Annexure- 66.14)
1) EC329 Drones: Design, Communication and Control
2) EC461 UAV Avionics System</td></tr>
<tr><td>Reso. 66.14</td><td>Department of Electronics Engineering has proposed the syllabus of the twonewelective coursesunder the MeitY sponsored Drone Project for B.Tech. III(EC), 5th Semester and B.Tech IV (EC) 7th / 8th Semester (Batch 2022) from July 2024, which has been recommended for the approval of the Senate.</td></tr>
<tr><td>Item 66.15</td><td>To modify the syllabus of EC 332: Global Navigation Satellite System (B.Tech III Sem-VI, Elective –III, Batch 2022) looking to the ongoing MeitY sponsored Drone Project (Resolution no. 4 of the 83rd DAAC meeting held on 25/01/24).
(Annexure 66.15)</td></tr>
<tr><td>Reso. 66.15</td><td>The modified syllabus of EC332: Global Navigation Satellite System (B.Tech III Sem-VI, Elective –III, Batch 2022) is recommended to the Senate for further approval.</td></tr>
<tr><td>Item 66.16</td><td>A request of Ph.D. student Ishan Gawai (DS18ME14), working under the supervision of Dr. D.I. Lalwani, for the category conversion from the FIR to PEC (resolution no. 72.4 of the 72nd DAAC meeting held on 10/11/2023). The student has submitted 'No Objection Certificate' from the Employers with the recommendations.</td></tr>
<tr><td>Reso. 66.16</td><td>The recommendation of the DAAC, DoME is approved.</td></tr>
<tr><td>Item 66.17</td><td>A request of Ph.D. student Bari Nikhil Rambhau (D19ME008), working under the supervision of Dr. Shailendra Kumar, for the category conversion from the FIR to PEC (resolution no. 72.5 of the 72nd DAAC meeting held on 10/11/2023). The student has submitted synopsis on 27/02/24. The student has submitted 'No Objection Certificate' from the Employers with the recommendations.</td></tr>
<tr><td>Reso. 66.17</td><td>The recommendation of the DAAC, DoME is approved.</td></tr>
<tr><td>Item 66.18</td><td>About an 'addition' of Co-supervisor Dr. J. V. Menghani, Associate Professor, DoME for PhD Student Priya Bramhwanshi (D23ME009) enrolled in the PEC category currently working under the supervision of Dr. Sandeep Soni (Res. 73.2 of the 73rd</td></tr>
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<table>
<tr><td></td><td>meeting of the DAAC held on 23/02/2024). A consent letter of Dr. J.V. Menghani is submitted with the DAAC recommendation.</td></tr>
<tr><td>Reso. 66.18</td><td>The recommendation of the DAAC, DoME is approved.</td></tr>
<tr><td>Item 66.19</td><td>About an 'addition' of Co-supervisor Dr. J.V. Menghani, Associate Professor DoME for PhD Student Dhotare Sagar Anandrao Suvarna (D23ME010) enrolled in the PEC category currently working under the supervision of Dr. Sandeep Soni (Res. 73.3 of the 73rd meeting of the DAAC held on 23/02/2024). A consent letter of Dr. J.V. Menghani is submitted with the DAAC recommendation.</td></tr>
<tr><td>Reso. 66.19</td><td>The recommendation of the DAAC, DoME is approved.</td></tr>
<tr><td>Item 66.20</td><td>To change Ph.D. supervisors of Awadhesh Kumar Yadav (D20ME017) enrolled in the FIR category currently, working under the supervision of Dr. T.N. Desai, Professor, DoME, who is going to retired upon superannuation. Now, onwards Dr. Ravi Kant, Professor, DoME act as supervisor and Dr. T. N. Desai as Co-supervisor. (Res. 73.4 of the 73rd meeting of the DAAC held on 23/02/2024). A consent letter of Dr. Ravi Kant is submitted with the DAAC recommendation.</td></tr>
<tr><td>Reso. 66.20</td><td>The recommendation of the DAAC, DoME is approved. The total no of FIR and total number of research scholars working under Prof. Ravikant are within the limit.</td></tr>
<tr><td>Item 66.21</td><td>To consider a request from Ph.D. student Mayank Shah (DS17ME004) enrolled under the FIR category under the supervision of Dr. R.D. Shah, Asso. Professor, DoME upto July 12, 2024 extension for thesis submission. He has fulfilled the academic requirement and submitted the synopsis on September 20, 2023.</td></tr>
<tr><td>Reso. 66.21</td><td>Student has completed Six (06) months duration for the thesis submission on 19/03/2024. However, looking to his progress, the extension up to 19th May, 2024 is recommended for the approval of the Senate as a special case. The student is advised to submit the thesis well within the extended period.</td></tr>
<tr><td>Item 66.22</td><td>To consider the proposed new program B. Tech. (Engineering Physics) for commencement from 2024-25, as per the Reso. 14 of 61st IAAC dtd: 28/2/2. (Resolution no. 2 of the 47thDAAC meeting held on 15/01/24). (Annexure 66.23)</td></tr>
<tr><td>Reso. 66.22</td><td>It is decided to recommend the commencement of new program of B. Tech.(Engineering Physics) proposed by Department of Physics to the Senate. The program may start with the student strength of 30 from the academic year 2024-25.
It is further recommended that the number of seats of existing Five-year integrated M.Sc. program in Physics be reduced to 50 from 75.</td></tr>
<tr><td>Item 66.23</td><td>To consider swapping/shifting of 07 courses in the new NEP based curriculum of Integrated M.Sc. w.e.f. 2023-24 as per the urgent academic requirement. (Resolution no. 3 of the 47th DAAC meeting held on 15/01/24).
<table>
<tr><th>Sr. No.</th><th>Course Name</th><th>Scheme</th><th>Existing Code</th><th>Existing Semester</th><th>Proposed New Code and Semester for Shifting</th></tr>
<tr><td>1</td><td>Classical Mechanics</td><td>3-1-0</td><td>PH204</td><td>4th</td><td>PH203 (3rd)</td></tr>
<tr><td>2</td><td>Quantum Mechanics-I</td><td>3-1-0</td><td>PH203</td><td>3rd</td><td>PH204 (4th)</td></tr>
<tr><td>3</td><td>Fundamentals of Artificial Intelligence</td><td>3-0-2</td><td>CS300</td><td>5th</td><td>CS332 (6th) (3-0-2)* Artificial Intelligence</td></tr>
<tr><td>4</td><td>Digital Electronics</td><td>3-0-2</td><td>PH304</td><td>6th</td><td>PH403 (7th)</td></tr>
<tr><td>5</td><td>Nuclear Physics</td><td>3-0-2</td><td>PH403</td><td>7th</td><td>PH305 (5th)</td></tr>
<tr><td>6</td><td>Statistical Mechanics</td><td>3-1-0</td><td>PH302</td><td>6th</td><td>PH401 (7th)</td></tr>
<tr><td>7</td><td>Plasma Physics</td><td>3-1-0</td><td>PH401</td><td>7th</td><td>PH302 (6th)</td></tr>
</table>
* The actual course code and name is rectified.</td></tr>
</table>

Reso. 66.23	The Item is recommended for the approval of the Senate.
Item 66.24	To revise the course code of Dissertation Preliminaries (CY 506 to CY 503) of M.Sc. Chemistry, Semester IX. (Resolution no. 2 of the 123rd DAAC meeting held on 10/01/24).
Reso. 66.24	The Item is recommended for the approval of the Senate.
Item 66.25	To offer Course CY 251: Principles and Applications of Electrochemistry for 3rd Semester B. Tech. Electrical Engineering students. **(Annexure 66.25)**
Reso. 66.25	The Item is recommended for the approval of the Senate.
Item 66.26	A request of Ph.D. student Majethiya Priyanka (DS23MA002), working under the supervision of Dr. Shivam Bajpeyi, Asst. Professor, DoM for the category conversion from the FIR to ERS w.e.f. 01/02/2024. (resolution no.5.4 of the 5th DAAC meeting held on 24/01/24). He has qualified UGC-CSIR NET examination for Junior Research Fellowship in June2023.
Reso. 66.26	The request is approved.
Item 66.27	A request of Ph.D. student Nikita Chaudhary (D23MA001), working under the supervision of Dr. T. R. Singh, Asso. Professor, DoM for the category conversion from FIR to ERS w.e.f. 01/02/2024. (resolution no.5.5 of the 5th DAAC meeting held on 24/01/24). She has qualified UGC-CSIR NET examination for Junior Research Fellowship in June 2023.
Reso. 66.27	The request is approved.
Item 66.28	To consider the proposal to start new programme Dual Degree of Bachelor of Technology and Master of Technology in Mathematics & Computing (MaC). (resolution no.6.2 of the 6th DAAC meeting held on 13/03/24). **(Annexure -66.28)**
Reso. 66.28	Department of Mathematics proposed a new Dual Degree program of Bachelor of Technology and Master of Technology in Mathematics & Computing (MaC) for commencement from 2024-25, with the student strength of 30, which has been recommended for the approval of the Senate. It is further recommended to the Senate that the number of seats of existing Five-year integrated M.Sc. program in Mathematics be reduced to 50 from 75.
Item 66.29	A request of Ph.D. student Rituparna Mondal (D19MA003), working under the supervision of Dr. R.K. Jana, for the category conversion from the FIR to ERS w.e.f 03/2/2024. (resolution no. 6.3 of the 6th DAAC meeting held on 13/03/2024). The student has submitted 'No Objection Certificate' from the Employers with the recommendations.
Reso. 66.29	The request is approved.
Item 66.30	About an 'addition' of Co-supervisor Dr. Kirti Inamdar, Assistant Professor DoECE for PhD Student Jay Vipulkumar Vora (D23PH004) enrolled in the FIR category currently working under the supervision of Dr. Shail Pandey (Reso. 3 of the 48th meeting of the DAAC held on 19/02/2024). A consent email of Dr. Kirti Inamdar is submitted with the DAAC recommendation.

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<tr><td>Reso. 66.30</td><td>The request is approved.</td></tr>
<tr><td>Item 66.31</td><td>To approve to start Summer Internship for the students of the Institute and other institute for B.Tech. and 5 years integrated M.Sc. students with maximum 50 students.</td></tr>
<tr><td>Reso. 66.31</td><td>It is decided to start Summer Internship for the students of the Institute and other institute for B.Tech. and 5 years integrated M.Sc. students. This internship will be of 2 months duration and students will get Rs. 5000/- per month as fellowship which will be provided from IRG of the Institute.. Maximum 50 students will be offered this internship. The item is recommended for the approval of the Senate.</td></tr>
<tr><td>Item 66.32</td><td>To approve the scheme and curriculum of B.Tech-II year as per National Education Policy (NEP) for implementation from the Academic year 2024-25. (Annexure 66.32)</td></tr>
<tr><td>Reso. 66.32</td><td>The Scheme and Curriculum of B.Tech-II year, has been recommended for the approval of the Senate. All the engineering departments are advised to offer Minor Degree programs. The minimum number of students required will be 20 to run minor degree program in a particular department. It is also suggested to charge extra examination fees to the students opting for the Minor degree programs.
The Department of Computer Science & Engineering has submitted the Scheme and Curriculum of B.Tech-III & IV as well, which has been recommended for the approval of the Senate.
The Department of Mechanical Engineering has shifted the subject Workshop Practice (ME 105) from B.Tech-I (Mechanical), Sem-I to B.Tech-I (Mechanical), Sem-II with a code ME 108. This is recommended for the approval of the Senate.</td></tr>
<tr><td>Item 66.33</td><td>MoU signed with IIT, Mandi, to start Ph.D. joint Degree Programme from the Academic year 2023-24. Under this programme 4 Four students admitted as follows.
<table>
<tr><th>Home Institution</th><th>Host Institution</th><th>Number of students admitted</th></tr>
<tr><td>IIT Mandi</td><td>SVNIT, Surat</td><td>01</td></tr>
<tr><td>SVNIT, Surat</td><td>IIT, Mandi</td><td>03</td></tr>
</table>
Approval from chairman, Senate required for the same. (Annexure - Item 66.33)</td></tr>
<tr><td>Reso. 66.33</td><td>The Item is recommended for the approval of the Senate.</td></tr>
<tr><td></td><td>Item from Chair</td></tr>
<tr><td>Item 66.34</td><td>To finalize the credits for NPTEL/SWAM courses for 16 weeks.</td></tr>
<tr><td>Reso. 66.34</td><td>The matter discussed and recommended that any NPTEL/SWAM courses for 12 weeks and above has to be awarded 4 credits (Annexure 66.34)</td></tr>
<tr><td>Item 66.35</td><td>To consider the proposed new program B. Tech. (Industrial Chemistry) for commencement from 2024-25 (Resolution no. 2 of the 127th DAAC meeting held on 19/03/24). (Annexure 66.35)</td></tr>
<tr><td>Reso. 66.35</td><td>Department of Chemistry proposed new program B. Tech. (Industrial Chemistry) for commencement from 2024-25, with the student strength of 30, which has been recommended for the approval of the Senate.
It is further recommended that the number of seats of existing Five-year integrated M.Sc. program in Chemistry be reduced to 50 from 75.</td></tr>
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Item 66.36	To approve Reschedule of Academic Activities (Due to Parliamentary Election 2024) **(Annexure 66.36)**
Reso. 66.36	The Item is recommended for the approval of the Senate.

02.04.24

Member-Secretary, IAAC

अनुपम शुक्ला

Director 08/04/24.

Annexure 3(a)
60th DAAC DoCE

CO (Course Outcome) of Undergraduate Seminar

At the end of the course the student will be able to:

CO1	**Identify** and discuss the current real-time issues in the chosen field/area of Civil Engineering
CO2	Learn the art of **literature survey** on identified problem pertaining to Civil Engineering
CO3	Compile the information in a logical manner to produce state-of- the-art technical report
CO4	Develop **technical report writing and presentation skills**
CO5	Develop professional ethics and life long learning skills

Old Rubrics for B Tech V Semester Evaluation

CRITERIA	NOT ACCEPTABLE(1)- POOR	BELOW EXPECTATIONS(2)- AVERAGE	MEET EXPECTATIONS(3)-GOOD	EXCEEDING EXPECTATIONS(4)- EXCELLENT
GENESIS	Any two of the following criteria are missing: Problem statement, objectives and scope	Either problem statement, or objectives or scope is missingor not clearly defined	Problem statement, objectives and scope aredefined	Problem statement, objectivesand scope all are well definedwith clarity
LITERATURE SURVEY	Poor level of literature survey	Level of Literature Study is not sufficient	Adequate Level of Literature Study	Extensive Literature Survey
REPORT PREPARATION	Format and flow of content both are not in logical sequence	Either Format or flow of content is not in logical sequence	Format and flow of content both are acceptable	Format and flow of content is in logical sequence and are well Defined
ORGANIZATION OF PRESENTATION	Any two of the following criteria are missing or poor: Degree of confidence, responsiveness and fluency	Either Degree of Confidence or Responsiveness or Fluency is missing	Degree of Confidence, Responsiveness and Fluency is good	Degree of Confidence, Responsiveness and Fluency is well blended
PROFESSIONAL ETHICS	Plagiarism >31% No Acknowledgement No Citation on figures/tables etc	Plagiarism 21-30% Acknowledgements, citations are missing largely	Plagiarism 11-20% Acknowledgements, citations are missing in few	Plagiarism < =10% Acknowledgements, citations are clearly shown in each figures and tables.

New Rubrics for B Tech V Semester Evaluation

CRITERIA	UNSATISFACTORY (1)-POOR	NOT ACCEPTABLE (2)- POOR	BELOW EXPECTATIONS (3)-	MEET EXPECTATIONS (4)-GOOD	EXCEEDING EXPECTATIONS (5)-EXCELLENT
GENESIS	No Problem statement, objectives and scope	Any two of the following criteria are missing: Problem statement, objectives and scope	Either problem statement, or objectives or scope is missing or not clearly defined	Problem statement, objectives and scope are defined	Problem statement, objectives and scope all are well defined with clarity
LITERATURE SURVEY	No literature survey	Poor level of literature survey	Level of Literature Study is not sufficient	Adequate Level of Literature Study	Extensive Literature Survey
REPORT PREPARATION	No Format and flow of content	Format and flow of content both are not in logical sequence	Either Format or flow of content is not in logical sequence	Format and flow of content both are acceptable	Format and flow of content is in logical sequence and are well Defined
ORGANIZATION OF PRESENTATION	No Degree of confidence, responsiveness and fluency	Any two of the following criteria are missing or poor: Degree of confidence, responsiveness and fluency	Either Degree of Confidence or Responsiveness or Fluency is missing	Degree of Confidence, Responsiveness and Fluency is good	Degree of Confidence, Responsiveness and Fluency is well blended
PROFESSIONAL ETHICS	Plagiarism >41% No Acknowledgement No Citation on figures/tables etc	Plagiarism >31-40% No Acknowledgement No Citation on figures/tables etc	Plagiarism 21-30% Acknowledgements, citations are missing largely	Plagiarism 11-20% Acknowledgements, citations are missing in few	Plagiarism < =10% Acknowledgements, citations are clearly shown in each figures and tables.

Annexure 3(b)
60th DAAC DoCE

Revised CO And Rubrics for UG Project-CE407

Annexure 1
UG Project CE407

Course Outcome:

- At the end of the course, student will be able to
- CO1: Demonstrate sound technical knowledge of selected problem as a project work pertaining to civil engineering domain.
- CO2: Assimilate the art of literature **survey** and appropriate usage of modern tools and techniques relevant to selected problem.
- CO3: Develop the methodological framework and carry out design of experiments related to Field/Laboratory/Computational investigations leading to ~~**valid**~~ **a** conclusion.
- CO4: Acquire the skill of writing and presenting comprehensive technical report/document.
- CO5: Exhibit tendency of lifelong learning, professional ethics and function as a member or leader in a team.

Rubrics for Evaluation

CRITERIA	NOT ACCEPTABLE (1)- POOR	BELOW EXPECTATIONS (2)- AVERAGE	MEET EXPECTATIONS (3)-GOOD	EXCEEDING EXPECTATIONS (4)-EXCELLENT
TECHNICAL KNOWLEDGE (CO1)	Any two of the following criteria are missing: objectives ,scope Or Methodology	Either objectives ,scope Or methodology is missing or not clearly defined	Objectives , scope & methodology are defined	Objectives , scope and methodology is clearly defined
LITERATURE REVIEW (CO2)	Poor level of Literature Survey	Level of Literature Survey is just sufficient	Adequate Level of Literature Survey	Significant Literature Survey
CONDUCT EXPERIMENT or ANALYSIS (CO3)	Incomplete Experiment/Analysis No results None of the objectives met	Complete Experiment/Analysis Few results 35%-50% objectives met	Complete Experiment/Analysis Results not Compiled 51%-70% objectives met	Complete Experiment/Analysis Results are Compiled >70% objectives met
REPORT and PRESENTATION PREPARATION (CO4)	Format and flow of report & presentation both not clear	Either Format or flow of Report & presentation not clear	Format and flow of report & presentation is Adequate	Format and flow of report & presentation well Defined
PROFESSIONAL ETHICS and LIFE-LONG LEARNINIG (CO5)	Plagiarism >31% No Acknowledgement No Citations of Figures Tables etc.	Plagiarism 20-30% Acknowledgement Citations are largely missing	Plagiarism 10-20% Acknowledgements Few Citations are missing	Plagiarism < 10%, sincerity All Acknowledgements and Citations are clearly mentioned

Annexure-B

SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY, SURAT
DEPARTMENT OF ELECTRICAL ENGINEERING
Course Structure and Scheme of Evaluation (Semester-wise)
***M.Tech. in Control and Automation**
(A revised nomenclature of Instrumentation and Control Programme)

SEMESTER I

Sr. No.	Course Code	Course	L	T	P	Credits	Examination Scheme			
			Hrs	Hrs	Hrs		Theory Marks	Tutorial Marks	Practical Marks	Total Marks
1	ELCA101	**Linear System Theory**	3	0	0	03	100	-		100
2	ELCA102	**Robust and Optimal Control**	4	0	0	04	100	-	-	100
3	ELCA103	**Industrial Automation**	3	0	2	04	100	-	50	150
4	ELCA104	**Process Dynamics and Control**	3	0	2	04	100		50	150
5	ELCA1XX	**Elective 1**	3	0	0	03	100	-	-	100
6	ELCA1XX	**Elective 2**	3	0	0	03	100	-	-	100
		TOTAL	**19**	**0**	**4**	**21**	**600**	-	**100**	**700**
	TOTAL			**23**		**21**				

SEMESTER II

Sr. No.	Course Code	Course	L	T	P	Credits	Examination Scheme			
			Hrs	Hrs	Hrs		Theory Marks	Tutorial Marks	Practical Marks	Total Marks
1	ELCA201	**Nonlinear Systems &Control**	3	0	0	03	100	-		100

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2	ELCA202	**System Identification and Adaptive Control**	4	0	0	04	100	-		100
3	ELCA203	**Advanced Control &Instrumentation**	3	0	2	04	100	-	50	150
4	ELCA204	**Advanced Automation**	3	0	2	04	100		50	150
5	ELCA2XX	**Elective 3**	3	0	0	03	100	-		100
6	ELCA2XX	**Elective 4**	3	0	0	03	100	-	-	100
		TOTAL	**19**	**0**	4	**21**	**600**	-	100	**700**
	TOTAL			**23**		**21**				

SEMESTER III

Sr. No.	Course Code	Course	L	T	P	Credits	Examination scheme				
			Hrs	Hrs	Hrs		Theory Marks	Tutorial Marks	Term work Marks	Practical Marks	Total Marks
1	ELCA 301	**Seminar**	-	-	04	02	-	-	20	30	50
2	ELCA302	**Dissertation Preliminaries**	-	-	16	08	-	-	100	150	250
		TOTAL	-	-	**20**	**10**	-	-	**120**	**180**	**300**
	TOTAL			**20**		**10**					

Ch. Rajesh Patil
27/11/23

SEMESTER IV

Institute Elective

Sr. No.	Course Code	Course	L Hrs	T Hrs	P Hrs	Credits	Theory Marks	Tutorial Marks	Term work Marks	Practical Marks	Total Marks
1	ELCA401	**Dissertation**	-	-	24	12	-	-	160	240	400
		TOTAL	**-**	**-**	**24**	**12**	**-**	**-**	**160**	**240**	**400**

Seminar descriptions includes research writing, product design report preparation and their dissemination.

Total: 64 credits (obeying the credit range as adopted in the Senate resolution7 of its 51st meeting)

Elective I (From amongst the following electives, one subject will be offered to each group of students)	
ELCA110	Digital Signal Processing
ELCA111	Embedded Control
ELCA112	Autonomous Vehicles
ELCA113	AI and ML
ELCA114	Mathematical methods in Control

Elective II (From amongst the following electives, one subject will be offered to each group of students)	
ELCA121	Power Electronic Converters
ELCA122	Guidance and Fight control
ELCA123	Control of Renewable Energy Systems
ELCA124	Robotics and Automation
ELCA125	Cyber Physical Systems
ELCA126	Image Processing
ELCA127	Wide Area Power System Control

Elective III (From amongst the following electives, one subject will be offered to each group of students)	
ELCA210	Estimation of Signals and Systems
ELCA211	IoT
ELCA212	Electric Vehicles
ELCA213	Networked Control Systems
ELCA214	Advanced Communications

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ELCA230	Automotive Control Systems
ELCA231/EEPE231	Modern Industrial Drives and Automation
ELCA232	Optimization in Control and Automation
ELCA233	Smart Grids
ELCA234	Instrumentation-based System Design

Note: Throughout this scheme structure, the notations L, T, P, C denote lecture, tutorial, practical and credit respectively for the related subject.

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DRONES: DESIGN, COMMUNICATION, AND CONTROL

L	T	P	Credit
3	0	2	04

EC 329 **Scheme**

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Understand basics of drones and radio communications for drones
CO2	Apply the control theory to drone payload design and control
CO3	Analyze the drone control and navigation
CO4	Evaluate the performance and endurance of battery and fuel powered drones
CO5	Design navigation and control routines for drones
CO6	Explain the components of a drone

2. **Syllabus:**

- **DESIGN OF DRONE SYSTEMS** **(06 Hours)**
Introduction to Design and Selection of the System, Aerodynamics and Airframe Configurations, Characteristics of Aircraft Types, Components and functions of a fixed wing and multi-rotor drones, Design Standards and Regulatory Aspects-India Specific.

- **AVIONICS HARDWARE OF DRONES** **(08 Hours)**
Flight controller module, mission controller onboard computer, data link, telemetry module, servos, accelerometer, gyros, magnetometer, GNSS, actuators, Pressure sensor, velocity sensor, power supply-processor, integration, installation, configuration.

- **PAYLOADS AND CONTROLS** **(08 Hou**
Type, size, and nature of Payloads, Payload versus endurance, Tracking, controls-PID feedback, memory system, simulation, Kalman filtering, kinematics of drones, the control strategy of multi-rotors, Payload release, and variation handling.

- **COMMUNICATION** **(08 Hours)**
Basics of radio wave communication, coherent and non-coherent transmission, modulation-demodulation, filtering, ADC and DAC, baseband signal processing of radio transceiver, Telemetry, radio control frequency range, modems, Servo receiver, and remote controller.

- **NAVIGATION AND TESTING** **(08 Hours)**
Waypoints navigation, Code based positioning, phase-based positioning, Single Point Positioning, Differential positioning, Precise Point Positioning, RTK, ground control software, System Ground Testing, System In-flight Testing

- **FUEL POWERED DRONES** **(07 Hours)**
Engines for drones, thrust control, configurations of fuel-powered drones (FPDs), Analysis of range, power, and weight for FPDs, Vibration issues and mitigation, and Dynamics of FPDs.

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. **List of Practicals:**

1. Basic Setting of ArduPilot for IMU Calibration
2. Basic Setting of ArduPilot for GPS Interface
3. Basic Setting of ArduPilot for RC Settings
4. Basic Setting of ArduPilot for PID tunning
5. Quad-copter Testing and Calibration using Calibration kit
6. Quad-Copter Drone assembly

7. Identify the BLDC motor for drone Take require thrust into consideration while selecting motors
8. Identify LiPo Battery for specific drone and Calculate hover time for drone considering its weight and payload
9. BLDC Motor Introduction and Interface ESC with MCU for Speed Control with PWM
10. PID controller and Implementation of PID controller in MCU
11. Interface RC Controller with Flight Controller and Parameters Setting
12. Flight Controller Introduction and Software Interface

4. Books Recommended:

1. Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.
2. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
3. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007
4. Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998
5. Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics
6. B. P. Lathi and Zhi Ding, "Modern Digital and Analog Communication Systems", Oxford University Press, 2010.

AVIONICS SYSTEM

L	T	P	Credit
3	0	2	04

EC 461

Scheme

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Explain avionics components' working and interfacing
CO2	Program for different avionics components and their interfacing
CO3	Describe the data communication between different avionics components
CO4	Understand basics of SoC
CO5	Design and develop basic IPs and codes in SoC for GNSS receiver and communication transceiver
CO6	Implement system design for positioning of drones using SoCs

2. **Syllabus:**

- **WORKING OF UAV AVIONICS SYSTEMS** **(14 Hours)**
Electronic Speed Controllers, Drone Motors, Ranging Sensors: Light detection and ranging (LiDAR), Laser detection and ranging (LADAR), Synthetic Aperture radar (SAR), Homing Radar, Positioning and Motion Sensors: Gyroscope, accelerometer, magnetometer; Pressure sensor, velocity sensor, Current and Voltage sensors, DC-DC Converters, Telemetry Communication Modules, Remote Servo Control Modules, Flight controller and mission controller onboard computer.

- **UAV EMBEDDED CONTROLLER AND SOFTWARE** **(14 Hours)**
Peripheral protocols like I2C, UART, and SPI; Sensor Interfacing: Accelero/Gyro/Magneto-meter module, Ultrasonic distance sensors, Infrared distance sensors, Lidar, pressure sensor, velocity sensor; Actuator Interfacing: BLDC motor, Servo motor, Solenoid Valve, Encoder DC motor, Gimble; Battery management System interfacing, Flight control software, Mission Control software, GNSS module interfacing, Robotic Motion peripheral interfacing: Motors, Motor Drivers, Motor Shields, ADC, DAC and PWM, Camera Interfacing, remote data logging, Introduction to ROS, Gazebo, and Mission Planner.

- **SOC-BASED GNSS RECEIVER** **(11 Hours)**
Introduction to SoC with RF front ends, Example of SoC designs, architecture of Processor subsystem and Programmable logic sections, data interchange between PS and PL, Implementation of control IPs for PL section including controlling RF front-end and digital control and data channels, FPGA based GNSS receiver Acquisition and Tracking algorithms, PL section system design and integration, Interface design between PL and PS, Implementation of control routines in PS section, AXI-based programming to control PS from PL section, testing of PL and PS section design, PS-PL integrated based band signal processing for GNSS receiver.

- **SOC-BASED TELEMETRY MODULE** **(06 Hours)**
Basics of telemetry transceiver design, radio communication aspect of the transceiver, Implementation of RF signal transmitter and receiver in PL section, Implementation of modulator and demodulator in PL section, DMA controller implementation for data exchange between PS and PL, Implementation of PL routines to get send/receive data between PS/PL and UART interface of PS section, testing of telemetry module.

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. **List of Practicals:**

1. Write a Program to Interface MPU6050 Sensor with MCU
2. Write a Program to Interface BMP280 Sensors with MCU
3. Write a Program to Interface Ultrasonic Sensors with MCU
4. Write a Program to Interface Micro Lidar Sensors with MCU
5. Introduction to Xilinx Vivado-SDK tool chain
6. Example program on Xilinx Vivado
7. Example program on Xilinx SDK
8. Vivado-SDK program PS to PL and PL to PS communication
9. FPGA coding for RF front end interfacing
10. FPGA coding framework for GNSS acquisition
11. FPGA coding framework for GNSS tracking
12. SDK coding for FPGA IP control

4. Books Recommended:

1. Andey Lennon, "Basics of R/C Model Aircraft Design" Model Airplane News Publication
2. John Baichtal, Building your own Drone: A begginers' Guide to Drones,UAVs, and ROVs.
3. Clive Max Maxfield, "The Design Warrior's Guide to FPGAs", Newnes, Elsevier, Oxford OX2 8DP, UK

5. Reference Material:

1. https://docs.xilinx.com/v/u/en-US/dh0050-zynq-7000-design-overview-hub
2. https://xilinx.github.io/video-sdk/v1.5/c_apis.html

GLOBAL NAVIGATION SATELLITE SYSTEM

L	T	P	Credit
3	0	2	04

EC 332 **Scheme**

1. Course Outcomes (COs):

At the end of the course the students will be able to:

CO1	Classify global as well regional navigation systems.
CO2	Apply knowledge of different signal structures of diverse navigation systems.
CO3	Analyze position of GNSS receiver using acquisition and tracking.
CO4	Evaluate various GNSS positioning techniques.
CO5	Design societal application using GNSS.
CO6	Develop GNSS based applications

2. Syllabus:

- **SATELLITE NAVIGATION SYSTEMS** **(08 Hours)**
  Introduction to GNSS systems, Global Navigation systems: GPS, GLONASS, GALILEO, Beidou Regional Navigation systems: QZSS, IRNSS/NavIC

- **SATELLITE SIGNAL and CHARACTERISTICS** **(10 Hours)**
  Signal Models, Correlations and Power Spectral Densities, Direct Sequence Spread Spectrum Signals, Spreading Modulations for Satnav, Doppler Effects, Ionospheric Effects, Signal CHARACTERISTICS: Carrier frequency, Power, Polarization, Multiple access, Spreading modulation and bandwidth, Spreading codes, Data message structure, Data message error correction and detection, Data modulation, Pilot and data components, Overlay codes, Multiplexing, Correlator Output SNR, SINR, SIR, Effective C/N

- **GNSS Receiver and baseband processing** **(12 Hours)**
  Receiver Front End: Components overview, AGC and ADC, Quantization resolution, Acquisition: Overview, Search space and CAF, Sampling Considerations, Serial Search, Parallel time search, FFT based search algorithm, Initial search performance parameters, Discrete update tracking loops: overview, loop design, Noise and dynamics effect on tracking loops, Carrier Tracking and Demodulation: signal processing for carrier tracking, FLL, PLL, coherent demodulation, Code Tracking: signal processing for code tracking, discriminator.

- **POSITION, VELOCITY, AND TIME CALCULATION** **(10 Hours)**
  Positioning: SPP, Determining Satellite Position at Time of Arrival, System of Equations for Finding Receiver Position and Clock Offset, Solving the System of Equations, Velocity Calculation: Using Delta Pseudoranges for Velocity Calculation, Pseudorange Rates for Velocity Calculation, Precise Point Positioning

- **APPLICATIONS OF GNSS** **(05 Hours)**
  Aviation Ground-based Augmentation, Marine Navigation, Space Navigation, Vehicle Navigation, Precision Agriculture, Military Applications, Geodesy, Surveying and Mapping, Atmospheric and Ionospheric Science

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. List of Practicals:

1. Generation and analysis of Gold sequence (PRN) on MATLAB
2. Implementation of continuous correlation on MATLAB
3. Simulation of simple GNSS baseband signal on MATLAB

4. Implementation of filtering baseband signal on MATLAB
5. Implementation of Delay-Doppler search using serial and parallel approach
6. Implementation of Code and Carrier discriminators
7. Implementation of loop filters
8. Implementation of GNSS tracking loops
9. Implementation of GNSS data demodulator
10. Implementation of GNSS data decoder extractor
11. Implementation of GNSS navigation signal processing
12. Implementation of GNSS position solution processing

4. Books Recommended:

1. John W. Betz - Engineering Satellite-Based Navigation and Timing Global Navigation Satellite Systems, Signals, and Receivers - Wiley-IEEE Press (2015)
2. Elliott_D._Kaplan, "Christopher_Hegarty Understanding GPS Principles and Applications", 3rd Ed., Archtech House, Artech House, 2017.
3. Kai Borre,_Dennis M. Akos, Nicolaj Bertelsen, "A Software-Defined GPS and Galileo Receiver: A Single-Frequency Approach", 1st Ed., Peterson, 2007.
4. Scott Madry, "Global Navigation Satellite Systems and Their Applications", Springer series 10058, 2015.
5. Teunissen, Montenbruck, "Handbook of Global Navigation Satellite Systems", 1st Ed., Springer-Verlag, 2017.

सरदार वल्लभभाई राष्ट्रीय प्रौद्योगिकी संस्थान, सूरत
SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY, SURAT
भौतिकी विभाग
DEPARTMENT OF PHYSICS

S V N I T

Ref. No: DoP/Meeting/DAAC/1296/2023-24 **Date**: 22.01.2024

To,
The Dean (Academic)
SVNIT Surat

Subject: Items proposed for the ensuing IAAC.

Ref. Minutes of the 47th DAAC of the Department of Physics, S.V.N.I.T. Surat held on 15th January 2024 at 4:00 PM in the Room No. 007, DoP.

It is to be noted that the 47th DAAC of the Department of Physics, S.V.N.I.T. Surat held on 15th January 2024 at 4:00 PM in the Room No. 007, DoP. In the meeting, resolution of the following items, along with the respective annexures, are placed. It is requested to consider the items in the ensuing IAAC.

Item 2	To consider and forward revised proposals for B.Tech. (Engineering Physics) for commencement from 2024-25, as per the Reso. 14 of 61st IAAC dtd. 28.02.2023.
Reso. 2	The Reso. 14 of 61st IAAC dtd. 28.02.2023 read as: "*The head of the department is advised to explore the placement scenarios of the currently running five years integrated M.Sc. in Physics program which will help in starting new program B.Tech. in Engineering Physics. It is resolved to consider the item for starting the program from the academic year 2024-25.*" The department has explored the placement scenario of the existing integrated M.Sc. course and also the same for B.Tech. (Engineering Physics) in referred institutions like IIT Bombay and IIT Delhi. In order to propose the new program B.Tech. (Engineering Physics) w.e.f. 2024-25, the department carried out rigorous exercise to develop an appropriate curriculum in line of the existing syllabus of IIT Bombay and IIT Delhi along with the approved NEP curriculum structure for B.Tech. program in our institute. The detail of the B.Tech. (Engineering Physics) proposal w.e.f. 2024-25 is placed in **Annexure I.**
Item 3	To consider swapping/shifting of five courses in the new NEP-based curriculum of Integrated M.Sc. w.e.f. 2023-24 as per the urgent academic requirement.
Reso. 3	The DAAC has reviewed the existing sequence of courses (Int. M.Sc. as per NEP-2020 w.e.f. 2023-24). As a result of this, following revised sequences is recommended.

Sr. no.	Course Name	Scheme	Existing Code	Existing Semester	Proposed New Code and Semester for Shifting
1	Classical Mechanics	(3-1-0)	PH204	4th	PH203 (3rd)
2	Quantum Mechanics-I	(3-1-0)	PH203	3rd	PH204 (4th)
3	Fundamentals of Artificial Intelligence	(3-0-2)	CS300	5th	CS332 (6th) [Artificial Intelligence]*
4	Digital Electronics	(3-0-2)	PH304	6th	PH403 (7th)

22-1-24.

विभागाध्यक्ष/Head
भौतिकी विभाग
Department of Physics
स.व.रा.प्रौ.सं., सूरत-७/S.V.N.I.T., Surat-7

	5	Nuclear Physics	(3-0-2)	PH403	7th	PH305 (5th)
	6	Statistical Mechanics	(3-1-0)	PH302	6th	PH401 (7th)
	7	Plasma Physics	(3-1-0)	PH401	7th	PH302 (6th)
	*The actual course code and name is rectified					
Item 4	To consider rectifying the marks of third year student KISHANT KUMAR BHUSHAN (I20PH010) of Int. M.Sc. Physics Course.					
Reso. 4	The following changes in the results of third year student KISHANT KUMAR BHUSHAN (I20PH010) of Int. M.Sc. Physics Course is recommended:					

Sr. No	Adm. No.	Student Name	Tutorial	Mid Sem	Quiz	Internal	End Sem	Total	Grades
1	I20PH010	KISHANT KUMAR BHUSHAN	20.00	30.00	19.00	69.00	42.0	111	AA

This is submitted for consideration of DAAC recommendation.

22-1-24
Member Secretary, DAAC
Department of Physics

22/1/2024
Chairman, DAAC and HoD
Department of Physics

विभागाध्यक्ष /Head
भौतिकी विभाग
Department of Physics
स.व.रा.प्रौ.सं., सूरत-७ /S.V.N.I.T., Surat-7

सरदार वल्लभभाई राष्ट्रीय प्रौद्योगिकी संस्थान, सूरत
SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY, SURAT
भौतिकी विभाग
DEPARTMENT OF PHYSICS

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Ref. No: DoP/Meeting/DAAC/ 1692/2023-24 **Date**: 15.03.2024

To,
The Dean (Academic)
SVNIT Surat

Subject: Items proposed for the ensuing IAAC.

Ref. Minutes of the 49th DAAC of the Department of Physics, S.V.N.I.T. Surat held on 14th March 2024 at 4:00 PM in the Room No. 106, DoP.

It is to be noted that the 49th DAAC of the Department of Physics, S.V.N.I.T. Surat held on 15th March 2024 at 4:00 PM in the Room No. 106, DoP. In the meeting, resolution of the following items, along with the respective annexures, are placed. It is requested to consider the items in the ensuing IAAC.

Item 2	To consider and finalize the revised full syllabus of various courses of M.Sc.-II (Semester III & IV) w.e.f. 2023-24 under NEP-2020.
Reso. 2	The full syllabus of various courses of M.Sc.-II (Semester III & IV) w.e.f. 2023-24 under NEP-2020 was forwarded to the Academic Section through 48th DAAC of DoP (Reso. no. 2; DoP/Meeting/DAAC/1484/2023-24 dtd. 22.02.2024). A **revised version** of the full syllabus of various courses of M.Sc.-II (Semester III & IV) w.e.f. 2023-24 under NEP-2020 is placed as **Annexure I** for consideration.
Item 3	To consider the revised curriculum scheme of Four years of B.Tech. (Engineering Physics) course along with the full syllabus of first year B.Tech. (Engg. Phys.).
Reso. 3	The proposal and curriculum scheme of Four years of B.Tech. (Engineering Physics) course was forwarded to the Academic Section through 47th DAAC of DoP (Reso. no. 2; DoP/Meeting/DAAC/1276/2023-24 dtd. 22.01.2024). A **revised version** of the Curriculum Scheme and Manpower, Infrastructure & Financial Management of Four years of B.Tech. (Engineering Physics) course, along with the **full syllabus** of various courses of the **First year** B.Tech. (Engineering Physics) course is placed as **Annexure II** for consideration.
Item 4	To consider the category conversion of Ms. Nisha Devanand Khotele (Admission No: DS23PH004), Ms. Vishwa Kamal Desai (Admission No: D22PH011), Ms. Juhi Oudichhya (Admission No: DS19PH002) and Ms. Aditi Pathak (Admission No: DS20PH005).

Reso. 4 It is resolved to recommend the proposed category conversion of following students as below:

Name of Student	Admission No	Previous Category	Proposed Category	w.e.f.
Nisha Devanand Khotele	DS23PH004	FIR	ERS (FRS)	29/12/2023
Vishwa Kamal Desai	D22PH011	ERS (FSF)	ERS (FRS)	24/08/2022
Juhi Oudichhya	DS19PH002	FIR	ERS (ERS)	01/03/2024
Aditi Pathak	DS20PH005	FIR	ERS (FSF)	01/03/2024

Item 5 To adopt a policy for selecting a Full-year dissertation for Integrated M.Sc. (w.e.f. July, 2020) Final Year students.

Reso. 5 The item is discussed in length and looking on a better implementation of the selection policy and associated terms of 25% students for the full year dissertation for Integrated M.Sc. (w.e.f. July, 2020) final year students (M.Sc. V) following are concluded:

- Full year dissertation will be applicable only for the candidates who desired to carry out their dissertation in the outstation (outside SVNIT) reputed Int'l or Nat'l Universities/Institutions with full year consent letter/approval from the host University/Professor.
- The selection would be based on the CGPA criteria. However, deserving and exceptional candidate may be considered case-to-case basis.
- In case a selected candidate can't start dissertation work from the beginning of the semester at the designated outstation University/Institute, he/she must attend the department regularly with the assigned internal supervisor until he/she leave SVNIT for the said purpose.
- Any research publication of the full year dissertation students must be shared with the internal supervisor to credit SVNIT.

This is submitted for consideration of DAAC recommendations.

15-03-2024.

Member Secretary, DAAC
Department of Physics

15/03/2024

Chairman, DAAC and HoD
Department of Physics

ANNEXURE - I

S V NATIONAL INSTITUTE OF TECHNOLOGY, SURAT

DEPARTMENT OF PHYSICS

To
The Director
Chairman, IAAC & Chairman, Senate
SVNIT

Date: January 22, 2024

Subject: **B. Tech. (Engineering Physics) proposal w.e.f. 2024-25**
(Ref.: Reso. 14 of 61st IAAC dtd. 28.02.2023)

Dear Sir,

The B.Tech. (Engg. Phys.) proposal w.e.f. 2023-24 was forwarded for consideration in 61st IAAC dtd. 28.02.2023 which was deferred to start from 2024-25 with following resolution:

"*Reso.14: The head of the department is advised to explore the placement scenarios of the currently running five years integrated M.Sc. in Physics program which will help in starting new program B.Tech. in Engineering Physics. It is resolved to consider the item for starting the program from the academic year 2024-25.*"

Accordingly, the placement scenario of ongoing Integrated M.Sc. (Physics) is explored and the entire B.Tech. (Engineering Physics) curriculum is thoroughly revised as per NEP 2020, in the line of currently ongoing same degree course in reputed institutions like IIT Bombay and IIT Delhi, ongoing new NEP based curriculum w.e.f. 2023-24 in Int. M.Sc. (Physics) and other B.Tech. curriculum of SVNIT.

As mandated in Reso. 14 above, the logic of initiating the Integrated MSc (as against classical two years post graduate course), are to train and create a pool of scientifically oriented intellectual manpower as it was realized that they are the ultimate torchbearers of next and more advanced phase of the development of the country.
Hence the courses are so designed that the students pursue their abilities and skills and interests in furthering the sciences. This is achieved by training them to be accepted for more advanced higher studies in the country as well as in abroad. The department is happy to address that with the continuous support, guidance and encouragement by the institute authority, the Integrated M.Sc. (Physics) is nicely placed as following representative statistics for last three academic years:

AY	Discipline	Program	Campus Placement*			Higher Educ. (Ph.D.)	Total students (Pass out)	Overall placed (%)
			Participated	Placed	% Placed			
2020-21	Physics	Int. M.Sc.	15	7	**46.66**	5	20	**60.00**
2021-22	Physics	Int. M.Sc.	34	12	**35.29**	7	42	**45.24**
2022-23	Physics	Int. M.Sc.	37	21	**56.75**	11	51	**62.74**

*Salary Range: 3.5 to 10 LPA Ref.: https://www.svnit.ac.in/web/t&p/about.php

As, just for the sake of clarity and comparison, the classic placement scenario in the above table is nicely aligned with that of the existing M. Tech. courses.

However, the undergraduate B.Tech. (Engineering Physics) is aimed to cater to the need of the industry oriented towards the utilization of the understanding of the core physics for their advanced level of applications, and research. To support this, we present the popularity of the B. Tech. (Engg. Phys.) course successfully running in the institutes across as follows:

Placement Records (Engg. Phys.):

IIT Bombay:

AY	Discipline	Program	Participated	Placed	% Placed	Avg. Salary
2020-21	Engineering Physics	B.Tech.	21	19	**90.48**	**22 LPA**
		Dual Degree (B.Tech.+M.Tech.)	6	6	100	
2021-22	Engineering Physics	B.Tech.	22	21	**95.45**	
		Dual Degree (B.Tech.+M.Tech.)	4	4	100	
2022-23	Engineering Physics	B.Tech.	25	21	**84**	
		Dual Degree (B.Tech.+M.Tech.)	5	4	80	

Ref.: https://campus.placements.iitb.ac.in/

IIT Delhi:

AY	Discipline	Program	% Placed		Avg. Salary
2022-23	Engineering Physics	B.Tech.		87.69	**20 LPA**

Ref.: www.shiksha.com

Recruiting Companies

Analog Devices | tsmc | BYJU'S | ACCENTURE | Capgemini | Flipkart | GAIL | ICICI | Deloitte, etc.

In light of the above, Department of Physics is confident that with the support of all the members of the institute, we will be able to create an excellent pull of undergraduates who can be directly employed in the industry.

The complete revised proposal of B.Tech. (Engineering Physics) is enclosed herewith for the needful.

22.01.24
Chairman

B. Tech. (Engg. Phys.) Proposal Committee

Head & Chairman, DAAC 21/1/2024
Department of Physics

विभागाध्यक्ष/Head
भौतिकी विभाग
Department of Physics
स.व.रा.प्रौ.सं., सूरत-७ /S.V.N.I.T., Surat-7

Encl.

1. Credit summary of B.Tech. (Engineering Physics) course
2. Curriculum of B.Tech. (Engineering Physics) course
3. Manpower, Infrastructure and Financial Management for B.Tech. (Engineering Physics) course

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
DEPARTMENT OF PHYSICS

B.Tech. (Engineering Physics)

Credits Summary

Semester	Credits	Teaching Scheme				Examination Scheme			
		L	T	P	Contact hour/week	L	T	P	Total
1	20	14	2	8	24	500	50	200	750
2	20	14	2	8	24	500	50	200	750
3	20	15	2	6	23	500	50	150	700
4	20	15	3	4	22	500	75	100	675
5	20/21	15	3/4	2/4	20/21/23	500	75/100	50/100	625/675/700
6	20/21	15	2/3	6/8	23/24/25/26	500	50/75	150/200	700/725/750
7	20	15	4/5	0/2	19/20/21/22	500	100/125	0/50	600/625/650
8	20	0	0	40	40	0	0	500	500
Total	**160 - 162**	**103**	**18-21**	**74-80**	**195-204**	**3500**	**500/575**	**1350/1500**	**5300-5475**

Details of Courses included from Parent and other Departments

Semester	No. of courses (Credits)								
	EP*	MA	CY	HSS	CSE	ECE	CE	ME	Total
1	3 (12)	1 (4)	-	1 (2)	-	-	-	1 (2)	**6 (20)**
2	3 (12)	-	-	1 (4)	-	-	-	1 (4)	**5 (20)**
3	3 (12)	1 (4)	-	-	-	-	1 (4)	-	**5 (20)**
4	4 (16)	-	-	-	1 (4)	-	-	-	**5 (20)**
5	4/5 (16/20)	-	0 (0) /1 (5)	-	-	-	-	-	**5 (20/21)**
6	3 (12/13)	-	-	-	1 (4)	1 (4)	-	-	**5 (20/21)**
7	4 (16)	-	-	1 (4)	-	-	-	-	**5 (20)**
8	1 (20)	-	-	-	-	-	-	-	**1 (20)**
Total	**25/26 (113-120)**	**2 (8)**	**0(0) /1(5)**	**3 (10)**	**2 (8)**	**1 (4)**	**1 (4)**	**2 (6)**	**37 (160-162)**
% (approx.)	**≈ 70 (72)**	**≈ 15 (12.5)**			**≈ 16 (14)**				**≈ 100 (100)**

*Proposed Abbreviation for Engineering Physics: EP

- Courses from Department of Physics: **25/26** courses (**113-120** Credits, **70%**)
- Courses from Engineering departments: **6** courses (**22** Credits, **16%**)
- Courses from other Science & HSS departments: **5/6** courses (**18/23** Credits, **15%**)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)
ANNEXURE - II

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	First Semester (1st year of UG)				
1	Waves and Mechanics	EP101	3-1-0	4	70
2	Basics of Electronics	EP103	3-0-2	4	85
3	Thermal Physics	EP105	3-1-0	4	70
4	Numerical Methods and Computer Programming	EP107	3-0-2	4	85
5	Mathematics for Physical Sciences-I	MA123	3-1-0	4	70
6	Indian Value System and Social Consciousness	HS120	2-0-0	2	40
			Total	**22**	**420**
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	EPV01 / EPP01	0-0-10	5	200 (20 x 10)
	Second Semester (1st year of UG)				
1	Basics of Electromagnetics	EP102	3-1-0	4	70
2	Semiconductor Physics	EP104	3-0-2	4	85
3	Introduction to Python Programming	EP106	3-0-2	4	85
4	Mathematics for Physical Sciences-II	MA118	3-1-0	4	70
5	English and Professional Communication	HS110	3-1-0	4	70
			Total	**20**	**380**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	EPV02 / EPP02	0-0-10	5	200 (20 x 10)
	Third Semester (2nd year of UG)				
1	Solid State Physics	EP201	3-0-2	4	85
2	Classical Mechanics	EP203	3-1-0	4	70
3	Optics, Laser and Photonics	EP205	3-0-2	4	85
4	Discrete Mathematical Structure	MA205	3-1-0	4	70
5	Energy and Environmental Engineering	EG110	3-0-2	4	85
			Total	**20**	**395**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	EPV03 / EPP03	0-0-10	5	200 (20 x 10)
	Fourth Semester (2nd year of UG)				
1	Introduction to Mathematical Physics	EP202	3-1-0	4	70
2	Quantum Physics and Applications	EP204	3-1-0	4	70
3	Electrodynamics and its Applications	EP206	3-1-0	4	70
4	Digital Electronics	EP208	3-0-2	4	85
5	Data Structure	CS102	3-0-2	4	85
			Total	**20**	**480**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	EPV04 / EPP04	0-0-10	5	200 (20 x 10)

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

	Fifth Semester (3rd year of UG)				
1	Atomic and Molecular Physics	EP301	3-1-0	4	70
2	Introduction to Quantum Computation	EP303	3-1-0	4	70
3	Nuclear and Particle Physics	EP305	3-0-2	4	85
4	Elective (DE-1)	EP3AA	3-1-0	4	70
5	Elective (DE-2)	EP3BB / CYXXX	3-X-X	4/5	70/100
			Total	**20/21**	**365/395**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	EPV05 / EPP05	0-0-10	5	200 (20 x 10)
	Sixth Semester (3rd year of UG)				
1	Microprocessor and Microcontrollers	EP302	3-0-2	4	85
2	Plasma Science and Applications	EP304	3-1-0	4	70
3	Artificial Intelligence	CS332	3-0-2	4	85
4	Machine Learning	EC366	3-0-2	4	85
5	Elective (DE-3)	EP3CC	3-1-0	4	70
6	Elective (DE-4)	EP3DD	3-X-X	3/4	55/70/85
			Total	**23/24**	**450/465/480**
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	EPV06 / EPP06	0-0-10	5	200 (20 x 10)
	Seventh Semester (4th year of UG)				
1	Professional Ethics, Economics and Business Management	MG210	3-1-0	4	70
2	Statistical Mechanics	EP401	3-1-0	4	70
3	Condensed Matter Physics	EP403	3-1-0	4	70
4	Elective (DE-5)	EP4AA	3-1-0	4	70
5	Elective (DE-6)	EP4BB	3-X-X	4	70/85
			Total	**20**	**350/365**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	EPV07 / EPP07	0-0-10	5	200 (20 x 10)
	Eighth Semester (4th year of UG)				
1	Industrial Internship / Professional Experience (Mandatory)	EP402	0-0-40	20	800 (20 x 40)
			Total	**20**	**800**

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

Sr. No.	Elective	Code	Scheme L-T-P
	DE-1		
1	Introduction to Special Theory of Relativity	EP351	3-1-0
2	Basics of Astronomy and Astrophysics	EP353	3-1-0
3	Nanoscience and Nanotechnology	EP355	3-1-0
4	Quantum Mechanics-II	EP357	3-1-0
	DE-2		
5	Remote sensing	EP359	3-1-0
6	State and Properties of Matter	CY205	3-1-2
7	Laser Technology and Applications	EP361	3-1-0
8	Low-Dimensional Physics and Applications	EP363	3-1-0
	DE-3		
1	Materials Science and Engineering	EP352	3-1-0
2	Density Functional Theory and Applications	EP354	3-1-0
3	Particle Physics and Applications	EP356	3-1-0
4	Interpretative Molecular Spectroscopy	CY302	3-1-0
	DE-4		
5	Solar Cell Technology	EP362	3-0-0
6	Non-Destructive Testing	EP364	3-0-0
7	Thin Films and Vacuum Technology	EP366	3-0-0
8	Global Navigation Satellite System	EP368	3-0-0
	DE-5		
1	Astrophysics and Space Science	EP465	3-1-0
2	Introduction to Quantum Field Theory	EP467	3-1-0
3	Elementary Excitation in Solids	EP469	3-1-0
4	Advanced Quantum Computation	EP471	3-1-0
	DE-6		
5	Electromagnetic Communication	EP473	3-1-0
6	Characterization Techniques	EP475	3-0-2
7	Microwave Plasma Techniques	EP477	3-1-0
8	Nuclear Science and Technology	EP479	3-0-2

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. I, Semester-I WAVES AND MECHANICS EP101	Scheme	L	T	P	Credit
		3	1	0	4

1.	**Course Outcomes (COs):** **At the end of the semester students will be able to**
CO1	Provide a basic understanding of vector algebra and coordinate systems.
CO2	Define the concepts of various laws of motion and moments of inertia.
CO3	Explain Euler's concepts related to rigid body motion.
CO4	Interpret the elastic properties of materials and rephrase the concept of hydrodynamics.
CO5	Develop an understanding of simple harmonic motions via various applications.
CO6	Classify waves and oscillations.

2.	**Syllabus**	
	FUNDAMENTALS OF VECTOR ALGEBRA AND DIFFERENT COORDINATE SYSTEMS	**(07 Hours)**
	Unit vectors, Vector operations, Scalar and vector triple products, Vector algebra in terms of the components, Differential calculus, Cartesian coordinate system, Cylindrical coordinate system, Spherical coordinate system.	
	NEWTON'S LAWS OF MOTION, CONSERVATION LAWS, AND MOMENTS OF INERTIA	**(08 Hours)**
	Mechanics of single and many particles, Equation of motion, Various conservation laws, Moments of inertia, Motion in the central force field	
	RIGID BODY MOTION	**(08 Hours)**
	Euler's theorem, Angular momentum and kinetic energy, Euler's equation of motion, Euler's angles.	
	ELASTICITY AND HYDRODYNAMICS	**(08 Hours)**
	Stress and strain, Young's modulus, Shear modulus and Bulk modulus, Buoyancy, Types of fluid flow, Bernoulli's equation, Viscosity, Terminal velocity.	
	WAVES	**(07 Hours)**
	Wave Motion, Interference and the principle of superposition, Reflection and transmission of waves,Standing waves, Vibration, Transverse and longitudinal waves; Propagation of sound wave, its properties, Beats, Diffraction, Doppler effect.	
	OSCILLATIONS	**(07Hours)**
	Simple Harmonic Oscillations, Damped Oscillations, Coupled Oscillations, and Resonance.	
	Tutorials will be based on the coverage of the above topics separately (15 Hours)	
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Tutorials**
1.	Proof of various relations formed using the different kind of vectors.
2.	Cover the various mechanical and electrical problems based on vector analysis.
3.	Though the numerical exercise one will learn the role of coordinate systems to solve the problems.
4.	Problems based on the motion of a single and many particles under the influence of different kindof forces.
5.	Projectile motion of particle, Motion of a charged particle in electromagnetic fields, Variousproblems related to moment of inertia.
6.	Numerical questions based on the aspects covered in the section of rigid body motion.
7.	Various types of questions for the calculation of stress, strain, young's modulus, shear modulus and bulk modulus;
8.	Numerical problems based on Bernoulli principles and terminal velocity.
9.	Basic numerical questions to understand the concept of waves on string and sound waves both andobtain various physical parameters used to quantify the waves.
10.	Problems based on simple harmonic motion, damped and coupled oscillations etc.

4.	**BOOKS RECOMMENDED**
1.	Mathur D. S., Mechanics, S. Chand & Company, 2000.
2.	Takwale R. G. & Puranik P. S., Introduction to Classical Mechanics, Tata McGraw-Hill Book Co., 1997.
3.	Feynman R. P., Lighton R. B. and Sands M., The Feynman Lectures in Physics Vol. 1, NarosaPublishers, 2008.
4.	Verma H. C., Concepts of Physics, Vol. 1 & 2, Bharati Bhavan, 2007.
5.	Landau L. D. & Lifshitz E M, Course on Theoretical Physics, Vol. 1: Mechanics, Addison- Wesley, 2002

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. I, Semester-I BASICS OF ELECTRONICS EP 103	Scheme	L	T	P	Credit
		3	0	2	4

1.	Course Outcomes (COs): At the end of the semester students will be able to
CO1	Understand the basis concept of circuit analysis theorem
CO2	Demonstrate familiarity with basic electronic components and use them to design simple electronic circuits
CO3	Describe the application of transistors for Current and voltage amplification. Also, to describe the characteristics of different configurations of the transistor
CO4	Discuss the ideal of operational amplifier and their electrical parameters
CO5	Analyze and design the different types of Oscillators, and their applications

2.	Syllabus	
	BASIC CIRCUIT ANALYSIS	**(06 Hours)**
	Kirchhoff's current and voltage law, Network analysis, Superposition theorems.	
	SEMICONDUCTOR JUNCTION DIODES & APPLICATIONS	**(08 Hours)**
	The open circuit p-n junction, Energy bands in junction diode, I-V characteristics of p-n junction,diode as rectifier, Half-wave, full-wave, and bridge rectifier. Various applications of diode	
	SEMICONDUCTOR TRANSISTOR & APPLICATIONS	**(08 Hours)**
	Junction transistor, transistor construction, CB, CE and CC configurations, cut-off and saturation regions, transistor load-line, Quiescent point, Transistor as an amplifier, Current gain and voltagegain.	
	FREQUENCY RESPONSE OF AMPLIFIERS	**(07 Hours)**
	The gain-bandwidth product, frequency response of CB, CE and CC amplifier, Classification of amplifiers, Feed-back in amplifiers and its classification, Study of different properties with feed- back Amplifier applications.	
	OPERATIONAL AMPLIFIERS	**(08 Hours)**
	The differential amplifier, The basic operational amplifier, The emitter-coupled differential amplifier, Transfer characteristics of a differential amplifier, Offset error voltage and currents, Parameters, Frequency response.	
	OSCILLATORS	**(08 Hours)**
	Criteria for oscillation, tank circuit, L-C oscillator, Hertley Oscillator, Colpitts oscillator, The phaseshift oscillator, the Wien bridge oscillator, Crystal oscillator.	
		Tutorials will be based on the coverage of the above topics separately (15 Hours)
		(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Practicals**
1.	Study and verification of Norton's Theorem.
2.	Study and verification of Thevenin's Theorem.
3.	Study and verification of Reciprocity Theorem.
4.	Study and verification of Superposition Theorem.
5.	Study and verification of Maximum Power Theorem.
6.	Study of Half Wave Rectifier.
7.	Study of Full Wave Rectifier.
8.	Study of Full Wave Bridge Rectifier.

4.	**Books Recommended**
1.	Ryder, J.D., Electronics fundamentals and applications: Integrated and Discrete Systems, Prentice – Hall of India, 1999.
2.	Sze, S.M., Physics of Semiconductor Devices, John Wiley & sons, 1981.
3.	Floyd, T.L., Electronic Devices (5th ed). Pearson education Asia, 2001.
4.	Malvino, A.P. Electronic Principles, Tata McGraw Hill,1999.
5.	Mottershed, A., Electronic Devices and circuits, Prentice Hall India,1989.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B. Tech. - I, Semester - I THERMAL PHYSICS EP105	Scheme	L	T	P	Credit
		3	1	0	4

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Explain the fundamental concepts of thermodynamics laws and thermodynamic processes
CO2	Acquire the knowledge of Maxwell's thermodynamics relations and thermodynamic potentials.
CO3	Learn the concepts of black body radiation from thermodynamics point of view.
CO4	Develop the fundamental concept of kinetic theory of gases.
CO5	Learn the properties of ideal gas and real Van der wall's gas state.

2.	**Syllabus**	
	FUNDAMENTALS OF THERMODYNAMICS	**(12 Hours)**
	Zeroth law of Thermodynamics, First and Second laws of Thermodynamics, Work done in different Thermodynamic process, Heat capacity and Specific heat capacity, Internal energy and entropy, Heat engine, Carnot Cycle and Theorem, Calculations of change of internal energy and entropy in various thermodynamic processes.	
	THERMODYNAMICS POTENTIALS & MAXWELL'S RELATIONS	**(10 Hours)**
	Internal Energy, Gibbs and Helmholtz energy, Gibb's paradox and its resolution, Enthalpy, Maxwell's thermodynamic relations, Application of Maxwell's thermodynamic relations.	
	THERMODYNAMICS OF BLACK BODY	**(08 Hours)**
	Black body and characteristics, Radiation principles like Rayleigh Jeans, Wein's and Planck's law of black body radiation	
	KINETIC THEORY OF GASES	**(08 Hours)**
	Maxwell Boltzmann equation, Postulates of kinetic theory of gases, velocity of gas molecules, Molecular energy, Kinetic-molecular model of an ideal-gas, kinetic interpretation of temperature, Degree of freedom of gas molecules, Maxwell's law of equipartition of energy.	
	TRANSPORT PROPERTIES	**(07 Hours)**
	Viscosity of a gas, Thermal conductivity of gases, Van der wall's equation of state, Brownian motion.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
		(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Tutorials**
1	Cover a variety of numerical problems to understand the concepts of thermodynamics
2	Problems based on refrigerator, heat engine and Carnot engine to understand its working principle.
3	Calculation of various equilibrium quantitates such as heat capacity, internal energy, pressure, volume, temperature etc. using the thermodynamics potential and Maxwell's relations.
4	Numerical exercise on Maxwell Boltzmann equation and distribution function to understand its concepts used in Kinetic Theory of gases.
5	Problems to obtain the various equilibrium quantities derived in the section of kinetic theory of gases.
6	Problems based on transport properties of gases mainly focused on the calculation of viscosity and thermal conductivity
7	Problems based on radiation principles, Wein's and Planck's law related to the thermodynamics of black body radiation.

4.	**Books Recommended**
1	Sears F. W. & Salingar, Thermodynamics, Kinetic theory and Statical Thermodynamics, 3rdEdition. Addison-Wesley/Pearson, 1975.
2	Young & Freedman, Sears and Zemanski's University Physics, Pearson Education, Singapore, 2004.
3	Feynman R. P., Leighton R. B. and Sands M., The Feynman Lectures in Physics, Vol.1 Narosa Publishers, 2008.
4	Zemanski M. W., Heat and Thermodynamics, McGraw Hill, 1957.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B. Tech. - I, Semester - I NUMERICAL METHODS AND COMPUTER PROGRAMMING EP107	Scheme	L	T	P	Credit
		3	0	2	4

1.	Course Outcomes (COs): At the end of the semester students will be able to
CO 1	Students will be able to understand basics about error and numerical solution method for solving Algebraic and Transcendental Equations
CO 2	Analyze about interpolation and curve fitting method for solve real world problems
CO 3	Understand about method for Numerical integration and Ordinary Differential Equations
CO 4	Understand of basics of computers and programming language
CO 5	students will be able to simulate that physical science problems by knowing some compiler languages

2.	Syllabus	
	BASICS OF COMPUTER PROGRAMMING	**(10 Hours)**
	Operating systems, higher level compiler languages, algorithm; flow charting, C Language: Introduction to C language, identifiers and keywords, data types, constants and variables, arithmeticexpressions; input and output statements, conditional statements: while-loop, for-loop, do while– loop; arrays; logical operators and expressions, structures: switch, break and continue statements.	
	C PROGRAMMING	**(06 Hours)**
	C Language: functions; structures; pointer data type; random and sequential files, file handling in C.	
	NUMERICAL METHOD FOR FINDING ROOTS OF EQUATION	**(06 Hours)**
	Error in Numerical Calculation, Errors and their computations, Absolute, relative and percentageerrors, general error formula Solutions of Algebraic and Transcendental Equations, Bi-Section Method, Graphical Method, Regular False, Newton Raphson Method.	
	NUMERICAL INTERPOLATION AND POLYNOMIAL CURVE FITTING	**(07 Hours)**
	Interpolation, Finite Difference, Forward difference, backward difference, Central Difference, Newton interpolation formula, Lagrange interpolation formula, Least Square Fitting Method & Curve Fitting by polynomials.	
	NUMERICAL METHOD FOR INTEGRATION AND ORDINARY DIFFERENTIAL EQUATIONS	**(08 Hours)**
	Numerical Integration, Newton-Cote's formula, Trapezoidal, Simpson 1/3rd and 3/8th rule and Weddle rules.	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	Numerical Solutions of Ordinary Differential Equations: Euler, Picard and Taylor series methods,Runge–Kutta 2nd order and 4th order method.	
	C PROGRAMMING PRACTICE	**(08 Hours)**
	C Programs: Program writing in C for interpolation, integration, roots of equations, matrixdiagonalization, solution of differential equations. Good programming practices.	
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	Practicals
1	Error in numerical computation, error in construction of a model, approximations, Truncationerror and their estimation
2	Solutions of Algebraic and Transcendental Equations using Newton Raphson method.
3	Interpolation using Lagrange's formula.
4	Linear square fitting and Curve fitting by polynomials method.
5	Numerical Integration using Simpson 1/3rd method.
6	Numerical Solutions of Ordinary Differential Equations using Runge–Kutta Method.
7	Writing and testing C program for Error calculation.
8	Writing and testing C program for Newton Raphson method.
9	Writing and testing C program for Lagrange's formula.
10	Writing and testing C program for Curve fitting.
11	Writing and testing C program for Simpson 1/3rd method.
12	Writing and testing C program for Runge–Kutta Method.

4.	Books Recommended
1	Chapra S. C. and Canale R. P., Numerical Methods for Engineers. 7th Edition, TataMcGraw Hill, 2021.
2	Sastry S. S., Introductory Methods of Numerical Analysis, 2nd Edition, PHI, 2012.
3	Hoffman J. D., Numerical Methods for Engineers and Scientist, 2nd Edition, CRC Press, 2018.
4	Xavier C., C Language and Numerical Methods, 2nd Edition, New Age publishers, 2007.
5	Herbert Scheldt, C: The Complete Reference, 4th Edition, McGraw Hill Education, 2018.

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B. Tech. - I, Semester - I MATHEMATICS FOR PHYSICAL SCIENCES-I MA123	Scheme	L	T	P	Credit
		3	1	0	4

1.	**Course Outcomes (COs):** **At the end of the semester students will be able to**
CO1	Explain the basic concept of ordinary differential equation with its different forms and methods.
CO2	Discuss the related Applications in Mathematical Modelling and with knowledge of Ordinarydifferential equations, can resolved here.
CO3	Narrate about the series solution and Frobenius series solution with different point.
CO4	Illustrate the PDE with linear and Non-linear equations and its solution.
CO5	Discuss the Vector calculus and System of Linear Algebraic equations.

2.	**Syllabus**	
	ORDINARY DIFFERENTIAL EQUATION	**(10Hours)**
	Reorientation of differential equation first order first degree, exact differential equation and Integrating factors, first order higher degree odes, solvable for p, y and x, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficient, Method of variation of parameters.	
	APPLICATION OF DIFFERENTIAL EQUATION (MATHEMATICAL MODELLING)	**(07 Hours)**
	Modeling of Real world problems particularly Engineering System, Electrical network models (LCR),spread of epidemic (SI, SIS, SIR), Newton's Law of cooling. Single compartment modelling, Bending of beam models.	
	SERIES SOLUTION AND SPECIAL FUNCTIONS	**(07 Hours)**
	Regular point, Singular point, series solution of ODE of 2nd order with variable coefficient with special emphasis to differential equation of Legendre's and Bessel's for different cases of roots of indicial equations.	
	INRODUCTION TO PARTIAL DIFFERENTIAL EQUATION	**(08 Hours)**
	Introduction to Partial differential equation, Formation of partial differential Equation, Partial differential Equation of first order, Linear partial differential equation of first order (Pp+Qq-R) and method of obtaining its general solution, Non-linear partial differential equation of first order f(p, q)=0, f(z.,p.,q)=0, f(x, p)=g(y,q), z=px + qy +f(p,q).	
	VECTOR CALCULUS	**(07 Hours)**
	Scalar and vector point function, differential operator, gradient, directional derivative, divergence, curl and Laplacian operator with their properties, Line integral, Surface Integral, Volume integral, Green's, Gauss and Stokes theorem (Only statement) & application.	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	SYSTEM OF LINEAR ALGEBRIC EQUATION	**(06 Hours)**
	Linear systems, Elementary row and column transformation, rank of matrix, consistency of linear system of equations, Linear Independence and Dependence of vectors, Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Tutorial one will be related to Ordinary differential equations.
2	Tutorial two, also will be on ordinary differential equations with variable co-efficient.
3	Tutorial three will be on different examples of ordinary differential equations.
4	Tutorial four will be on Mathematical modelling.
5	Tutorial five will be on Series solution and other special cases of it.
6	Tutorial six will cover partial differential equations.
7	Tutorial seven will be on examples of partial differential equations.
8	Tutorial eight will be on Vector Calculus.
9	Tutorial nine will be on applications of Area, Volume.
10	Tutorial ten will be on system of linear algebraic equations

4.	**Books Recommended**
1	Kreyszing E., Advanced Engineering Mathematics, John Wiley & Sons, Singapore, Int Student Ed. 2015.
2	James Steward De, Calculus, Thomson Asia, Singapore, 2003.
3	O'Neel Peter., Advanced Engg. Mathematics, Thompson, Singapore, Ind. Ed. 2002.
4	Hilderband, F. B., Methods of Applied mathematics, PHI, New Delhi, 1968
5	Wiley C. R., Advanced Engineering Mathematics, McGraw Hill Inc., New York Ed. 1993,
	Reference Books
1	Ramana D. V., Higher Engg. Mathematics, The MaGraw-Hill Inc., New Delhi, 2007.
2	Hay George E., Vector and Tensor Analysis. Dover Publications, 2012.
3	Srimanta Pal, Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, New Delhi, 2015.
4	Boas.Mary L., Mathematical Methods in the Physical Sciences, John Wiley & Sons,Ed.2005.
5	Kapur. J. N., Mathematical Models in Biology and Medicine. East west Press, New Delhi 1985.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B.Tech. I /M.Sc. I: Semester I/ II INDIAN VALUE SYSTEM AND SOCIAL CONSCIOUSNESS HS120	Scheme	L	T	P	Credit
		2	0	0	2

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	interpret the important values that need to be cultivated
CO2	analyse the cultures depicted in Ramayana, Mahabharata, Jainism and Buddhism
CO3	review the structure of Indian knowledge system
CO4	discuss the significance of constitution of India
CO5	demonstrate social responsibility

2.	Syllabus	
	HUMAN VALUES AND CONSCIOUSNESS	**(08 Hours)**
	Human Values Definition and Classification of Values; The Problem of Hierarchy of Values andtheir Choice; Self-Exploration; 'Basic Human Aspirations; Right understanding, Relationship and Physical Facility; fulfilment of aspirations; Understanding Happiness and Prosperity, Harmony at various levels. What Is Consciousness? ; Can We Build A Conscious Machine?; Levels Of Consciousness; Mind,Matter And Beyond; Holistic Lifestyle; Dealing With Anxiety; Connecting Mind To Brain; Minds, Brains, And Programs.	
	INDIAN CULTURE AND HERITAGE	**(07 Hours)**
	Culture and its salient features: The Vedic – Upanishadic Culture and society, Human aspirations in those societies; Culture in Ramayana and Mahabharata: The Ideal Man and Woman, Concepts Maitri, Karuna, Seela, Vinaya, Kshama, Santi, Anuraga – as exemplified in the stories and anecdotes of the Epics; The Culture of Jainism: Jaina conception of Soul, Karmaand liberation, Buddhism as a Humanistic culture; The four Noble truths of Buddhism; Vedanta and Indian Culture;	
	INDIAN KNOWLEDGE SYSTEM	**(08 Hours)**
	Indian knowledge as a unique system, Place of Indian knowledge in mankind's evolution, Relevance of Indian knowledge to present day and future of mankind, Nature of Indian Knowledge; Structure of Indian Knowledge: Types of knowledge (para, apara), The scientific and the unscientific, Instruments for gaining and verifying knowledge, Knowledge traditions: Lineages, Instruments - debate, epistemology and pedagogy, The inverted tree – axiomatic, deductive, empirical knowledge, and evolution of knowledge; Disciplines of Study: A brief outline of	

	the subjects, the major contributions and theories along with timelines where relevant: Mathematics; Astronomy; Physical Sciences; Cosmogony; Language studies;Astrology; Moral studies/righteousness; Statecraft and political philosophy	
	INDIAN CONSTITUTION	**(04 hours)**
	History of Making of the Indian Constitution; Philosophy of the Indian Constitution: Preamble; Salient Features; Contours of Constitutional Rights & Duties; Organs of Governance: Parliament; Composition; Qualifications and Disqualifications; Powers and Functions	
	SOCIAL RESPONSIBILITY	**(03 Hours)**
	Social Responsibility: Meaning and Importance, Different Approaches of Social Responsibility. Social Responsibility of Business towards different Stakeholders. Evolution and Legislation ofCSR in India.	
	(Total Contact Time: 30 Hours)	

3.	**Books Recommended**
1	D. K. Chaturvedi, Professional Ethics Values and Consciousness, Ane Books Pvt. Ltd., 2023.
2	R.R. Gaur, R Sangal, G. P. Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010.
3	A.N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
4	P R Rao, Indian Heritage and Culture, Sterling Publishers Pvt. Ltd, 1988.
5	D. Singh, Indian Heritage and Culture, APH Publishing Corporation, 1998.
6	Sri Prashant Pole, Treasure Trove of Indian knowledge, Prabhat Prakashan, 2021.
7	Sri Suresh Soni, Sources of our cultural heritage, Prabhat Prakashan, 2018.
8	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B. Tech. - I, Semester - II BASICS OF ELECTROMAGNETICS EP102	Scheme	L	T	P	Credit
		3	1	0	4

1.	**Course Outcomes:** **At the end of the semester students will be able to**
CO1	Outline briefly the basics of vector algebra, various coordinate systems and differential calculus.
CO2	Explain the Coulomb's law and Gauss's law and their applications in electrostatics.
CO3	Classify the electric fields in conductors and dielectrics and extend it to understand the polarization effects and apply to boundary value problems.
CO4	Explain the Ampere's law and related aspects, and their applications in magnetostatics.
CO5	Explain the magnetic fields in matter and examine magnetization in linear and nonlinear media.

2.	**Syllabus**	
	VECTOR CALCULUS	**(06 Hours)**
	Vector Algebra, Coordinate Systems and Transformations, Differential Length, Differential Area and Differential Volume; Line, Surface and Volume Integrals, Gradient, Divergence, Curl and Laplacian (Cartesian & Polar Coordinates)	
	ELECTROSTATICS	**(06 Hours)**
	Coulomb's Law, Intensity of Electric field, Gauss's Law and its Application, Divergence and curl of Electric Field, Electric Potential, Work and Energy in Electrostatics.	
	SPECIAL TECHNIQUES	**(08 Hours)**
	Laplace's equation, The method of images, Separation of variables, Multipole expansion	
	ELECTRIC FIELDS IN MATTER	**(08 Hours)**
	Polarization, The Field of a Polarized Object, The electric Displacement, Linear Dielectrics	
	MAGNETOSTATICS	**(08 Hours)**
	The Lorentz Force Law, The Biot-Savart Law, The Divergence and Curl of B, Applications of Ampere's Law, Magnetic Vector Potential	
	MAGNETIC FIELDS IN MATTER	**(08 Hours)**
	Magnetization – Diamagnets, Paramagnets, Ferromagnets, The field of a Magnetized Object, The	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	Auxiliary Field H, Linear and Nonlinear media,	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1.	Numerical problems based on vector algebra, various coordinate systems and differential calculus.
2.	Problems related to the calculation of electric fields and potentials using coulomb' law and Gauss's law.
3.	Numerical problems based on Laplace's equation, The method of images.
4.	Numerical Problems related to Separation of variables, Multipole expansion.
5.	Problems for the calculation of polarization and fields due to a polarized objects.
6.	Problems related to electric displacement and the calculation of energy and forces in dielectric systems.
7.	Problems based on the Lorentz force law, the Biot-Savart Law and Ampere's law.
8.	Problems based on magnetic vector potentials.
9.	Problems for the calculation of magnetization and the field due to a magnetized object.
10.	Numerical exercise for the calculation of the Auxiliary field H and other problems based on linear and nonlinear media.

4.	**Books Recommended**
1.	Griffiths D. J., Introduction to Electrodynamics, 3rd Edition, Pearson Education, 2008.
2.	Jackson J. D., Classical Electrodynamics, 3rd Edition, Wiley, 2018.
3.	Sadiku M.N.O., Elements of Electromagnetics, 6th Edition, Oxford university press, 2014.
4.	Landau L. D., Lifshitz E. M., The Classical Theory of Fields, Course of Theoretical Physics: Vol. 2, 3rd Edition, Pergamon Press, 1967.
5.	Edminister J. A., Schaum's Outline series, Theory and Problems of Electromagnetics, McGraw Hill, 1993.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B. Tech. - I, Semester - II SEMICONDUCTOR PHYSICS EP102	Scheme	L	T	P	Credit
		3	1	0	4

1.	Course Outcomes (COs): At the end of the semester students will be able to
CO1	Understand the working of various FET devices and their applications.
CO2	Understand the principle of operation of DIAC and TRIAC devices.
CO3	Identify the principle of operation and structure of SCR devices.
CO4	Interpret the concept of heterojunction devices and their applications.
CO5	Classify the characteristics of various photonic devices.
CO6	Examine the properties and applications of microwave devices.

2.	Syllabus	
	INTRODUCTION	**(06 Hours)**
	Semiconductor Fundamentals, intrinsic & extrinsic semiconductors, free carrier and carrier concentration and Fermi-level. Scattering and Drift, Mobility, Hall Effect, excess carriers, Metal Semiconductor Contacts (Schottky and Ohmic), Schottky barriers; Schottky barrier height, C-V characteristics, current flow across Schottky barrier: thermionic emission	
	VARIOUS FET DEVICES: INTRODUCTION, CHARACTERISTICS AND APPLICATION	**(09 Hours)**
	Types of FET, JFET, MODFET, SIT, MOSFET, Structure and principle of operation of MOSFET, MOSFETas an amplifier, MOSFET analysis, Threshold voltage. Power MOSFET, HEMT, Compare JFET and BJT-List the merits of JFET over BJT, Principle of operation of CMOSFET.	
	DIAC, TRIAC: INTRODUCTION, CHARACTERISTICS AND APPLICATION	**(06 Hours)**
	Structure of DIAC, DIAC Principle of operation, Structure, and principle of operation of TRIAC, Applications of TRIAC.	
	PNPN: INTRODUCTION, CHARACTERISTICS AND APPLICATION	**(06 Hours)**
	The silicon-controlled rectifier, Device structure, Principle of operation, Equivalent circuit,Applications.	
	INTRODUCTION TO THE HETERO JUNCTIONS AND APPLICATIONS	**(06 Hours)**
	Concept of Heterojunction, Multilayer Heterojunction, Energy band diagram for Heterojunction, Confinement of charge carrier, Application of Heterojunction.	
	PHOTONIC DEVICES: INTRODUCTION, CHARACTERISTICS AND APPLICATION	**(06 Hours)**

	Light Emitting Diode (LED), Characteristics of LED, Materials and wavelength of light, Laser diode, Structure, Characteristics of laser diode, Photodiode and solar cell, Display devices, Operation of LCDs, LED, HDTV, Plasma displays.	
	MICROWAVE DEVICES: INTRODUCTION, CHARACTERISTICS AND APPLICATION	**(06 Hours)**
	MESFET, HEMT	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1.	Study of the characteristics of Unijunction Transistor (UJT) and to calculate interbase resistance and intrinsic standoff ratio.
2.	To study the VI characteristic of TRIAC with positive and negative biasing and plot the curve betweenV & I.
3.	To study the phenomenon of holding current and latching current in TRIAC.
4.	To study the RC Phase shift oscillator using BJT.
5.	To study the VI characteristic of DIAC with positive biasing and plot the curve between V & I.
6.	Study and plot V-I characteristic of SCR.
7.	To study the phenomenon of holding current and latching current in SCR.
8.	To study the triggering of SCR using OP-AMP 741 and to study the application of SCR in alarm circuit.

4.	**Books Recommended**
1.	Schilling D.L. and Belove C., Electronic Circuits: Discrete and Integrated, McGraw Hill, 1989.
2.	Streetman B. and Banerjee S., Solid State Electronic Devices, Prentice Hall, 2005.
3.	Boylestad R.L. and Nahselsky L., Electronic Devices and Circuit Theory, Prentice Hall, 2005.
4.	Liao S.Y., Microwave Devices and Circuits, Prentice Hall, 1996.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. - I, Semester - II INTRODUCTION TO PYTHON PROGRAMMING EP106	Scheme	L	T	P	Credit
		3	0	2	4

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Learn the basics of programming and create your first program in Python IDLE.
CO2	Implement Conditional Statement concepts in your programming.
CO3	Use different Python Libraries and Create an application with the support of graphics in Python.
CO4	Write code using functions, files, and exception handling.
CO5	Implement Python to Physics and Machine Learning problems.

2.	Syllabus	
	INTRODUCTION	**(08 Hours)**
	Introduction: The Programming Language, History, features, Debugging: Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging, Formal and Natural Languages Features of Python, Python installation and setup, Python IDLE and basic operations, Writing and executing Python programs, Variables and data types, Basic operations, Input/output operations	
	CONDITIONAL STATEMENTS	**(08 Hours)**
	Conditional Statements: if, if-else, nested if–else Looping: for, while, nested loops Control statements: Terminating loops, skipping specific conditions	
	INTRODUCTION TO POPULAR PYTHON LIBRARIES	**(07 Hours)**
	Introduction to popular Python libraries (e.g., NumPy, Pandas, Matplotlib), Introduction to data analysis and visualization in Python, working with data using Python libraries (e.g., Pandas, Matplotlib). GUI Programming With Tkinter, import the module – Tkinter, create the main window (container), add any number of widgets to the main window, and apply the event trigger on the widgets.	
	OVERVIEW OF LISTS, TUPLES AND DICTIONARIES	**(10 Hours)**
	Lists: Values and Accessing Elements, Lists are mutable, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods Tuples and Dictionaries: Tuples, accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in Tuple Functions Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods.	
	FILE HANDLING and INTRODUCTION TO ML & AL	**(12 Hours)**
	Files: Text Files, The File Object Attributes, Directories Exceptions: Built-in Exceptions, Handling Exceptions, Exception with Arguments, User-defined Exceptions.	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	Introduction to machine learning and its applications, Introduction to popular Python libraries for machine learning (e.g., scikit-learn, TensorFlow).	
	Practical will be based on the coverage of the above topics separately.	**(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours= 75 Hours)

3.	**Practical**
1	Program to calculate the sum and average of a list of numbers using functions.
2	Write a program that prints a giant letter A like the one below. Allow the user to specify how large the letter should be.
3	Program to read data from a CSV file using the Pandas library and perform data analysis.
4	Program to plot & save graph of sine wave and cosine wave using Matplotlib.
5	Program to create a class representing a student and calculate their grades based on specific criteria.
6	Program to calculate the mean, median, and mode of a list of numbers using NumPy and statistics.
7	Program to implement linear regression using the scikit-learn library for a given dataset.
8	Program to calculate the roots of a quadratic equation using the math library.
9	Program to compute the derivative of a given function using symbolic mathematics with SymPy.
10	Program to calculate the eigenvalues and eigenvectors of a matrix using NumPy.

4.	**Books Recommended:**
1	Zhang Y., An Introduction to Python and Computer Programming, Springer Verlag, Singapore, 2015
2	Langtangen H.P., A Primer on Scientific Programming with Python, Springer, 2016.
3	Ham, D. A., Object-oriented Programming in Python for Mathematicians Paperback, 2023.
4	Johansson R., Numerical Python: Scientific Computing and Data Science Applications with NumPy, SciPy, and Matplotlib, Apress,2019.
5	Fuhrer C., Solem, J.E. and Verdier O., Scientific Computing with Python: High-performance scientific computing with NumPy, SciPy, and Pandas, Packt Publishing Limited, 2021.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. - I, Semester – II MATHEMATICS FOR PHYSICAL SCIENCES -II MA118	Scheme	L	T	P	Credit
		3	1	0	4

1.	Course Outcomes (COs): At the end of the semester students will be able to
CO1	Explain about infinite series.
CO2	Discuss the Fourier series and periodic functions and with different period.
CO3	Narrate the Fourier transform and theorems.
CO4	Explain Complex Variables.
CO5	Illustrate basic of statistics and sampling theory and estimation.

2.	Syllabus	
	INFINITE SERIES	**(05 Hours)**
	Introduction, Positive term series, Comparison test, Cauchy's root test, D'Alembert's test, Raabe'stest, Logarithmic test, Integral test, Gauss's test.	
	FOURIER SERIES	**(07 Hours)**
	Definition, Fourier series with arbitrary period, in particular periodic function with period 2 π. Fourier series of even and odd function, Half range Fourier series.	
	FOURIER TRANSFORM AND FOURIER TRANSFORM OF AN INTEGRAL	**(07 Hours)**
	Fourier transform and its operational properties, Fourier Integral theorem, Fourier Cosine and solution, transform of derivatives, Inversion formula for Fourier transforms.	
	COMPLEX VARIABLES	**(06 Hours)**
	Basic mathematical concept, Analytic function, Cauchy – Riemann equations, Harmonic functions, its applications, Linear transformation of complex domain, bilinear transformations, conformal mapping and its application, complex integration over closed contour.	
	BASIC OF STATISTICS AND PROBABILITY DISTRIBUTION	**(06Hours)**
	Reorientation of random experiments, events, probability and its distributions of Binomial &Poisson‟s, their properties and Normal distribution, jointly distributed random variables, expectedvalues, function of random variable moments, moment generating functions.	
	SAMPLING THEORY AND ESTIMATION	**(07 Hours)**
	Some basics of sampling, statistical inference, Random Samples, Sampling distribution, Sample mean, variance and other statistics, point estimate and interval estimate confidence of interval, maximum likehood estimate.	
	TESTING OF HYPOTHESIS	**(07 Hours)**

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	Sampling and Test of significance, Statistical hypothesis and significance, Type I and Type II errors, Test of significance. Level of Significance, single tail and two tail tests hypothesis Chi-square (2 χ) test, student's t Test of significance of the mean of a random sample, t-test for difference of means of two small samples, Snedecor‟s variance ratio test or F-test and tis applications.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1.	Tutorial one will be related to infinite series.
2.	Tutorial two will be on different test of infinite series for its convergence.
3.	Tutorial three, will be on Fourier series.
4.	Tutorial four will be on Fourier transform.
5.	Tutorial five will cover examples of Fourier integral theorem.
6.	Tutorial six will be on Complex variables.
7.	Tutorial seven will cover basic of statistics.
8.	Tutorial eight will be based on Probability Distribution.
9.	Tutorial nine will be based on Sampling theory.
10.	Tutorial ten will be on Estimation: different test and its applications.

4.	**Books Recommended**
1.	Kreyszing E., Advanced Engineering Mathematics, John Wiley & Sons, Singapore, Int. Student Ed. 1995.
2.	Wiley C. R., Advanced Engineering Mathematics, McGraw Hill Inc., New York Ed. 1993
3.	O‟Neil Peter., Advanced Engg. Mathematics, Thompson, Singapore, Ind. Ed. 2002.
4.	Greenbar Michael D., Advanced Engg. Mathematics, Pearson, Singapore, Ind. Ed. 2007.
5.	Ramana D. V., Higher Engg. Mathematics, The MaGraw-Hill Inc., New Delhi, 2007.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. - I/ M.Sc. - I, Semester – I/II ENGLISH AND PROFESSIONAL COMMUNICATION HS110	Scheme	L	T	P	Credit
		3	1	0	4

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	show enhanced reception towards the use of English language.
CO2	choose and employ appropriate words for professional communication.
CO3	develop sentences and text in English coherently and formally.
CO4	demonstrate overall improvement in oral communication.
CO5	analyze and infer from written and oral messages.

2.	**Syllabus**	
	COMMUNICATION	**(05 Hours)**
	Introduction to Communication, Different forms of Communication, Barriers to Communicationand some remedies, Non-Verbal Communication – Types, Non-Verbal Communication in Intercultural Context.	
	VOCABULARY AND USAGE OF WORDS	**(05 Hours)**
	Common Errors, Synonyms, Antonyms, Homophones, and Homonyms; One Word Substitution; Misappropriations; Indianisms; Redundant Words.	
	LANGUAGE THROUGH LITERATURE	**(09 Hours)**
	Selected short stories, essays, and poems to discuss nuances of English language.	
	LISTENING AND READING SKILLS	**(06 Hours)**
	Types of listening, Modes of Listening-Active and Passive, Listening and note taking practice, Practice and activities. Reading Comprehension (unseen passage- literary /scientific/technical) Skimming and scanning, fact vs opinion, Comprehension practice	
	SPEAKING SKILLS	**(10 Hours)**
	Effective Speaking, JAM, Presentation Skills- types, preparation and practice. Interviews- types, preparation and mock interview; Group Discussion- types, preparation and practice.	
	WRITING SKILLS	**(10 Hours)**
	Prerequisites of effective writing, Memo-types, Letter Writing- types, Email etiquette and Netiquette, Résumé-types, Report Writing and its types, Editing.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Tutorials**
1	Letter and Resume
2	Group Discussion
3	Presentation Skills (Individual)
4	Role Play on Nonverbal communication
5	Group Presentation
6	Debate
7	Body language and intercultural communication
8	Listening Activities
9	Editing
10	Report Writing
11	Mock interviews
12	JAM

4.	**Books Recommended**
1	Kumar, Sanjay and Pushp, Lata. *Communication Skills*, 2nd Edition, OUP, New Delhi, 2015.
2	Raman, Meenakshi & Sharma Sangeeta. *Technical Communication Principles and Practice*, 3rdEdition, OUP, New Delhi, 2015.
3	Raymond V. Lesikar and Marie E Flatley. *Basic Business Communication skills for Empowering theInternet generation.* Tata McGraw Hill publishing company limited. New Delhi 2005.
4	Courtland L. Bovee, John V. Thill, and Mukesh Chaturvedi. “Business Communication Today.” NinthEdition. Pearson, 2009.
5	Mike Markel. “Practical Strategies for Technical Communication,” Bedford/ St. Martin's SecondEdition, 2016
6	Laura J. Gurak and John M. Lannon. “Strategies for Technical Communication in the Workplace,”Pearson, 2013.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
DEPARTMENT OF PHYSICS
B.Tech. (Engineering Physics)

Proposed Intake: **40**

MANPOWER, INFRASTRUCTURE AND FINANCIAL MANAGEMENT

- **Manpower Management:**
  - **Faculty Requirements**
    [considering M.Sc. and B.Tech. will be conducted together for same/almost similar (± 5-10% variation) courses]:
    - **Total number of courses = 55 (Dept of Physics = 44; Other Dept = 11)**
    - **32 out of 44 courses of B.Tech. from DoP are common with M.Sc. (Phys)**
    - **No. of new courses = 12 (in 7 semesters of B.Tech.; 8th sem. is Intern)**
    - **In an Odd/Even semester average no. of new course = 12/2 = 6**
    - **1 faculty can take 8 credits or 2 courses (of 4 credits each) per semester**
    - **No. of faculty required: 6/2 ≈ 3**

- **Infrastructure Requirements:**
  - **Classroom Requirements:**
    - **Available no. of classrooms (80 capacity) in DoP = 05**
    - **Proposed B.Tech. (Engg. Phys.) and M.Sc. (Physics) classes may be managed with the available 05 classrooms in the department.**
  - **Laboratory Space Requirements:**
    - **Available no. of laboratories (30+) in DoP = 05**
    - **Additional Laboratory Space required from 2nd year (2025-26): 02**
      [For experiments of newly added courses:
      (a) Optics, Lasers and Photonics (EP205)
      (b) Characterization Techniques (EP475)]
  - **Furniture Requirements:** **50 Benches**
    [10 additional for each classroom for expected additional 20 students in each class]

    6 Tables (6x4 ft) and Stools for Labs

    Racks and Cupboards for Labs

    Lab instruments from Annual Plan Grant (Appx. Rs. 10 Lakh per anum)

D. [signature]

* Financial Managements:

  - Annual Tuition Fees:
    - 40 students (Same as B.Tech. Students of the Institute: Appx: 1,50,000/- p.a.)
  - Total annual fees collection (as per current fees):
    - Approx. Rs. 46,50,000/- from 31 students (50 % Gen + 27 % OBC) p.a.
    - Total Fees Collection: Rs. 1,86,00,000/- (31 students for 4 years)

* Expenditures:

The fees may cover the salary of faculty and support staff employed for the program. The routine maintenance and laboratory etc will require normal DoC or other such operational grant from the Institute.

Designation	Required Strength	Average monthly CTC	Annual CTC	Total
Faculty	3	1,00,000/-	36,00,000/-	36,00,000/-
			Total	36,00,000/-

Annexure I

PRINCIPLES AND APPLICATIONS OF ELECTROCHEMISTRY

CY 251

L	T	P	C
3	0	0	3

Scheme

1. Course Outcomes (Cos):

At the end of the course students will be able to:

CO1	Acquire knowledge about basic concepts of electrochemistry in the elementary level such as different type of cells, laws of electrolysis, theory of conduction of electricity in solution, etc.
CO2	Understand about electrochemical kinetics and mechanism
CO3	Develop understanding about electrochemical techniques involved in the area of energy conversion and storage
CO4	Differentiate between electrochemical devices
CO5	Accumulate a deep knowledge about electrochemistry concepts applicable in multidisciplinary areas.

- **FUNDAMENTALS OF ELECTROCHEMISTRY** **(07 Hours)**

Electrochemical cells; Characteristics of electrochemical cells; Importance of electrochemical systems; Scientific units, Constants, Cell conventions; Faraday's law; Faradic efficiencies; Electrochemical cells, Electrochemical series; Electrode types (SHE, Glass, Calomel etc.); Equilibrium cell potentials; Reversibility and Gibb's free energy; Free Energy and Standard cell potentials; Effect of temperature on standard cell potentials; Activity coefficients; EMF and concentration; The Nernst equation; Liquid junction potentials.

- **ELECTROCHEMICAL KINETICS AND CATALYSIS** **(06 Hours)**

Electrochemical double layer; Dynamic equilibrium; Rate equation; Arrhenius equation and activation energy; Exchange current density; Interfacial potential; Butler–Volmer equation; Current –overpotential characteristics; Tafel equation.

- **ELECTRODE STRUCTURE AND CONFIGURATIONS** **(06 Hours)**

Structure and characterization of porous electrodes; Electrode material type: silicon, carbon based, transition metal, rare earth metals based etc.; Gas-liquid interface in porous electrode; Three-phase electrodes.

- **ELECTROCHEMICAL METHODS** **(06 Hours)**

Types of techniques; Detection; current-potential characteristics; A planar microelectrode; Cyclic voltammetry; Electrochemical Impedance; Rotating Disc electrode.

- **ENERGY HARVESTING APPLICATIONS OF ELECTROCHEMISTRY:**

(14 Hours)

Batteries: Fundamentals, classification and components of a cell; Cell characteristics and electrochemical performance; Efficiency of cell; Supercapacitors: Introduction, types, advantages and applications; Solar cells: Principle, Construction, working and application of solar cells, crystalline silicon-based and thin-film solar cells: silicon based solar cells, Cadmium telluride solar cells, Dye sensitized solar cells, Copper-indium-gallium-selenide (CIGS) solar cells. Introduction and types of fuel cells; EMF of fuel cell; Current-voltage characteristics and overpotentials, direct alcohol fuel cells; molten carbonate fuel cells; solid oxide fuel cells; proton exchange membrane fuel cell (PEMFC).

- **INDUSTRIAL SIGNIFICANCE OF ELECTROCHEMISTRY** **(06 Hours)**

Electrochemical Corrosion; Electrodeposition; Industrial electrolysis; Redox-flow batteries.

(Total Lecture Hours: 45)

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4. Books Recommended:

1. S. Glasstone, An Introduction to Electrochemistry, Maurice Press, 2011.
2. Thomas F. Fuller, John N. Harb., "Electrochemical Engineering" Wiley, 2018.
3. Corrosion Engineering: Principles and Practices, Pierre R. Roberge, McGraw Hill, 2008.Corrosion, Vol. I, Edited by L. L. Shreir
4. Allen J. Bard, Larry R. Faulkner., "Electrochemical Methods-Fundamentals and Applications" John Wiley & Sons.
5. Thomas Engel and Philip Reid, Physical Chemistry, Pearson Publication 2006.

For further reading:

1. The Elements of Physical Chemistry', P.W. Atkins & Julio de Paula, 8th edition, Oxford University Press, Oxford 2006.
2. P. C. Rakshit, Physical Chemistry, 7th Edition, Sarat Book Distributors, Kolkata, 2004.

Department of Mathematics
SardarVallabhbhai National Institute of Technology, Surat

Minutes of the 6th DAAC held on 13/03/2024(Wednesday) in DoM Seminar Hall, 12:30 pm onwards. The following members were present:

1.	Prof. A.K.Shukla, Professor of Mathematics	Member
2.	Prof. V. H. Pradhan, Professor of Mathematics	Member
3.	Prof. NeeruAdlakha, Professor of Mathematics	Member
4.	Dr Sushil Kumar, Associate Professor of Mathematics	Member
5.	Dr.Jayesh M. Dhodiya, Associate Professor of Mathematics	Head and Chairman, DAAC
6.	Dr. R. K. Jana, Associate Professor of Mathematics	Member
7.	Dr. Twinkle R. Singh, Associate Professor of Mathematics	Member Secretary, DAAC
8.	Dr.R.K.Meher, Associate Professor of Mathematics	Member
9.	Dr. Indira P. Tripathi, Assistant Professorof Mathematics	Member
10.	Dr. S. K. Srivastava, Assistant Professor of Mathematics	Member
11.	Dr. Amit Sharma, , Assistant Professor of Mathematics	Member
12.	Dr.Saroj R. Yadav, Assistant Professor of Mathematics	Member
13.	Dr.Sudeep Singh Sanga, Assistant Professor of Mathematics	Member
14.	Dr.Raj Kamal Maurya, Assistant Professor of Mathematics	Member
15.	Dr.Sourav Gupta, Assistant Professor of Mathematics	Member
16.	Dr.ShivamBajpeyi, Assistant Professor of Mathematics	Member

Dr. V.D. Pathak, Dr. Himanshu Chapani, of Mathematics could not remain present due to their prior commitments.

Item No. 6.1 To confirm the minutes of the 5th DAAC meeting.

Resolution: The meeting of 5th DAAC meeting were confirmed by all member of DAAC

Item No. 6.2: To recommend scheme of the programme and First year syllabus of B.Tech I year, proposed Dual Degree (New) programme of'Batchelor of Technology and Master of Technology in Mathematics & Computing (MaC)'.

Resolution: The scheme of the proposed New Dual Degree programme of'Batchelor of Technology and Master of Technology in Mathematics & Computing (MaC)' and the syllabus of B.Tech I was discussed at length. After the valuable suggestions of the members of the DAAC the proposed scheme and the syllabus for the same is recommended as per Annexure – I.

Item No. 6.3: To discuss conversion of category from FIR to ERS of Ph.D. student Rituparna Mondal (D19MA003).

Resolution: After reviewing the application along with the supporting documents(Annexure-II) submitted by the candidate, the members of the DAAC recommendedRituparna Mondal (D19MA003) for the category change from FRS to ERS w.e.f. 03/02/2024.

Member Secretary, DAAC
DoM

Chairman, DAAC
DoM

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	First Semester (1st year of B.Tech. & M.Tech. MaC)				
1	Foundation Course in Mathematics-I	MA101	3-1-0	4	70
2	Calculus	MA125	3-1-0	4	70
3	Computer Programming using C/C++	MA131	3-0-2	4	85
4	English and Professional Communication	HS110	3-1-0	4	70
5	Modern Physics	PHXXX	3-0-2	4	85
			Total	**20**	**380**
6	Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV01 / MAP01	0-0-10	5	200 (20 x 10)
	Second Semester (1st year of B.Tech. & M.Tech. MaC)				
1	Foundation Course in Mathematics-II	MA102	3-1-0	4	70
2	Advanced Calculus	MA120	3-1-0	4	70
3	Fundamental of Python Programming	MA134	3-0-2	4	85
4	Digital Gates and Electromagnetic Circuits	PHXXX	3-0-2	4	85
5	Foundation of Data Science	MA136	3-1-0	4	70
6	Indian Value System and Social Consciousness	HU120	2-0-0	2	35
			Total	**22**	**415**
7	Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV02 / MAP02	0-0-10	5	200 (20 x 10)
	Third Semester (2nd year of B.Tech. & M.Tech. MaC)				
1	Element of Analysis	MA201	3-1-0	4	70
2	Analytical Geometry	MA203	3-1-0	4	70
3	Discrete Mathematics for Computing	MA207	3-1-0	4	70
4	Data Structure and algorithm	MA233	3-0-2	4	85
5	Database Management System	MA/CS/AIXXX	3-0-2	4	85
			Total	**20**	**380**
6	Mathematical Software-I Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV03 / MAP03	0-0-10	5	200 (20 x 10)
	Fourth Semester (2nd year of B.Tech. & M.Tech. MaC)				
1	Numerical Analysis	MA202	3-1-0	4	70
2	Computational Linear Algebra	MA206	3-1-0	4	70
3	Elementary Number theory	MA232	3-1-0	4	70
4	Object Oriented Programming	MA/CS/AIXXX	3-0-2	4	85
5	Computer Networks	MA/CS/AIXXX	3-0-2	4	85

Subject Code:##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4)EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Department of Mathematics

Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

			Total	**20**	**380**
6	Mathematical Software-II Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV04 / MAP04	0-0-10	5	200 (20 x 10)
	Fifth Semester (3rd year of B.Tech. & M.Tech. MaC)				
1	Ordinary Differential Equations and computations	MA305	3-0-2	4	85
2	Analysis of Algorithms	MA303	3-1-0	4	70
3	Probability and Statistics	MA331	3-1-0	4	70
4	Machine Learning	MA/CS/AIXXX	3-0-2	4	85
5	Elective	MA/CS/AIXXX	3-X-X	4	55/70/85
			Total	**20**	**335-365**
6	Mini Project-I Preliminary Part-I Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV05 / MAP05	0-0-10	5	200 (20 x 10)
	Sixth Semester (3rd year of B.Tech. & M.Tech. MaC)				
1	Complex Analysis	MA302	3-1-0	4	70
2	Partial Differential Equation and Computing	MA306	3-0-2	4	85
3	Artificial Intelligence	MA/CS/AIXXX	3-1-0	4	70
4	Operating Systems	MA/CS/AIXXX	3-0-2	4	85
5	Elective	MA/CS/AIXXX	3-X-X	4	55/70/85
			Total	**20**	**350-380**
6	Mini Project-I Preliminary Part-II Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV06 / MAP06	0-0-10	5	200 (20 x 10)
	Seventh Semester (4th year of B.Tech. & M.Tech. MaC)				
1	Topology and Functional Analysis	MA407	3-1-0	4	70
2	Fuzzy Logic and Computation	MA409	3-1-0	4	70
3	Computational Fluid Dynamics	MA433	3-0-2	4	85
4	Optimization Techniques and Computing	MA435	3-0-2	4	85
5	Elective	MA/CS/AIXXX	3-X-X	4	55/70/85
			Total	**20**	**335-365**
6	Mini Project-II Preliminary Part-I Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV07 / MAP07	0-0-10	5	200 (20 X 10)
	Eighth Semester (4th year of B.Tech. & M.Tech. MaC)				
1	Industrial Internship / Professional Experience (Mandatory)	MA404	0-0-40	20	800 (40 X 20)
			Total	**20**	**800**

Subject Code:##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4)EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

6	Mini Project-II Preliminary Part-II Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV08 / MAP08	0-0-10	5	200 (20 X 10)
	Ninth Semester (5th year of B.Tech. & M.Tech. MaC)				
1	Measure Theory and Integration	MA501	3-1-0	4	70
2	Advanced Mathematical and Simulation Modelling	MA503	3-0-2	4	85
3	Uncertainty theory and Computation	MA533	3-0-2	4	70
4	Elective*	MA/CS/AIXXX	3-1-0	4	70
5	Elective*	MA/CS/AIXXX	3-X-X	4	55/70/85
			Total	**20**	**350-380**
	Tenth Semester (5th year of B.Tech. & M.Tech. MaC)				
1	Dissertation	MAP10	0-0-40	20	800 (40x 20)
			Total	**20**	**800**

**NPTEL, SWAYAM and other Massive Open Online Course (MOOC) approved by DAAC

Sr. No.	Optional Core	Code	Scheme L-T-P
1	Computer Programming using C/C++	MA131	3-0-2
2	Fundamental of Python Programming	MA134	3-0-2
3	Foundation of Data Science	MA136	3-1-0
4	Data Structure and Algorithm	MA233	3-0-2
5	Database Management System	MA/CS/AIXXX	3-0-2
6	Elementary Number theory	MA232	3-1-0
7	Object Oriented Programming	MAXXX/CS/AIXXX	3-1-0
8	Computer Networks	MA/CS/AIXXX	3-0-2
9	Probability and Statistics	MA331	3-1-0
10	Machine Learning	MA/CS/AIXXX	3-0-2
11	Analysis of Algorithms	MA303	3-1-0
12	Artificial Intelligence	MA/CS/AIXXX	3-1-0
13	Operating Systems	MA/CS/AIXXX	3-0-2
14	Computational Fluid Dynamics	MA433	3-0-2
15	Optimization Techniques and Computing	MA435	3-0-2
16	Uncertainty Theory and Computation	MA533	3-0-2

Sr. No.	Elective	Code	Scheme L-T-P
1	Data Visualization	MA357	3-0-2
2	Theory of Computation	MA/CS/AI3XX	3-1-0
3	Information Theory and Coding	MA/CS/AI3XX	3-1-0

Subject Code:##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4)EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

4	Soft Computing	MA/CS/AI3XX	3-0-2
5	Mathematical Methods-I	MA351	3-1-0
6	Stochastic Differential equation and computation	MA358	3-0-2
7	Financial Mathematics and computation	MA359	3-0-2
8	Advanced Evolutionary Algorithms	MA360	3-0-2
9	Block Chain Technology	MA/CS/AI3XX	3-1-0
10	High Performance Computing	MA/CS/AI3XX	3-1-0
11	Fourier Analysis	MA361	3-1-0
12	Cryptography	MA362	3-0-2
13	Integral and Wavelet Transform	MA363	3-1-0
14	Mathematical Modelling and computation	MA364	3-0-2
15	Professional Ethics, Economics, and Business Management	MG210	3-1-0
16	Advance Mathematical Methods-II	MA452	3-1-0
17	Natural Language Processing	MA/CS/AI4XX	3-0-2
18	Data Analytics	MA453	3-0-2
19	Multi Objective Optimization and Computing	MA456	3-1-0
20	Image Processing and Mining	MA/CS/AI4XX	3-0-2
21	Deep Learning	MA/CS/AI4XX	3-0-2
22	Computational Finance and Financial Econometrics	MA457	3-1-0
23	Foundations of Robotics	MA/CS/AI4XX	3-1-0
24	Innovation, Incubation and Entrepreneurship	MG110	3-1-0
25	Quantum Computing	MA458	3-0-2
26	Finite Element Methods and Computations	MA459	3-0-2
27	Error Correcting Codes	MA460	3-0-2
28	Cloud Computing	MA/CS/AI4XX	3-0-2
29	Advanced Computational Fluid Dynamics	MA555	3-1-0
30	Hybrid Algorithms	MA556	3-0-2
31	Reinforcement Learning	MA/CS/AI5XX	3-0-2
32	Financial Instruments and Risk Management	MA557	3-1-0
33	Advance Operations Research	MA551	3-1-0
34	Computational Fluid Dynamics in Porous Media	MA558	3-1-0
35	Advanced Numerical Analysis and computation	MA559	3-0-2
36	Nonlinear and Robust Control Optimization	MA560	3-1-0
37	Theoretical and Computational Neuroscience	MA561	3-1-0
38	Stochastic Finance	MA562	3-1-0
39	Computational Heat and Mass Transfer	MA563	3-0-2
40	Advanced Computational Finance and Financial Econometrics	MA564	3-1-0
41	Robotic Path Planning and Control	MA/CS/AI5XX	3-1-0

Subject Code:##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4)EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – I FOUNDATION COURSE IN MATHEMATICS-I MA101	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to:
CO1	interpret basic concepts of set-theoretic identities like countability and well-ordering principle.
CO2	demonstrate the knowledge of functions and relations on sets.
CO3	demonstrate the knowledge of POSET, GLB, LUB, Hasse diagrams, etc.
CO4	determine the convergence and divergence of sequence and series.
CO5	Interpret the limit, continuity, and differentiability of functions.

2.	Syllabus	
	SET THEORY	**(08 Hours)**
	Sets, Intervals, Boundedness of sets, Supremum and infimum, and Countable and uncountable sets. Well- Ordering Theorem and their equivalence, Process of the proof by mathematical induction, application of the method by looking at natural numbers as the least inductive subset of real numbers. The principle of mathematical induction (weak and strong) and simple applications.	
	RELATIONS AND FUNCTIONS	**(08 Hours)**
	Definitions, Types of relations and related properties, Cartesian product, One to one and onto functions, composite functions, the inverse of a function, and Binary operations. Function as a special kind of relation from one set to another. The real-valued function of the real variable, domain, and range of these functions, constant, identity, polynomial, rational, modulus, signum, and greatest integer functions with their graphs. Sum, difference, product, and quotients of functions.	
	PARTIALLY ORDERED SET	**(08 Hours)**
	Basic Definitions: Partial Order, least element, greatest element, maximal element, minimal element, upper bound, lower bound, least upper bound, greatest lower bound, total order and totally ordered sets, chain. Hasse diagrams and lattices. LUB property, GLB property, and their equivalence.	
	REAL SEQUENCES	**(07 Hours)**
	Sequences, Limit points of a sequence, Limits inferior and superior, Convergent sequences, non-Convergent sequences, Cauchy's general principle of convergence, Algebra of sequences, Some important theorems, and Monotonic sequences.	
	INFINITE SERIES	**(07 Hours)**
	Introduction, Positive term series, Comparison test, Cauchy's root test, D'Alembert's test, Raabe's test, Logarithmic test, Integral test, Gauss's test, Series with arbitrary terms, Rearrangement of terms.	
	LIMITS AND CONTINUITY OF FUNCTIONS ON R	**(07 Hours)**

	Neighbourhood, Interior points, Open and closed sets, Limit points, Limit of a function, Theorems on limits, Continuity of functions and properties, Uniform continuous functions, and related results. Definitions of derivatives and related results, Increasing and decreasing functions, Darboux's theorem, Rolle's theorem, Mean value theorems of differential calculus and their applications.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours=60 Hours)	

3.	**Tutorials**
1	Tutorial will be based on Set theory-I
2	Tutorial will be based on Set theory-II
3	Tutorial will be based on Relations and functions-I
4	Tutorial will be based on Relations and functions-II
5	Tutorial will be based on the Partially ordered set-I
6	Tutorial will be based on the Partially ordered set-II
7	Tutorial will be based on Sequences-I
8	Tutorial will be based on Sequences-II
9	Tutorial will be based on Infinite Series
10	Tutorial will be based on Limit and Continuity

4.	**Books Recommended:**
1	W. Rudin, Principles of Mathematical Analysis, 3rd Edition, McGraw Hill, New York, NY, 1976.
2	S.C. Malik and Savita Arora, Mathematical Analysis, 2nd Edition, New Age International (P) Limited, New Delhi, India, 1994.
3	T. Apostol, Mathematical Analysis, 2nd Edition, Narosa Publishers, India, 2002.
4	H. L. Royden, Real Analysis, 4th Edition, Macmillan Publishing Co. Inc., New York, NY, 1993.
5	N.S. Gopalakrishnan, University Algebra, New Age International (P) Limited, New Delhi, India, 2018.

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – I CALCULUS MA125	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to:
CO1	analyze first-order ordinary differential equations and it solutions with different methods.
CO2	apply differential equations to model real-world problems in different fields.
CO3	develop series solutions of ordinary differential equations.
CO4	apply different techniques to evaluate multiple integrals.
CO5	use multiple integrals to calculate area and volume.

2.	Syllabus	
	ORDINARY DIFFERENTIAL EQUATION	**(10 Hours)**
	Reorientation of the differential equation first order first degree, exact differential equation and Integrating factors, first order higher degree odes, solvable for p, y and x, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficient, Method of variation of parameters.	
	APPLICATION OF DIFFERENTIAL EQUATION (Mathematical Modeling)	**(08 Hours)**
	Modeling of Real-world problems, particularly Engineering Systems, Electrical network models (LCR), the spread of epidemic (SI, SIS, SIR), Newton's Law of cooling, Single compartment modeling, Bending of beam models.	
	BETA AND GAMMA FUNCTION	**(05 Hours)**
	Beta and Gamma function with their properties and duplications formula without proof.	
	SERIES SOLUTION AND SPECIAL FUNCTIONS	**(08 Hours)**
	The regular point, Singular point, series solution of ODE of 2nd order with variable coefficient with special emphasis on the differential equation of Legendre's and Bessel's for different cases of roots of indicial equations.	
	DOUBLE INTEGRALS	**(08 Hours)**
	Reorientation of concepts of integrals and Double integrals, Evaluation techniques, change of order of Integration, Change of variable, Application of double integrals for evaluation of area and volume.	

Subject Code:##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4)EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	TRIPLE INTEGRALS	**(06 Hours)**
	Triple integrals, Evaluation techniques, Application of triple integrals for evaluation of volume.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)	

3.	**Tutorials**
1	Tutorial will be based on Ordinary Differential Equations-I
2	Tutorial will be based on Ordinary Differential Equations-II
3	Tutorial will be based on applications of ODE-I
4	Tutorial will be based on applications of ODE-II
5	Tutorial will be based on Beta and Gamma functions-I
6	Tutorial will be based on Beta and Gamma functions-II
7	Tutorial will be based on some special functions and series solutions-I
8	Tutorial will be based on some special functions and series solutions-II
9	Tutorial will be based on double integrals
10	Tutorial will be based on triple integrals.

4.	**Books Recommended:**
1	E. Kreyszing, "Advanced Engineering Mathematics", John Wiley & Sons, Singapore, International Student Edition, 2015.
2	J. S. De, "Calculus", Thomson Asia, Singapore, 2003.
3	P. O'Neel, "Advanced Engineering Mathematics", Thompson, Singapore, Indian Edition, 2002.
4	F. B. Hildebrand, "Methods of Applied Mathematics", PHI, New Delhi, 1968.
5	C. R. Wiley, "Advanced Engineering Mathematics", McGraw Hill Inc., New York Edition, 1993.
	Additional Reference Books
1	B. V. Ramana, "Higher Engineering Mathematics", The McGraw-Hill Inc., New Delhi, 2007.
2	G. E. Hay, "Vector and Tensor Analysis", Dover Publications, 2012.

3	S. Pal and S. C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi, 2015.
4	M. L. Boas, "Mathematical Methods in the Physical Sciences", John Wiley & Sons, Edition 2005.
5	J. N. Kapur, "Mathematical Models in Biology and Medicine", East West Press, New Delhi, 1985.

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – I COMPUTER PROGRAMMING USING C/C++ MA131	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to:
CO1	elaborate the number system
CO2	demonstrate the data types operators library functions, etc., of C and C++ language.
CO3	develop computer code using control statements, arrays, structures, and pointers in C and C++.
CO4	design user-defined functions in C and C++
CO5	utilizing the concept of object-oriented programming.

2.	Syllabus	
	NUMBER SYSTEMS	**(04 Hours)**
	Introduction and type of Number system, Conversion between number system, Arithmetic operations in different number systems, Signed and unsigned number system.	
	C PROGRAMMING BASICS	**(10 Hours)**
	Characteristics of C language, Identifiers, and keywords, Data types, Constants and Variables, Types of C Constants, Types of C Variables, Declarations and Statements, Representation of expressions, Classification of Operators and Library Functions for Data input and output statements, Form of a C Program, Formatted input and output statements, Comments in a C Program.	
	CONTROL STATEMENT, DATA STRUCTURES, POINTERS	**(12 Hours)**
	Decision Control Instruction, Loop control instructions, case-control instructions, One-dimensional array of numbers and characters, Two-dimensional array, Introduction and development of user-defined functions, Different types of Variables and Parameters, Structure and union, Introduction to pointers, Pointer arithmetic, Array of pointers, Pointers, and functions, Pointers and structures, File handling operations.	
	FUNCTIONS	**(07 Hours)**
	Functions, Passing the arguments, return values from functions, Recursion, Header Files Design, File handling operations, Read and Write to Secondary Devices, and Read and Write to Input and Output Ports.	
	C++ PROGRAMMING: INTRODUCTION	**(12 Hours)**

	Need of Object-Oriented Programming, Characteristics of Object-Oriented Languages, C++ and C, Input, output statements, Comments, Objects, and Classes: defining the class, using the class, Constructors, Objects as function arguments, Operator Overloading: Overloading unary operators, Overloading binary operators, Data conversion. Inheritance: Derived Class and Base Class, Derived Class Constructors, Overriding Member Functions, Multiple Inheritance.	
	Practical's will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours= 75 Hours)	

3.	**Practical**
1.	Practical based on basics of C programming
2.	Practical based on CONTROL STATEMENT and loops using C programming
3.	Practical based on the array using C programming
4.	Practical based on POINTERS in using C programming
5.	Practical based on structures using C programming
6.	Practical based on Function using C programming
7.	Practical based on CONTROL STATEMENT and loops using C++ programming
8.	Practical based on the array using C++ programming
9.	Practical based on POINTERS in using C++ programming
10.	Practical based on structures using C++ programming
11.	Practical based on Function using C++ programming
12.	Practical based on Objects and Classes using C++ programming
13.	Practical based on Operator Overloading using C++ programming
14.	Practical based on inheritance using C++ programming

4.	**Books Recommended:**
1	Gottfried B.S., “Programming with C, Schaum’s outline Series”, 2/E, Tata McGraw-Hill, 2006.
2	Brian W. Kernighan and Dennis M. Ritchie, “The C Programming language”, 2/E, Prentice Hall PTR publication, 1988.
3	E. Balagurusamy, “Programming in ANSI C”, 6/E, Tata Mc-Graw Hill, 2012.
4	Pradip Dey, “Programming in C”, 2/E, Oxford University Press, 2012.
5	Robert Lafore, “Object-Oriented Programming in C++”, 4th Ed. SAMS, Indianapolis, Indiana, USA, 2002.
6	YashavantKanetkar, “Let Us C++”, BPB Publications, India, 2020.

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – I ENGLISH AND PROFESSIONAL COMMUNICATION HS110	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to:
CO1	Show enhanced reception towards the use of English language.
CO2	Choose and employ appropriate words for professional communication.
CO3	Develop sentences and text in English coherently and formally.
CO4	Demonstrate overall improvement in oral communication.
CO5	Analyze and infer from written and oral messages.

2.	Syllabus	
	COMMUNICATION	**(05 Hours)**
	Introduction to Communication, Different Forms of Communication, Barriers to Communication and some remedies, Non-Verbal Communication – Types, Non-Verbal Communication in Intercultural Context	
	VOCABULARY AND USAGE OF WORDS	**(05 Hours)**
	Common Errors, Synonyms, Antonyms, Homophones, and Homonyms; One Word Substitution; Misappropriations; Indianisms; Redundant Words.	
	LANGUAGE THROUGH LITERATURE	**(09 Hours)**
	Selected short stories, essays, and poems to discuss nuances of the English language.	
	LISTENING AND READING SKILLS	**(06 Hours)**
	Types of listening, Modes of Listening-Active and Passive, Listening and note-taking practice, Practice and activities, Reading Comprehension (unseen passage- literary /scientific/technical),Skimming and scanning, fact vs opinion, Comprehension practice	
	SPEAKING SKILLS	**(10 Hours)**
	Effective Speaking, JAM, Presentation Skills- types, preparation, and practice. Interviews- types, preparation and mock interview; Group Discussion- types, preparation, and practice	
		(10 Hours)
	Prerequisites of effective writing, Memo-types, Letter Writing- types, Email etiquette and Netiquette, Résumé-types, Report Writing and its types, and Editing.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

Subject Code:##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4)EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

3.	**Tutorials**
1	Letter and Resume
2	Group Discussion
3	Presentation Skills (Individual)
4	Role Play on Nonverbal communication
5	Group Presentation
6	Debate
7	Body language and intercultural communication
8	Listening Activities
9	Editing
10	Report Writing
11	Mock interviews
12	JAM

4.	**Books Recommended:**
1	Kumar, Sanjay and Pushp, Lata. *Communication Skills*, 2nd Edition, OUP, New Delhi, 2015.
2	Raman, Meenakshi & Sharma Sangeeta. *Technical Communication Principles and Practice*, 3rd Edition, OUP, New Delhi, 2015.
3	Raymond V. Lesikar and Marie E Flatley.*Basic Business Communication skills for Empowering the Internet generation.* Tata McGraw Hill publishing company limited. New Delhi 2005.
4	Courtland L. Bovee, John V. Thill, and Mukesh Chaturvedi. “Business Communication Today.” Ninth Edition. Pearson, 2009.
5	Mike Markel. “Practical Strategies for Technical Communication,” Bedford/ St. Martin's Second Edition, 2016
6	Laura J. Gurak and John M. Lannon. “Strategies for Technical Communication in the Workplace,” Pearson, 2013.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – I MODERN PHYSICS PHXXX	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to:
CO1	Enhance the basic principles of physics related to solid-state physics, quantum mechanics, photonics, and electromagnetism.
CO2	Illustrate the various physical phenomena with interpretation based on the mathematical expressions involved.
CO3	Apply the concepts/principles to solve the problems related to solid-state physics, quantum mechanics, photonics, and electromagnetism.
CO4	Analyze and examine the solution to the problems using physical and mathematical concepts involved.
CO5	Interpret and justify the results obtained from the experiments.

2.	Syllabus	
	SOLID-STATE PHYSICS	**(12 Hours)**
	Crystallography – Crystalline and amorphous solids, Lattice and unit cell, seven crystal system and Bravais lattices, Symmetry operation, Miller indices, Atomic radius, Coordination number, Packing factor calculation for SC, BCC, FCC, Bragg's law of X-ray diffraction, Rotating crystal method, Laue Method, Powder crystal method. *Nanomaterials* – Introduction, Synthesis of Nanomaterials, Top down and Bottom up approach, Ball milling, PVD method, Applications. *Superconductivity* – Meissner effect, Type-I, and Type-II superconductors. *Semiconductor physics* – Introduction, Direct and indirect band gap semiconductors, Intrinsic and extrinsic semiconductors, Law of Mass action, Charge neutrality, Hall effect.	
	QUANTUM MECHANICS	**(10 Hours)**
	Inadequacy of classical mechanics (black body radiation, photoelectric effect, bright line optical spectra), Electron diffraction, de Broglie concept of matter waves, Wave and Particle duality of radiation and matter, Heisenberg's uncertainty principle, Interpretation of wavefunction and probability density, Postulates of quantum mechanics, Schrodinger's wave equation, Eigenvalues and eigenfunctions, Superposition principle, Particle confined in one-dimensional infinite potential box.	
	PHOTONICS	**(11 Hours)**
	Einstein's theory of matter radiation interaction and A & B coefficients, Properties of laser, Spontaneous and stimulated emission, Amplification of light by population inversion, Types of lasers: solid-state laser (Neodymium), gas lasers (CO_2), Optical fiber- principle [TIR] - types-material, mode,	

	refractive index-Fibre Loss-Expression for acceptance angle and numerical aperture, Application-Communication.	
	ELECTROMAGNETISM	**(12 Hours)**
	Overview of electrostatics and magnetostatics – divergence and curl of the electric field, Gauss law and its applications, polarization, Internal field, Clausius-Mossotti relation, Lorentz force, Biot-Savart's law and Ampere's law, Divergence and Curl of Magnetostatic fields, Magnetic materials, Magnetization, Faraday's law, Maxwell's equations, Continuity Equation, Wave solution of Maxwell Equations.	
	Practical's will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours= 75 Hours)	

3.	**Practical**
1	Radiation correction
2	Prism Angle
3	Magnetic Field of Circular Coil
4	Malus' Law: Polarization of light
5	Stefan's Law
6	Plank's Constant using Photovoltaic Cell
7	Diffraction Grating
8	Newton's Ring

4.	**Books Recommended**
1	C. Kittel, Introduction to Solid State Physics, John-Wiley, 2016.
2	A. Beiser, Concept of the Modern Physics, McGraw-Hill, 2008
3	R. Eisberg and R. Resnick, "Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles", John-Wiley, 2nd Edition, 2006
4	D. J. Griffiths, Introduction to Electrodynamics, Pearson India.
5	R. Resnick and D. Halliday Physics (Part I & II), Wiley 2007.

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Department of Mathematics

Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – II FOUNDATION COURSE IN MATHEMATICS-II MA102	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to:
CO1	demonstrate an understanding of binary relations, functions, and binary operations, and apply them to solve problems in abstract algebra.
CO2	analyze the fundamentals of group theory and apply the basic concepts to prove theorems on Groups.
CO3	apply the concepts of Cayley's theorem and Cauchy's theorem to prove related results.
CO4	evaluate exponential values of sines, cosines, and hyperbolic functions and to solve problems related to trigonometry
CO5	interpret Gregory's series and Infinite product of sine and cosine.

2.	Syllabus	
	GROUP THEORY-UNIT-I	**(07 Hours)**
	Binary relation, Function, Binary Operation, Groups, Various properties and examples of groups, Subgroups, Properties of subgroups, Normal subgroups and important results, Cyclic groups and their generators, Properties of Cyclic groups.	
	GROUP THEORY- UNIT -II	**(07 Hours)**
	Cosets, Lagrange's theorem, Euler theorem, Fermat's theorem (with proofs), Isomorphism and homomorphism of groups and their examples and results, Quotient group	
	GROUP THEORY- UNIT -III	**(07 Hours)**
	First, Second, and Third Isomorphism Theorems (with proofs), Direct product of groups and their related results.	
	GROUP THEORY- UNIT -IV	**(06 Hours)**
	Permutations, even and odd permutations, transportation, disjoint cycles, permutation groups and theirrelated results, Cayley's theorem, Cauchy's theorem (with proofs)	
	TRIGONOMETRY- UNIT -I	**(10 Hours)**
	Exponential values of sines, cosines, hyperbolic functions, Inverse circular and hyperbolic functions, and the logarithm of the complex quantities.	

	TRIGONOMETRY- UNIT -II	**(08 Hours)**
	Gregory's series, Summation of series, Infinite product of sine and cosine	
	Tutorials will be based on the coverage of the above topics separately.	(**15 Hours**)
	(Total Contact Time: 45 Hours + 15 Hours=60 Hours)	

3.	**Tutorials**
1	Tutorial will be based on topics: Groups, subgroups, etc.
2	Tutorial will be based on topics: Normal subgroups, cyclic groups, etc.
3	Tutorial will be based on topics: Cosets and Lagrange’s theorem.
4	Tutorial will be based on topics: Homomorphism and Isomorphism theorems.
5	Tutorial will be based on topics: Direct products of groups.
6	Tutorial will be based on Cauchy’s theorem.
7	Tutorial will be based on circular and hyperbolic trigonometric functions.
8	Tutorial will be based on the logarithm of the complex quantities.
9	Tutorial will be based on Summations of the series.
10	Tutorial will be based on the Infinite product of sine and cosine.

4.	**Books Recommended**
1	N.S. Gopalakrishnan, "University Algebra," New Delhi: New Age International (P) Limited, 2018.
2	J.A. Gallian, "Contemporary Abstract Algebra," 9th ed. Cengage Learning, 2016.
3	J.B. Fraleigh, "First Course in Abstract Algebra," 3rd ed. New Delhi: Narosa Publishing House, 2003.
4	S.L. Loney, "Plane Trigonometry-I," Palala Press, 2016.
5	S.L. Loney, "Plane Trigonometry-II," Palala Press, 2016.

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – II **ADVANCED CALCULUS** **MA120**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

Subject Code:##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4)EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to:**
CO1	demonstrate the knowledge of Successive Differentiation
CO2	Analyze and apply concepts of derivatives of multivariable functions.
CO3	plot the curves in Cartesian, polar, and parametric forms.
CO4	analyze the Fourier series, Fourier Integral, and Fourier transform of a function
CO5	apply the concept of vector calculus to engineering problems

2.	**Syllabus**	
	DIFFERENTIAL CALCULUS	**(07 Hours)**
	Differentiation of Hyperbolic and Inverse Hyperbolic Functions. Successive Differentiation, standard forms, Leibnitz's theorem and applications, Power series, Expansion of functions, Taylor's and Maclaurin's series. Curvature, Radius of curvature for Cartesian curve with the application.	
	PARTIAL DIFFERENTIATION	**(10 Hours)**
	Functions of several variables, Limits and continuity, Partial differentiation, Euler's theorem for homogeneous function, Modified Euler's theorem, and Taylor's and Maclaurin's series for two variables. Tangent plane and Normal line, Error and Approximation, Jacobians with properties, Extreme values of a function of two variables, Lagrange's methods of undetermined multipliers	
	CURVE TRACING	**(06 Hours)**
	Envelopes, Concavity, Convexity, Multiple points, Classification of double points, tangents at the origin, Asymptotes (Cartesian and polar form), Curve tracing (Cartesian, polar and parametric forms).	
	FOURIER SERIES	**(07 Hours)**
	Definition, Fourier series with an arbitrary period, particularly periodic function with period 2π. Fourier series of even and odd function, Half range Fourier series.	
	FOURIER INTEGRAL AND FOURIER TRANSFORMS	**(07 Hours)**
	Fourier Integral theorem, Fourier sine and cosine integral complex form of integral, Inversion formula for Fourier transform, Fourier transforms of the derivative of a function.	
	VECTOR CALCULUS	**(08 Hours)**
	Scalar and vector point function, differential operator, gradient, directional derivative, divergence, curl and Laplacian operator with their properties, Line integral, Surface Integral, Volume integral, Green's, Gauss and Stokes theorem (with proofs) & applications.	
	Tutorials will be based on the coverage of the above topics separately.	(**15 Hours**)
	(Total Contact Time: 45 Hours + 15 Hours=60 Hours)	

Subject Code:##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4)EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Tutorials**
1	Tutorial will be based on Differential Calculus-I
2	Tutorial will be based on Differential Calculus-II
3	Tutorial will be based on Partial Differential Equations-I
4	Tutorial will be based on Partial Differential Equations-II
5	Tutorial will be based on Curve Tracing-I
6	Tutorial will be based on Curve Tracing-II
7	Tutorial will be based on the Fourier Series-I
8	Tutorial will be based on the Fourier Series-I
9	Tutorial will be based on the Fourier Integral and Transformation.
10	Tutorial will be based on Vector Calculus.

4.	**Books Recommended**
1	J. Stewart, "Calculus," Thomson Asia, Singapore, 2003.
2	P. O'Neil, "Advanced Engineering Mathematics," Thompson, Singapore, Ind. Ed. 2002.
3	E. Kreyszing, "Advanced Engineering Mathematics," John Wiley & Sons, Singapore, Int. Student Ed. 2015.
4	C. R. Wiley, "Advanced Engineering Mathematics," McGraw Hill Inc., New York Ed. 1993.
5	F. B. Hildebrand, "Methods of Applied Mathematics," PHI, New Delhi, 1968.
	Additional Reference Books
1	B. V. Ramana, "Higher Engineering Mathematics", The McGraw-Hill Inc., New Delhi, 2007.
2	S. Pal and S. C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi, 2015.
3	Bali and Iyengar, "Engineering Mathematics," Laxmi Publications, New Delhi, 2004.

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – II FUNDAMENTAL OF PYTHON PROGRAMMING MA134	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to:**
CO1	learn the basics of programming using Python
CO2	familiarize with object-oriented programming concepts
CO3	use different Python Libraries
CO4	write code using functions, files, and exception handling
CO5	implement Python to mathematics and computer science problems

2.	**Syllabus**	
	INTRODUCTION TO PYTHON, DATA TYPES, CONTROL STRUCTURES, DATA ANALYSIS &VISUALIZATION	**(12 Hours)**
	Overview of programming and programming languages, Introduction to Python programming, Features of Python, Python installation and setup, Python IDLE and basic operations, Writing and executing Python programs, Variables and data types (integers, floats, strings, Booleans), Basic operations (arithmetic, comparison, logical), Input/output operations (print (), input()), Conditional statements (if, elif, else), Looping constructs (for, while), Break, continue, and pass statements, Introduction to popular Python libraries (e.g., NumPy, Pandas, Matplotlib), Introduction to data analysis and visualization in Python, working with data using Python libraries (e.g., Pandas, Matplotlib).	
	FUNCTIONS AND OBJECT-ORIENTED PROGRAMMING	**(06 Hours)**
	Defining and calling functions, Function parameters and return values, Scope and lifetime of variables, Introduction to object-oriented programming (OOP), Classes and objects in Python, Constructors and destructors, Inheritance, and polymorphism.	
	FILE HANDLING, EXCEPTION HANDLING, AND INTRODUCTION TO ML & AL	**(05 Hours)**
	Opening, reading, and writing text and binary files, File modes and file objects, Exception handling using try, except, else, and finally, handling specific exceptions, Introduction to machine learning	

	and its applications, Introduction to popular Python libraries for machine learning (e.g., scikit-learn, TensorFlow).	
	APPLICATIONS OF PYTHON IN COMPUTATIONAL ALGEBRA	**(08 Hours)**
	Basic mathematical operations using Python, working with math libraries (e.g., math, random), Solving for x; Expanding terms; Creating and accessing Matrices using Sympy and Numpy; Prime factorization; Solving inequalities; Summation and Products; Algebra of polynomials; Finding roots of polynomials; Complex numbers; Logarithm properties; Arithmetic sequences; Geometric sequences; Maxima and minima of functions; Even and odd functions.	
	PYTHON FOR TRIGONOMETRY AND CALCULUS	**(08 Hours)**
	Plotting random phase angles; converting angles and radians; plotting curves of trigonometric functions; Calculus – computing limits of a function, derivatives of functions, plotting tangent lines, finding critical points; partial derivatives; Indefinite integrals; definite integrals; the area between curves; First-order and second-order ordinary differential equations.	
	ADVANCED APPLICATIONS OF PYTHON IN LINEAR ALGEBRA AND STATISTICS	**(06 Hours)**
	Row and column vectors; algebra of vectors – dot product, adding, scalar multiplication; Matrix multiplication; Matrix inverse; solving system of linear equations; Eigenvalues and Eigenvectors. Graphical presentation of data; Measure of central tendency – Mean, Median and Mode, Variance, and standard deviation.	
	Practical's will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours=75 Hours)	

3.	Practical
1	Program to calculate the sum and average of a list of numbers using functions.
2	Program to read data from a CSV file using the Pandas library and perform data analysis.
3	Program to plot a sine wave and cosine wave using Matplotlib.
4	Program to perform basic arithmetic operations (addition, subtraction, multiplication, division) using functions.
5	Program to create a class representing a student and calculate their grades based on certain criteria.
6	Program to create a class representing a graph and perform basic operations like adding nodes, edges,
7	Program to handle exceptions while reading a file and display appropriate error messages.
8	Program to implement linear regression using the scikit-learn library for a given dataset.
9	Program to calculate the roots of a quadratic equation using the math library.
10	Program to generate a random matrix using the NumPy library and perform matrix multiplication.

11	Program to compute the derivative of a given function using symbolic mathematics with SymPy.
12	Program to calculate the definite integral of a function using numerical integration methods from SciPy.
13	Program to calculate the mean, median, and mode of a list of numbers using NumPy and statistics.
14	Program to solve a system of linear equations using NumPy.
15	Program to calculate the eigenvalues and eigenvectors of a matrix using NumPy.

4.	**Books Recommended**
1	Timothy A Budd, “Exploring Python”, Tata McGraw Hill, New Delhi. Michel Dawson, “Python Programming for Absolute Beginners”, Third Edition, Course Technology Cengage Learning Publications, 2013.
2	Allen B. Downey, Think Python: How to Think Like a Computer Scientist, second edition, O'Reilly Media, Inc, 2015.
3	Bill Lubanovic , Introducing Python, O'Reilly Media, Inc. 2nd Edition, November 2019.
4	Amit Saha, Doing Math with Python Use Programming to Explore Algebra, Statistics, Calculus, and More, No Starch Press, 2015.
5	Robert Johansson, Numerical Python: Scientific Computing and Data Science Applications with NumPy, SciPy, and matplotlib, Apress,2018.
6	David A. Ham , Object-oriented Programming in Python for Mathematicians Paperback, 2023.

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – II DIGITAL GATES AND ELECTROMAGNETIC CIRCUITS PHXXX	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to:
CO1	explain the basic concepts and terminology of number systems, binary codes and logic gates
CO2	interpret the basic relations of logic gates conversations by using Boolean algebra
CO3	interpret the dielectrics and polarization and their applications in electrostatics
CO4	explain magnetization in materials and magnetic fields in matter
CO5	analyze the magnetization in materials and their applications

2	Syllabus	
	INTRODUCTION, NUMBER SYSTEM	(07 Hours)
	Digital & Analog System, Logic Levels and Pulse Waveforms, Elements of Digital Logic, Functions of Digital Logic, Digital Integrated Circuits, The Decimal Number System, The Binary Number System, Representation of Signed Numbers and Binary Arithmetic in Computers, Different Number Systems.	
	BINARY CODES & LOGIC GATES	(02 Hours)
	Different Codes, and Gates, Inhibit circuits, 7400 series ICs, ANSI/IEEE Standard Logic symbols, Pulsed operation of Logic Gates	
	BOOLEAN ALGEBRA	(07 Hours)
	Logic Operations, Axioms and Laws of Boolean Algebra, Duality, Reducing Boolean Expressions, Boolean Expression and Logic Diagrams, Converting AND/OR/Invert Logic to NAND/NOR logic, Determination of Output level from the diagram	
	ELECTRIC FIELDS IN MATTER	**(09 Hours)**
	Conductors, Dielectrics, Polarization, The field of Polarized object, The electric displacement, Boundary Conditions, Conduction, and convection currents, Ohm's law	
	BOUNDARY VALUE PROBLEMS	**(09 Hours)**

	Laplace equation in one, two, and three-dimensions, 1st and 2nd uniqueness theorem, Classic image problem, Induced surface charge, Force and energy, other image problems, Separation of variables, Multipole expansion	
	MAGNETIC FIELDS IN MATTER	**(09 Hours)**
	Magnetization in materials, The field of a magnetized object, The auxiliary field H, Linear and non-linear media, Magnetic boundary conditions.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours=75 Hours)	

3.	**Practical**
1	Digital Integrated Circuits, Representation of Signed Numbers and Binary Arithmetic in Computers
2	Inhibit circuits, Pulsed operation of Logic Gates , Reducing Boolean Expressions
3	Converting AND/OR/Invert Logic to NAND/NOR logic, Determination of Output level from the diagram
4	Wheatstone Bridge
5	Melde's Experiment
6	Decay Constant/ Probability
7	Carey Foster Bridge
8	Magnetic Field of Earth
9	Vibrational and Deflection Magnetometer
10	Two Bean Interference by Fresenl Bi Prism and Fresenl Mirror

4.	**Books Recommended**
1	M. N. O. Sadiku, Elements of Electromagnetics, Oxford University Press, 2003.
2	J. D. Jackson, Classical Electrodynamics, Wiley,2012.
3	Mark Zemansky, Richard Dittman, Heat and Thermodynamics, McGraw Hill Education,2017.
4	D. J. Griffiths, Introduction to electrodynamics, Prentice-Hall of India Private Limited, 2015
5	A. Beiser, S. Mahajan and S. R. Choudhary, Concepts of Modern Physics, McGraw Hill Education, 2015.
6	Floyd T. L, Jain R. P., Digital Fundamentals, Dorling Kindersley (India) Pvt Ltd 2008.
7	Morris Mano M. Digital Logic & Computer Design, Dorling Kindersley (India) Pvt. Ltd. 2008.

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – II Foundation Course of Data Science MA136	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to:
CO1	acquaint with the properties data
CO2	Find correlation of data
CO3	Apply regression on data
CO4	Learn Sampling from population
CO5	analyse Data Collection Methods

2	Syllabus	
	Introduction	**(09 Hours)**
	Data Science and Big Data, Facets of Data, Data Science Process, Defining Research Goals Retrieving Data, Data Preparation, Exploratory Data Analysis, Build the Models, Presenting Findings and Building Applications, Data Mining, Data Warehousing, Basic Statistical Descriptions of Data methods.	
	Describing Data	**(07 Hours)**
	Types of Data, Types of Variables, Describing Data with Tables, Graphs for Quantitative Data, Graph for Qualitative (Nominal) Data, Misleading Graph, Describing Data with Averages, Describing Variability, Normal Distributions and Standard (z) Scores	
	Describing Relationships-I	**(07 Hours)**
	Correlation, Scatter Plots, Correlation Coefficient for Quantitative Data, Coefficient of Multiple Correlation, Properties of Correlation	
	Describing Relationships-II	**(08 Hours)**
	Regression, Interpretation of R2, Multiple Regression Equations, Regression Towards the Mean	
	Sampling	**(05 Hours)**

	Introduction, Population Parameter & Sample Statistic, Sampling, Probabilistic Sampling, Non-Probability Sampling, Advantages and disadvantages of non-probability sampling	
	Data Collection Methods	**(09 Hours)**
	Different Data collection method, Questionnaire design, Role of interviewers, Data gathering and processing, Estimation, Weighting, Sampling Error, Non-Sampling Error, Quality Measurement	
	Tutorial will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours=75 Hours)	

3.	**Tutorial**
1.	Tutorial on Basic of Data
2.	Tutorial on types of Data
3.	Tutorial on Data Visualization
4.	Tutorial on correlation
5.	Tutorial on multiple correlation
6.	Tutorial on Regression
7.	Tutorial on multiple Regression
8.	Tutorial on Sampling
9.	Tutorial on Data Collection Method
10.	Tutorial on Sampling Error

4.	**Books Recommended**
1	Cathy O'Neil and Rachel Schutt, " Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014.
2	Jiawei Han, Micheline Kamber and Jian Pei, " Data Mining: Concepts and Techniques", Third Edition. ISBN 0123814790, 2011.
3	Mohammed J. Zaki and Wagner Miera Jr, "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2014.
4	Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.
5	S.P.Gupat, "Statistical Methods", Sultan Chand & Sons, New Delhi , 2012.

Annexure-I

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Dual Degree Programme: Bachelor of Technology and Master of Technology in Mathematics and Computing

Dual Degree: B.Tech. & M.Tech. MaC - I, Semester – II INDIAN VALUE SYSTEM AND SOCIAL CONSCIOUSNESS HS120	Scheme	L	T	P	Credit
		2	0	0	02

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	interpret the important values that need to be cultivated
CO2	analyse the cultures depicted in Ramayana, Mahabharata, Jainism and Buddhism
CO3	review the structure of Indian knowledge system
CO4	discuss the significance of constitution of India
CO5	demonstrate social responsibility

2.	Syllabus	
	HUMAN VALUES AND CONSCIOUSNESS	**(08 Hours)**
	Human Values Definition and Classification of Values; The Problem of Hierarchy of Values and their Choice; Self-Exploration; 'Basic Human Aspirations; Right understanding, Relationship and Physical Facility; fulfilment of aspirations; Understanding Happiness and Prosperity, Harmony at various levels. What Is Consciousness? ; Can We Build A Conscious Machine?; Levels Of Consciousness; Mind, Matter And Beyond; Holistic Lifestyle; Dealing With Anxiety; Connecting Mind To Brain; Minds, Brains, And Programs.	
	INDIAN CULTURE AND HERITAGE	**(07 Hours)**
	Culture and its salient features: The Vedic – Upanishadic Culture and society, Human aspirations in those societies; Culture in Ramayana and Mahabharata: The Ideal Man and Woman, Concepts Maitri, Karuna, Seela, Vinaya, Kshama, Santi, Anuraga – as exemplified in the stories and anecdotes of the Epics; The Culture of Jainism: Jaina conception of Soul, Karma and liberation, Buddhism as a Humanistic culture; The four Noble truths of Buddhism; Vedanta and Indian Culture;	
	INDIAN KNOWLEDGE SYSTEM	**(08 Hours)**
	Indian knowledge as a unique system, Place of Indian knowledge in mankind's evolution, Relevance of Indian knowledge to present day and future of mankind, Nature of Indian Knowledge; Structure of Indian Knowledge: Types of knowledge (para, apara), The scientific and the unscientific, Instruments for gaining and verifying knowledge, Knowledge traditions:	

	Lineages, Instruments - debate, epistemology and pedagogy, The inverted tree – axiomatic, deductive, empirical knowledge, and evolution of knowledge; Disciplines of Study: A brief outline of the subjects, the major contributions and theories along with timelines where relevant: Mathematics; Astronomy; Physical Sciences; Cosmogony; Language studies; Astrology; Moral studies/righteousness; Statecraft and political philosophy	
	INDIAN CONSTITUTION	**(04 hours)**
	History of Making of the Indian Constitution; Philosophy of the Indian Constitution: Preamble; Salient Features; Contours of Constitutional Rights & Duties; Organs of Governance: Parliament; Composition; Qualifications and Disqualifications; Powers and Functions	
	SOCIAL RESPONSIBILITY	**(03 Hours)**
	Social Responsibility: Meaning and Importance, Different Approaches of Social Responsibility. Social Responsibility of Business towards different Stakeholders. Evolution and Legislation of CSR in India.	
	(Total Contact Time: 30 Hours)	

3.	**Books Recommended**
1	D. K. Chaturvedi, Professional Ethics Values and Consciousness, Ane Books Pvt. Ltd., 2023.
2	R.R. Gaur, R Sangal, G. P.Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010.
3	A.N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
4	P R Rao, Indian Heritage and Culture, Sterling Publishers Pvt. Ltd, 1988.
5	D. Singh, Indian Heritage and Culture, APH Publishing Corporation, 1998.
6	Sri Prashant Pole, Treasure Trove of Indian knowledge, Prabhat Prakashan, 2021.
7	Sri Suresh Soni, Sources of our cultural heritage, Prabhat Prakashan, 2018.
8	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Annexure 66.32
of the 66th meeting of the IAAC

ANNEXURE-1
SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY

DEPARTMENT OF CHEMICAL ENGINEERING

B. Tech. in Chemical Engineering

SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY

ICHHANATH, SURAT – 395007, GUJARAT.

VISION & MISSION

INSTITUTE VISION

To be one of the leading Technical Institutes disseminating globally acceptable education, effective industrial training and relevant research output.

DEPARTMENT VISION

In-line with the vision of the institute, to be a well reputed department with global acceptance and to produce highly skilled and knowledgeable chemical engineering graduates, post graduates and doctorates capable of delivering the best output to the society.

INSTITUTE MISSION

To be a globally accepted centre of excellence in technical education catalyzing absorption, innovation, diffusion and transfer of high technologies resulting in enhanced quality for all the stake holders.

DEPARTMENT MISSION

To be one of the top engineering departments with excellent research work in the fields related to Chemical Engineering and offering technical knowhow to the stake holders.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Students of B. Tech. in Chemical Engineering Program will

PEO 1: Have successful career in the diversified area of chemical engineering industry and/or higher studies by acquiring knowledge in fundamentals of chemical engineering at global level.

PEO 2: Analyze and design contemporary chemical engineering issues with environmental and social awareness as well as ethical responsibility.

PEO 3: Exhibit professional approach, effective communication skills, leadership qualities and team work in their profession and adapt to modern trends by engaging in lifelong learning.

PROGRAM OUTCOMES (POs)

Students of B. Tech. in Chemical Engineering Program will be able to

PO 1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: To apply and evaluate Chemical Engineering Principles to design and improve chemical processes and equipments in conventional and emerging areas of chemical and allied fields.

PSO 2: To apply acquired knowledge of chemical engineering professionally and ethically for the benefits of society by providing sustainable solutions.

TEACHING SCHEME

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	First Semester (1st year of UG)				
1	Introduction to Chemical Engineering	CH101	3-1-0	4	70
2	Energy and Environment in Chemical Engineering	EG111	3-1-0	4	70
3	Mathematics	MA107	3-1-0	4	70
4	Engineering Drawing	ME110	2-0-4	4	100
5	Applied Chemistry	CY107	3-0-2	4	85
6	Workshop Practice	ME105	0-0-4	2	60
7	Indian Value System Social Consiousness	HS120	2-0-0	2	35
			Total	**24**	**490**
8	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CHV01 / CHP01	0-0-10	5	200 (20 x 10)
	Second Semester (1st year of UG)				
1	Process Calculations	CH102	3-1-0	4	70
2	Unit Processes	CH104	3-0-0	3	55
3	Fundamentals of Computer and Programming	CS110	3-0-2	4	85
4	English and Professional Communication	HS110	3-1-0	4	70
5	Numerical Methods in Chemical Engineering	CH106	3-1-0	4	70
			Total	**19**	**350**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CHV02 / CHP02	0-0-10	5	200 (20 x 10)
	Third Semester (2nd year of UG)				
1	Mechanical Operations	CH201	3-1-2	5	100
2	Fluid Flow Operations	CH203	3-1-2	5	100
3	Heat Transfer Operations	CH205	3-1-2	5	100
4	Mass Transfer Operations-I	CH207	3-1-0	4	70
5	Elective	CH2AA	3-X-X	3/4	55/70/85
			Total	**22-23**	**425-455**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CHV03 / CHP03	0-0-10	5	200 (20 x 10)
	Fourth Semester (2nd year of UG)				
1	Chemical Engineering Thermodynamics – I	CH202	3-1-0	4	70
2	Mass Transfer Operations – II	CH204	3-1-2	5	100
3	Chemical Reaction Engineering-I	CH206	3-1-2	5	100
4	Professional Ethics, Economics and Business Management	MG210	3-1-0	4	70
5	Elective	CH2BB	3-X-X	3/4	55/70/85
			Total	**21-22**	**395-425**
6	Minor / Honor (M/H#1)	CH2CC	3-X-X	4	70/85
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CHV04 / CHP04	0-0-10	5	200 (20 x 10)

B.Tech. II (Chemical Engineering) Semester – III MECHANICAL OPERATIONS CH201	Scheme	L	T	P	Credit
		3	1	2	05

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Recognize and identify problems associated with characterization, handling, processing, and transportation of bulk solids encountered in process industries.
CO2	Analyze and estimate the effects of different types of forces on fluid particle interactions in unit operations
CO3	edict behavior of fluid solid system based on the process variables.
CO4	Calculate efficiency and the size of the unit operations based on the desirable performance
CO5	Design different fluid solid separation equipment
CO6	Devise effective strategies to enhance problem solving skills.

2.	**Syllabus**	
	INTRODUCTION AND PARTICLES AND POWDER CHARACTERIZATION	**(08 Hours)**
	Overview of different operations with real Industrial examples, Particle size measurements, Describing the Size of Single Particle and Populations of Particles, Particle size distribution and Conversion between Distributions, Particle shape characterization, Bulk properties measurement, characterization of powder flowability, methods of size measurements, Sieve analysis.	
	SIZE REDUCTION	**(04 Hours)**
	Size reduction of solids, Mechanism of size reduction, Models for Predicting Energy Requirement and Product Size Distribution, Types & Classification of size reduction equipment, Crushers and Ball mills, Types of Milling Circuit: Open and closed-circuit grinding.	
	BEHAVIOUR OF SINGLE PARTICLE AND MULTIPLE PARTICLES IN A FLUID	**(06 Hours)**
	Settling of a single particle in fluid, Stokes' law, Drag force and drag coefficient, Different settling regimes, Free Settling and Hindered settling, Richardson-Zaki law, Batch settling test, design of sedimentation tank, Separation of solids from liquid	
	FLUID FLOW THROUGH A PACKED BED OF PARTICLES & THEORY OF FILTRATION	**(06 Hours)**
	Estimation of packed bed parameters, Prediction of pressure drop using Kozeny-Carman Equation, Ergun's equation, Types of filtrations, Constant pressure and constant rate filtration, Filtration equipments: Plate and frame filter press, pressure leaf filter, and rotary filter	
	FLUIDIZATION OF SOLIDS	**(03 Hours)**
	Estimation of fluidized bed parameters, Prediction of pressure drop and minimum fluidization velocity using Ergun's equation, Types of fluidizations.	

	PHYSICAL SEPARATORS	**(09 Hours)**
	Mechanisms of Particle separation, Gas-Cyclone separation, Electrostatic Precipitator, Fabric filters, Centrifugal Separators, Flotation, Jigging, Magnetic separation processes.	
	SIZE ENLARGEMENT (AGGLOMERATION)	**(03 Hours)**
	Types of Forces affecting Agglomeration, Wetting, Nucleation and Growth mechanisms, granulation, Types of granulators.	
	MIXING OF PARTICULATE MATERIALS AND STORAGE OF POWDERS	**(04 Hours)**
	Random mixing and perfect mixing, segregation of particles, mechanisms of segregation, Equipments for mixing of particles and powders. Solids, Storage, Transportation and Handling of Solids.	
	HEALTH EFFECTS OF PARTICULATE MATERIALS	**(02 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

3.	**Tutorials**
1.	Problems to calculate equivalent spherical diameter and calculation of specific surface area.
2.	Problems related to the particle size distribution and conversion of particle size distribution
3.	Problems for calculation of different types of mean size of particles and specific surface area of powder.
4.	Problems for calculation of energy requirement using Rittinger's law, Kick's law and Bond's law.
5.	Problem for estimation of particle size distribution using selection function and breakage distribution function
6.	Problems for calculation of drag force, drag coefficient and terminal settling velocity using Stokes' law, Newton's law and Ricardson-Zaki equation.
7.	Problem for design of sedimentation tank using batch settling test data.
8.	Problems to calculate pressure drop through packed bed using Ergun's equation.
9.	Problems to calculate minimum fluidization velocity of fluidized bed system.
10.	Problems related to calculation of filtration time, washing time of plate and frame filter press.
11.	Problem for design of gas cyclone: Calculation of cyclone diameter, cut size and number of cyclones.
12.	Problems for calculation of air to cloth ratio for fabric filter and determination of size and number of filter bags.
13.	Problem for design of Electrostatic precipitator (ESP): Calculation of particle migration velocity, efficiency of ESP.
14.	Problem related to measurement of quality and mixing index of solid –solid mixtures.
15.	Problems related to the calculation of bulk properties of powder such as bulk density, tapped density, porosity and flowability index.

4.	**Practicals**
1.	Measurements of bulk and flow properties of different powders
2.	To study powder compaction behaviour of powder
3.	Measurement of angle of repose of different powders.
4.	Particle size measurement and analysis by sieve analysis.
5.	Particle size and shape analysis by image processing.
6.	Study of particle size reduction by ball milling.
7.	Study of sedimentation behaviour of $CaCO_3$ Suspension by batch settling test
8.	Study of flow of fluid through packed bed and estimation of pressure drop.
9.	Study of flow through fluidized bed with and estimation of minimum fluidization velocity.
10.	The prediction of pressure drop through packed bed using artificial neural network and virtual lab
11.	The separation of particles by cyclone separator
12.	The study of powder mixing using V type blender

5.	**Books Recommended**
1	Martin Rhodes, "Introduction to Particle Technology", 2nd Edition, John Wiley & Sons, 2008
2	McCabe W.L., Smith J.C., Harriott P., "Unit Operations of Chemical Engineering", 6th & 7th Eds., McGraw-Hill, New York, 2001 & 2005.
3	Foust A.S., Wenzel L.A., Clump C.W., Maus L., Anderson L.B. “Principles of Unit Operations”,2nd Edition, John Wiley & Sons, New York, 1980.
4	Coulson J.M., Richardson J.F., “Chemical Engineering”, Vol. 2, 5th Ed., Elsevier, New Delhi, 2002.
5	http://www.ide.iitkgp.ac.in/Pedagogy_view/example.jsp?USER_ID=82 online pedagogy course.

B. Tech. II (Chemical Engineering) Semester – III FLUID FLOW OPERATIONS CH203	Scheme	L	T	P	Credit
		3	1	2	05

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Predict the velocity profile and flow behaviour in various types of systems
CO2	Calculate pressure loss in different types of flow systems
CO3	Calculate power requirement for fluid transport
CO4	Compare and select appropriate types of fluid moving machineries for fluid transport
CO5	Justify the use of specific fluid moving machineries
CO6	Evaluate discharge coefficient of various flow meters, select appropriate flow meters, and justify the selection of flow meters for a variety of flow conditions

2.	**Syllabus**	
1	**INTRODUCTION**	**(03 Hours)**
	Definition of Unit Operations, Definition and basic concepts of fluid, Properties of fluids, Stress, Deformation, Dimensional analysis.	
2	**FLUID STATICS AND ITS APPLICATIONS**	**(5 Hours)**
	Nature of fluids: Incompressible and compressible fluids, Pressure concepts, Hydrostatic equilibrium in gravitational and centrifugal field, Manometers, Inclined manometer, Continuous gravity decanter and centrifugal decanter.	
3	**FLUID FLOW PHENOMENA**	**(5 Hours)**
	Types of flow, Potential flow, One dimensional flow, Laminar flow, Reynolds number, Newtonian and non-Newtonian fluids, Velocity gradient and Rate of shear, Viscosity of gases and liquids, Turbulent flow, Nature of turbulence, Eddy viscosity, Eddy diffusivity of momentum, Flow in boundary layers, Laminar and turbulent flow in boundary layers, Boundary layer formation in straight tube and flat plates, Boundary layer thickness, Boundary layer separation and wake formation.	
4	**BASIC EQUATIONS OF FLUID FLOW AND THEIR APPLICATIONS**	**(07 Hours)**
	Stream line and stream tubes, Average velocity, Mass velocity, Continuity equation, Momentum balance, Navier-Stokes equations, Bernoulli's equation.	
5	**FLOW OF INCOMPRESSIBLE FLUIDS**	**(08 Hours)**
	Flow of incompressible fluids in pipes, Friction factor, Laminar flow of Newtonian and non-Newtonian fluids, Turbulent flow in pipes and closed channels, Effect of roughness, Friction factor chart, Drag reduction in turbulent flow Friction factor in flow through channels of noncircular cross section, Friction from changes in velocity or direction, Effect	

	of fittings and valves, Practical use of velocity heads in design, Minimization expansion and contraction losses.	
6	**FLOW OF COMPRESSIBLE FLUIDS AND ITS APPLICATIONS**	**(4 Hours)**
	Continuity equations, Velocity of sound, Stagnation temperature, Processes of compressible flow.	
7	**FLUID FLOW MEASUREMENTS**	**(3 Hours)**
	Fluid flow measurement: Venturi meter, Orifice meter, Rotameter, Pitot tubes, etc.	
8	**FLUID MOVING MACHINERIES**	**(5 Hours)**
	Transportation and metering of fluids, Pipe, fitting and valves, Construction, working and characteristic features of various types of pumps, compressors, blowers and fans	
9	**APPLICATIONS OF FLUID MECHANICS**	**(5 Hours)**
	Flow past immersed bodies: Drag, Drag coefficients, Flow through beds of solids, Particle motion, Terminal velocity, Hindered settling, Settling and rise of bubbles and drops, Fluidization, Introduction to computational fluid dynamics.	
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

3.	**Tutorials**
1	Reynolds number
2	Flow behaviour
3	Fluid statics
4	Fluid flow phenomena and basic equations
5	Flow of incompressible fluids
6	Flow of compressible fluids
7	Flow measurement
8	Fluid moving machineries, etc.
9	Quiz
10	Assignments / Mini projects & presentation on related topics

4.	**Practical**
1	Experiment on equivalent length of pipe fittings
2	Experiment on Reynolds number
3	Experiment on viscosity by Stokes' law
4	Experiment on Bernoulli's theorem
5	Experiment on venturimeter
6	Experiment on rotameter
7	Experiment on orifice meter

8	Experiment on characteristics of the centrifugal pump
9	Experiment on flow through ‘V’ notch
10	Experiment on flow through rectangular notch
11	Experiment on cativation
12	Experiment on Darcy’s law
13	Virtual Lab experiments

5.	**Books Recommended**
1	F. M. White, Fluid Mechanics, 9th Ed., McGraw Hill, 2022
2	G. K. Batchelor, An Introduction to Fluid Dynamics, 2nd Ed., Cambridge Univ Press, 2000.
3	V. Gupta V., S. K. Gupta, Fluid Mechanics and Its Applications, 3rd Ed., New Age International Publ., 2015.
4	W. L. McCabe, J. C. Smith, P. Harriott P., Unit Operations of Chemical Engineering", 7th Ed., McGraw-Hill, New York, 2017.
5	R. B. Bird, W. E. Stewart, E. N. Lightfoot, Transport Phenomena, 2nd ed., John Wiley & Sons, 2006.

B. Tech. II (Chemical Engineering) Semester – II HEAT TRANSFER OPERATIONS CH205	Scheme	L	T	P	Credit
		3	1	2	05

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Explain conduction, convection and radiation principles and applications.
CO2	Mathematically model heat transfer problems
CO3	Estimate heat transfer coefficient for convection.
CO4	Identify the type of heat transfer model that needs to be applied.
CO5	Analyze the performance of heat exchangers.
CO6	Select evaporator for industrial applications.

2.	**Syllabus**	
	INTRODUCTION	**(02 Hours)**
	Modes of heat transfer: conduction, convection and radiation, Mechanism and applications.	
	CONDUCTION	**(06 Hours)**
	General conduction equation in Cartesian coordinate, Steady state conduction through Plane, Cylindrical and Spherical walls, Steady state conduction with heat generation, Transient heat conduction and Lumped heat capacity analysis.	
	EXTENDED SURFACES	**(04 Hours)**
	Different types of fins, Temperature profile and heat transfer of fins, effectiveness and fin efficiency	
	FORCED CONVECTION	**(08 Hours)**
	Hydrodynamic and thermal and boundary layer, Internal and external forced convection in laminar and turbulent flow, Flow in circular and non-circular tubes, Cylinder in cross flow, Flow across banks of tubes, Convection correlations.	
	NATURAL CONVECTION	**(04 Hours)**
	Physical considerations, Laminar and turbulent free convection on a vertical surface, Empirical correlations, Free convection within parallel plate channels and encloser, Combined free and forced convection	
	BOILING AND CONDENSATION	**(06 Hours)**
	Boiling modes, Pool boiling, Pool boiling correlation, Forced convection boiling, Laminar and turbulent film condensation on a vertical surface, Film condensation of radial systems, Condensation in horizontal tubes, Dropwise condensation.	
	HEAT EXCHANGERS	**(06 Hours)**
	Heat Exchanger Types: Double pipe heat exchanger, Shell-and-tube heat exchanger, Spiral and Plate heat exchanger, Extended surface heat exchanger and Compact heat exchanger, Overall heat transfer coefficient, Heat exchanger analysis: LMTD Method and Effectiveness-NTU method, LMTD correction factor, Fouling factor, Heat exchanger design and performance calculations.	

	EVAPORATION AND CRYSTALIZATION	**(05 Hours)**
	Different types of evaporators, Single effect and Multi-effect evaporators, Material and Heat balance in single and multi-effect evaporators. Equilibrium in crystallization, operation and equipment.	
	RADIATION	**(4 Hours)**
	Fundamental concepts, Radiation heat fluxes, Blackbody radiation, Emission from real surfaces, Absorption, reflection, and transmission by real surfaces, Kirchhoff's law, View factor, Blackbody radiation exchange, Radiation exchange between opaque, diffuse, gray surfaces in an enclosure.	
	TUTORIALS WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

3.	**Tutorials**
1	Tutorial is based on conduction through composite wall of plane, cylindrical and spherical wall
2	Tutorial is based on conduction in with heat generation of different boundary conditions
3	Tutorial is based on heat transfer in fins of infinite length and finite length with insulated end
4	Tutorial is based on heat transfer in fins of finite length with convection from fin end
5	Tutorial is based on transient heat conduction using lumped heat capacity
6	Tutorial is based on hydrodynamic and thermal boundary layers
7	Tutorial is based on forced convection on external surfaces
8	Tutorial is based on forced convection on flow across banks of tubes
9	Tutorial is based on forced convection on internal flows
10	Tutorial is based on natural convection
11	Tutorial is based on pool boiling and film condensation
12	Tutorial is based on material and energy balance for a single effect evaporator
13	Tutorial is based on overall heat transfer coefficient and LMTD method
14	Tutorial is based on Effectiveness-NTU method for heat exchanger analysis
15	Tutorial is based on radiation fluxes and view factor

4.	**Practicals**
1	Experiment on Heat transfer through composite wall at different temperature.
2	Experiment on Thermal conductivity of insulating powder (Asbestos powder).
3	Experiment on Heat transfer in double pipe heat exchanger in laminar flow.
4	Experiment on Heat transfer in double pipe heat exchanger in turbulent flow.
5	Experiment on Heat transfer by forced convection.
6	Experiment on Heat transfer coefficient in natural convection.
7	Experiment on Heat transfer in double pipe heat exchanger in parallel flow.
8	Experiment on Heat transfer in double pipe heat exchanger in counter-current flow.

9	Experiment on Shell and tube heat exchanger.
10	Experiment on Heat transfer by radiation: Stefan-Boltzmann Law.
11	Experiment on Heat Transfer in Agitated Vessel.

5.	**Books Recommended**
1	Hollman, J. P., Heat Transfer – Basic Approach, 10^{th} Edition, McGraw-Hill Pub., 2010.
2	Incropera, F.P., DeWitt, D.P., Bergman T.L., Lavine A.S., Incropera's Principles of Heat and Mass Transfer, Global Edition, Wiley India Edition, 2019.
3	Geankoplis C. J., Transport Processes and Separation Process Principles, Pearson, 4th Edition 2012.
4	Suryanarayana, N. V., Engineering Heat Transfer, 2nd Edition, Penram International Publishing (I) Private Ltd., Mumbai, 2015.
5	Kern, D. Q., Process Heat Transfer, McGraw-Hill Int. Edition, New York, 1997.

B.Tech. II (Chemical Engineering) Semester – III MASS TRANSFER OPERATIONS-I CH207	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Explain a scope of mass transfer operations in chemical industries.
CO2	Determine diffusivity and flux for compounds present in gas, liquid and solid system.
CO3	Analyze the mechanism of mass transfer in various systems related to chemical engineering and estimate mass transfer coefficient.
CO4	Estimate the gas-vapor properties and Estimate number of stages using graphical and analytical methods for separation operations excluding distillation.
CO5	Design (process design) the equipment for distillation operation (single stage and multiple stages) using graphical and analytical methods.

2.	**Syllabus**	
	INTRODUCTION	**(02 Hours)**
	Introduction to Mass Transfer Operation: classification & method.	
	DIFFUSION AND MASS TRANSFER	**(12 Hours)**
	Molecular diffusion in fluids, Steady state diffusion (both gases & liquids), Diffusivity of liquids & gases, Diffusion in solids.	
	MASS TRANFER COEFFICIENTS	**(06 Hours)**
	Mass Transfer co-efficient in laminar & turbulent flow, Mass, Heat and Momentum transfer analogies.	
	INTER PHASE MASS TRANSFER	**(06 Hours)**
	Equilibrium, Diffusion between phases, Material balance, Stages and efficiency.	
	DISTILLATION	**(14 Hours)**
	VLE data, Flash, differential and continuous distillation, McCabe-Thiele and Ponchon-Savarit method, Distillation in a packed column, Azeotropic, extractive, molecular and multicomponent distillation, Reactive distillation.	
	HUMIDIFICATION	**(05 Hours)**
	Vapor-gas mixtures, Psychrometric properties, Adiabatic and non-adiabatic operations, Cooling towers.	
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
	Problems based on the topics covered during the theory classes Problems based on diffusion and flux

	Problems based on mass transfer coefficients Problems based on estimation of number of stages Problems based on psychrometric properties Problems based on process design aspects of distillation

4.	**Books Recommended**
1	Treybal R.E., "Mass-Transfer Operations", 3rd Ed., McGraw-Hill, New York, 1981.
2	McCabe W.L, Smith J.C., Harriott P., "Unit Operations in Chemical Engineering", 6th & 7th Eds., McGraw-Hill, New York,2001 & 2005.
3	Coulson J.M., Richardson J.F., Backhurst J. R., Harker J.H. "Chemical Engineering" Vol. 1. 6th Ed. Elsevier, New Delhi, 2004.
4	Dutta, B. K., "Principles of Mass Transfer and Separation Process" PHI Learning Pvt Ltd., New Delhi, 2007.
5	Cussler E.L., "Diffusion: Mass Transfer in Fluid Systems", 2nd Ed., Cambridge University Press, Cambridge, 1997.

B.Tech. II (Chemical Engineering) Semester – IV CHEMICAL ENGINEERING THERMODYNAMICS - I CH202	Scheme	L	T	P	Credit
		3	1	0	04

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Understand and apply the laws of thermodynamics for open and closed systems to set up the energy balances and to solve them for various thermodynamic processes
CO2	Evaluate thermodynamic properties of pure substances using various PVT equations-of-state
CO3	Calculate heat transfer associated with processes involving phase changes and reactions.
CO4	Calculate the change in thermodynamic properties for the ideal and real fluid systems
CO5	Calculate the system states and energy rate of turbine, compressor, pumps etc. and asses the environmental & safety aspects in chemical engineering
CO6	Estimate the energy requirement of thermodynamics cycles and processes.

2.	**Syllabus**	
	INTRODUCTION AND FIRST LAW OF THERMODYNAMICS	**(07 Hours)**
	Introduction and Fundamentals of Thermodynamics Systems and variables, Work, Heat, Reversible and Irreversible Processes, internal energy, First Law: Closed and Open Systems, enthalpy, equilibrium state, phase rule, heat capacity, Steady and Transient Processes, Significance of Chemical Engineering Thermodynamics	
	PROPERTIES OF PURE SUBSTANCES	**(09 Hours)**
	Thermodynamics diagrams; Equation of states; Generalized correlations and acentric factor; Estimation of thermodynamic properties.	
	HEAT EFFECTS	**(05 Hours)**
	Heat capacities of gases as a function of temperature of liquids and solids, sensible heat, heat of vaporization, heat of reaction etc.	
	SECOND AND THIRD LAW OF THERMODYNAMICS	**(05 Hours)**
	Concept of entropy, reversible heat engine, entropy change and irreversibility, third law of thermodynamics.	
	THERMODYNAMIC PROPERTIES OF FLUID	**(08 Hours)**
	Mathematical relation among thermodynamic functions, Maxwell's relations, Interrelation between H, S, U, G, Cp, Cv, properties of single- and two-phase system. Residual properties using equation of state	
	THERMODYNAMICS OF FLOW PROCESS	**(07 Hours)**
	Throttling process, flow through nozzles, turbine, compressor, and pump with problems	
	REFRIGERATION AND LIQUEFACTION:	**(04 Hours)**

	Carnot refrigeration cycle, Vapor compression refrigeration cycle, liquefaction processes.	
	TUTORIALS WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Problem related to Introduction and First Law of Thermodynamics
2	Problem related to Introduction and First Law of Thermodynamics
3	Problem related to Introduction and First Law of Thermodynamics
4	Problem related to Properties of pure substance
5	Problem related to Properties of pure substances
C	Problem related to Properties of pure substances
7	Problem related to Heat Effects
8	Problem related to Heat Effects
9	Problem related to Second and third law of thermodynamics
10	Problem related to Second and third law of thermodynamics
11	Problem related to Thermodynamic properties of Fluid
12	Problem related to Thermodynamic properties of Fluid
13	Problem related to Thermodynamics of flow process
14	Problem related to Thermodynamics of flow process
15	Problem related to Refrigeration and Liquefaction

4.	**Books Recommended**
1	1. Smith J. M., Van Ness H. C., M.M. Abbott, “Introduction to Chemical Engineering Thermodynamics”, 6th Ed., McGraw-Hill, New York, 2001
2	Rao Y. V. C., “Chemical Engineering Thermodynamics”, Universities Press Limited, Heydrabad, 1997.
3	Kyle, B.G., "Chemical and Process Thermodynamics”, 2nd Ed., Prentice-Hall of India, New Delhi,1990.
4	Sandler, S.I., "Chemical and Engineering Thermodynamics", 2nd Ed., Wiley, New York, 1989.
5	Koretsky, M.D., “Engineering and Chemical Thermodynamics”, 2nd Ed., Wiley, New York, 2009

B.Tech. I (Chemical Engineering) Semester – I MASS TRANSFER OPERATIONS-II CH204	Scheme	L	T	P	Credit
		3	1	2	05

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Explain the mass transfer principles with reference to solid-liquid, gas-liquid, liquid-liquid contact.
CO2	Evaluate the scope of absorption, adsorption, liquid-liquid extraction, crystallization, leaching and drying.
CO3	Design (process design) the equipments for absorption, adsorption and liquid-liquid extraction.
CO4	Recommend suitable mode of operation and equipment for absorption, adsorption, liquid-liquid extraction, crystallization, leaching and drying.
CO5	Determine the time of drying and rate of drying for removal of moisture.
CO6	Appraise the concept of novel separation like membrane separation, supercritical fluid extraction, microwave assisted extraction, ultrasound assisted extraction, etc.

2.	**Syllabus**	
	ABSORPTION	**(09 Hours)**
	Equilibrium, Material balance for single component transfer, Multi-stage and packed tower operation (Equilibrium approach and rate approach), Graphical and analytical method for tray/ stage determination, Multi-component system, Non-isothermal operation, Absorption with chemical reaction.	
	EQUIPMENT FOR GAS-LIQUID OPERATIONS	**(03 Hours)**
	Sparged and agitated vessels, Venture scrubber, Wetted wall towers, Tray and packed towers, Mass transfer coefficients for packed towers, Hydrodynamic considerations.	
	LIQUID-LIQUID EXTRACTION	**(09 Hours)**
	Liquid equilibria, Stage-wise extraction, Graphical and analytical method for tray/ stage determination, Stage type extractor, Differential extractor.	
	ADSORPTION AND ION-EXCHANGE	**(07 Hours)**
	Adsorption equilibria, Stage-wise and continuous operations, Graphical and analytical method for tray/ stage determination, Principle of ion exchange, Equipments for adsorption and ion exchange.	
	DRYING	**(06 Hours)**
	Equilibrium, Batch and continuous drying, Mechanism and rate of drying, Equipments.	
	LEACHING	**(04 Hours)**
	Steady state and unsteady state operations, Methods of calculation, Equipments.	
	CRYSTALLIZATION	**(03 Hours)**
	Equilibrium, Operations and equipment.	

	INTRODUCTION TO RECENT SEPARATION TECHNIQUES	**(04 Hours)**
	Membrane separation, Supercritical fluid extraction, Microwave assisted extraction, etc.	
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

3.	**Tutorials**
	Problems based on the topics covered during the theory classes Problems based on liquid liquid extraction Problems based on absorption Problems based on adsorption Problems based on drying

4.	**Practicals**
1	Diffusion coefficient and Mass transfer coefficient
2	Crystallization
3	Vapor-liquid equilibria and Psychrometric properties
4	Differential Distillation and Azeotropic Distillation
5	Steam Distillation and Hydrodistillation
6	Ternary Diagram (Selection of a solvent)
7	Liquid-liquid Extraction (Single/Multiple stages)
8	Freundlich Isotherm and Adsorption in Packed Bed Column
9	Leaching using conventional techniques (Batch stirring, Soxhlet extraction, Open reflux extraction) and novel techniques (Microwave/Ultrasound assisted extraction)
9	Demo: Gas Chromatograph and UV-Vis Spectrophotometer
10	Demo: Pervaporation and Adsorption
11	Experiments through virtual lab

5.	**Books Recommended**
1	Treybal R.E., “Mass-Transfer Operations”, 3rd Ed., McGraw-Hill, New York, 1981.
2	McCabe W.L, Smith J.C., Harriott P., “Unit Operations in Chemical Engineering”, 6th & 7th Eds., McGraw-Hill, New York,2001 & 2005.
3	Coulson J.M., Richardson J.F., Backhurst J. R., Harker J.H. “Chemical Engineering” Vol. 1. 6th Ed. Elsevier, New Delhi, 2004.
4	Dutta, B. K., “Principles of Mass Transfer and Separation Process” PHI Learning Pvt Ltd., New Delhi, 2007.
5	Foust, A. S., Wenzel, A. L., Clump, C. W., Maus, L., Andersen, L. B. “Principles of Unit Operations”, 2nd Ed., John Wiley & Sons, Singapore, 2004.

B.Tech. II (Chemical Engineering) Semester – IV CHEMICAL REACTION ENGINEERING-I CH206	Scheme	L	T	P	Credit
		3	1	2	05

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Discuss kinetics of homogeneous reactions and applications
CO2	Solve kinetics, constant volume and variable volume batch reactor problems
CO3	Design for single and multiple reactions
CO4	Analyze the performance of CSTR and PFR
CO5	Design for Series-parallel reaction
CO6	Estimate heats of reaction from thermodynamics and product distribution

2.	**Syllabus**	
	INTRODUCTION	**(02 Hours)**
	Chemical kinetics, Classification of reactions, Variables affecting the rate of reaction, Reaction rate	
	KINETICS OF HOMOGENEOUS REACTIONS	**(05 Hours)**
	Concentration dependent term and temperature dependent terms of rate equation, Single and multiple reactions, Elementary and non-elementary reactions, Molecularity and order of reaction, Rate constant, Representation of reaction rate, Kinetic models, Temperature dependency from Arrhenius' law, thermodynamics, various theories, Activation energy, Searching for the reaction mechanism	
	INTERPRETATION OF BATCH REACTOR DATA	**(10 Hours)**
	Constant volume batch reactor, Variable volume batch reactor, Integral method and differential method of analysis of kinetic data, Temperature and reaction rate	
	INTRODUCTION TO REACTOR DESIGN	**(02 Hours)**
	Types of reactors, PFR, CSTR etc., Material & energy balances single ideal reactor, Space-time and space-velocity, Holding time, Introduction of non-ideal flow	
	DESIGN FOR SINGLE REACTIONS	**(10 Hours)**
	Size comparison of single reactors, General graphical comparison, Multiple reactor system, Recycle reactor, Autocatalytic reactions	
	DESIGN FOR MULTIPLE REACTIONS SYSTEMS	**(08 Hours)**
	Reaction in parallel, Reaction in series, Series-parallel reaction and applications	
	TEMPERATURE & PRESSURE EFFECTS	**(04 Hours)**
	Single & multiple reactions, Heats of reaction from thermodynamics, Product distribution	

	INDUSTRIAL APPLICATIONS	**(02 Hours)**
	Types of reactors used in industries, Advanced chemical reactors	
	INTRODUCTION TO BIOCHEMICAL REACTION ENGINEERING	**(02 Hours)**
	Types of bio-reactors, Design, scale-up, operation and control of bio-reactors, Kinetics of biochemical reactions	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

3.	**Tutorials**
1	Activation energy using Arrhenius law
2	Rate equation for non-elementary reaction
3	Arrhenius law and Temperature dependence
4	Representation of reaction rate and order of reaction
5	Size comparison of PFR and MFR
6	Space time and space velocity
7	Calculation of throughput for Recycle Reactor
8	Volume calculation for different arrangement of reactors
8	Series-parallel reaction
9	Production Distribution

4.	**Practical**
1	Integral method of analysis of kinetic data
2	Differential method of analysis of kinetic data
3	Activation energy and frequency factor
4	Half-life method
5	Pseudo first order reaction
6	Study of reaction kinetics in Batch Reactor
7	Study of reaction kinetics in Mixed Flow Reactor
8	Study of reaction kinetics in Plug Flow Reactor
8	Testing of kinetic data using Artificial Neural Network
9	Temperature dependency on Production Distribution

5.	**Books Recommended**
1	Levenspiel O., “Chemical Reaction Engineering”, 3rd Ed., John Wiley & Sons, Singapore,1998.
2	Fogler H.S., “Elements of Chemical Reaction Engineering”, 4th Ed., Prentice-Hall, NJ, 2006
3	Smith J. M., “Chemical Engineering Kinetics”, 3rd Ed., McGraw-Hill, New York, 1981.
4	Froment G.F., Bischoff K.B., “Chemical Reactor Analysis and Design”, 2nd Ed., John Wiley & Sons, Singapore, 1990.
5	Inamdar S.T.A., “Biochemical Engineering – Principles and Concepts”, Prentice-Hall of India, New Delhi, 2007.

B.Tech. II (Chemical Engineering) Semester – IV PROFESSIONAL ETHICS, ECONOMICS AND BUSINESS MANAGEMENT MG210	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Develop knowledge regarding Professional ethics
CO2	Develop knowledge of Economics in engineering
CO3	Develop managerial skills to become future engineering managers
CO4	Develop skills related to various functional areas of management (Marketing Management, Financial Management, Operations Management, Personnel Management etc.)
CO5	Build knowledge about modern management concepts
CO6	Develop experiential learning through Assignments, Management games, Case study discussion, Group discussion, Group presentations etc.

2.	Syllabus	
	PROFESSIONAL ETHICS	**(6 Hours)**
	Introduction, Meaning of Ethics, Approaches to Ethics, Major attributes of Ethics, Business Ethics, Factors influencing Ethics, Importance of Ethics, Ethics in Management, Organizational Ethics, Ethical aspects in Marketing, Mass communication and Ethics - Television, Whistle blowing, Education – Ethics and New Professional, Intellectual Properties and Ethics, Introduction to Professional Ethics, Engineering Ethics	
	ECONOMICS	**(8 Hours)**
	Introduction To Economics, Applications & Scopes of Economics, Micro & Macro Economics, Demand Analysis, Demand Forecasting, Factors of Production, Types of Cost, Market Structures, Break Even Analysis	
	MANAGEMENT	**(15 Hours)**
	Introduction to Management, Features of Management, Nature of Management, Development of Management Thoughts – Scientific Management by Taylor & Contribution of Henry Fayol, Coordination & Functions of Management, Centralization & Decentralization, Decision Making; Fundamentals of Planning; Objectives & MBO; Types of Business Organizations: Private Sector, Public Sector & Joint Sector; Organizational Behaviour: Theories of Motivation, Theories of Leadership	
	FUNCTIONAL MANAGEMENT	**(14 Hours)**
	Marketing Management: Core Concepts of Marketing, Marketing Mix (4p), Segmentation – Targeting – Positioning, Marketing Research, Marketing Information System, Concept of International Marketing, Difference Between Domestic Marketing & International Marketing; Operations Management: Introduction to Operations Management, Types of Operation Systems, Types of Layouts, Material Handling, Purchasing & Store System, Inventory Management; Personnel Management: Roles & Functions of Personnel Manager, Recruitment, Selection, Training; Financial Management: Goal of Financial Management, Key Activities In Financial Management, Organization of Financial Management, Financial Institutions, Financial Instruments, Sources of Finance	
	MODERN MANAGEMENT ASPECTS	**(2 Hours)**
	Introduction To ERP, e – CRM, SCM, RE – Engineering, WTO, IPR Etc.	

	TUTORIAL: Case Study Discussion, Group Discussion, Management games andAssignments / Mini projects & presentation on related Topics	**(15 Hours)**
(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)		

3.	**Tutorials**
1	Case Study Discussion
2	Group Discussion
3	Management games
4	Assignments / Mini projects & presentation on related Topics

4.	**Books Recommended:**
1	Balachandran V. and Chandrasekaran, Corporate Governance, Ethics and Social Responsibility, PHI, 2nd Edition, 2011
2	Prasad L.M., Principles & Practice of Management, Sultan Chand & Sons, 8th Edition,2015
3	Banga T. R. & Sharma S.C., Industrial Organisation & Engineering Economics, Khanna Publishers, 25th Edition, 2015
4	Everett E. Adam, Ronald J. Ebert, Production and Operations Management, Prentice Hall of India, 5th edition, 2012
5	Kotler P., Keller K. L, Koshi A.& Jha M., Marketing Management – A South Asian Perspective, Pearson, 14th Edition, 2014
6	Tripathi P.C., Personnel Management & Industrial Relations, Sultan Chand & sons, 21st Edition, 2013
7	Chandra P., Financial Management, Tata McGraw Hill, 9th Edition, 2015
ADDITIONAL REFERENCE BOOKS / FURTHER READING:	
1	Crane A. & Matten D., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Oxford University, 2010
2	Fritzsche D. J., Business Ethics: A Global and Managerial Perspectives, McGraw Hill Irwin, Singapore, 2004
3	Mandal S. K., Ethics in Business and Corporate Governance, Tata McGraw Hill, 2011

Annexure 66.32
of the 66th meeting of the IAAC

Teaching and Examination Syllabus

of

Bachelor of Technology (2nd Year)

in

Civil Engineering

Department of Civil Engineering

Sardar Vallabhbhai National Institute of Technology, Surat

Third Semester (2^{nd} year of UG) (Subjects)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Civil Engineering
B.Tech. Civil Engineering

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	First Semester (1st year of UG)				
1	Engineering Graphics	CE101	2-0-4	4	100
2	Surveying-I	CE103	3-1-2	5	100
3	Environmental Pollution and Management	CE105	3-0-0	3	55
4	Mathematics-I	MA109	3-1-0	4	70
5	English and Professional Communication	HS110	3-1-0	4	70
			Total	**20**	**395**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CEV01 / CEP01	0-0-10	5	200 (20 x 10)
	Second Semester (1st year of UG)				
1	Mechanics of Materials	CE102	3-0-2	4	85
2	Building Technology	CE104	3-0-2	4	85
3	Material Science	CY108	3-0-2	4	85
4	Mathematics II	MA108	3-1-0	4	70
5	Innovation, Incubation and Entrepreneurship	MG110	3-1-0	4	70
6	Indian Value System and Social Consciousness	HS120	2-0-0	2	35
			Total	**22**	**430**
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CEV02 / CEP02	0-0-10	5	200 (20 x 10)
	Third Semester (2nd year of UG)				
1	Hydraulic Engineering	CE201	3-1-2	5	100
2	Environmental Engineering	CE203	3-1-2	5	100
3	Building & Town Planning	CE231	3-1-2	5	100
4	Surveying II	CE207	3-1-2	5	100
5	Elective	CE2AA	3-X-X	3/4	55/70/85
			Total	**23-24**	**455**
	Fourth Semester (2nd year of UG)				
1	Concrete Technology	CE202	3-0-2	4	85
2	Highway Materials & Construction	CE204	3-0-2	4	85
3	Soil Mechanics	CE232	3-1-2	5	100
4	Elementary Structural Mechanics	CE206	3-0-2	4	85
5	Elective	CE2BB	3-X-X	3/4	55/70/85
			Total	**20-21**	**410-440**
6	Minor / Honor (M/H#1)	CE2CC	3-X-X	4	70/85
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CEV04 / CEP04	0-0-10	5	200 (20 x 10)
	Fifth Semester (3rd year of UG)				
1	Design of Steel Structures	CE301	3-0-2	4	85

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

CE 201 Hydraulic Engineering

L	T	P	C
3	1	2	5

1. Course Outcomes (COs)

At the end of the course, the students will be able to:

CO1	Apply linear momentum and energy equation in fluid flow problems
CO2	Analyse laminar and turbulent flows through close conduits
CO3	Analyze the growth of Boundary layer over flat plate
CO4	Compute and analyse flow in open conduit
CO5	Analyse the flow through pumps and turbines

2. Syllabus

- **FLUIDS PROPERTIES AND HYDROSTATICS** **(08 Hours)**
  Fluid continuum, fluid properties, hydrostatic forces on plain and curved surfaces, stability of floating and submerged bodies, pressure measurements.

- **FLUID KINEMATICS AND DYNAMICS** **(08 Hours)**
  Concept of fluid particles, stream lines, path lines, differential forms of continuity equation, stream function, translation, deformation, rotation, circulation and vorticity of fluid elements, , stream function, potential function, flow net, acceleration of fluid elements; System and control volume. Steady linear momentum equation, Euler's equation for one-dimensional flow, Bernoulli's equation including its applications for fluid flow problems.

- **BOUNDARY LAYER THEORY** **(03 Hours)**
  Concept and thickness of laminar and turbulent boundary layers over flat plates, boundary layer separation and their control.

- **LAMINAR AND TURBULENT FLOWS** **(08 Hours)**
  Reynolds experiments, Reynolds number and classification of laminar, transition and turbulent flows, flow development in laminar and turbulent flows, shear stress distribution, Hagen Poiseuille's equation, Coquette flow; characteristics of turbulent flows, Reynolds shear stresses, Prandtl's mixing length theory, velocity distributions in closed conduit flows with hydro dynamically smooth and turbulent flows, friction factor.

- **APPLICATION OF FLUID FLOWS THROUGH PIPES** **(04 Hours)**
  Major and minor head losses, pipes in series and parallel, pipes with equivalent diameter and length, Total energy and hydraulic gradient lines, analysis of water distribution network.

- **DIMENSIONAL ANALYSIS** **(02 Hours)**
  Development of functional relationships for fluid flows, pertinent and superfluous variables, Physical model laws, scale effect, distorted and undistorted models.

- **FLOWS AND CONCEPT OF SPECIFIC ENERGY IN OPEN CONDUITS** **(08 Hours)**
  Classification of open conduits flows, velocity and pressure distributions, applications of energy and momentum equations in open channels, development of uniform flows, resistance law, efficient channel section, section factors, specific energy and depth-discharge diagrams, critical flow, hydraulic jump.

- **INTRODUCTION TO PUPMS** **(04 Hours)**
  Classification of pumps, working principles and components of centrifugal pumps, velocity vector diagram and work done by centrifugal pumps, single and multistage pumps, Pumps in parallel and series, efficiency of pumps, operating characteristics of centrifugal pump.

3. Practical

1. Determination of metacentric height.
2. Estimation of hydraulic coefficients for orifice.
3. Calibration of rectangular and triangular notches.
4. Calibration of Venturi meter and orifice meter.
5. Verification of Bernoulli's principle.
6. Friction factors for laminar and turbulent flows for single and multiple pipes.
7. Characteristics of Forced and free vortex.
8. Measurement of velocity distribution using Pitot tube and Current meter.
9. Development of specific energy diagram.
10. Characteristics of Hydraulic jump.
11. Operating characteristics of centrifugal pumps.

(Total Lectures: 45 hours, Tutorial: 14 hours)

4. Books Recommended

1. W R Fox and A T McDonald, Introduction to Fluid Mechanics, Wiley and Sons Inc., New York, 1998.
2. A K Jain, Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2000.
3. K G Ranga Raju, Flow through Open channel, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1997.
4. K Subramanya, Flow in Open Channels, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1998.
5. F M. White, Fluid Mechanics, The McGraw Hill Companies, New York,2008

5. Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	1	1	1	1	1	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1
CO3	2	1	1	1	1	1	1	1	1	1	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1

1-Low 2-Moderate 3-High

6. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	1	1	1
CO3	1	1	1
CO4	1	1	1
CO5	1	1	1

1-Low 2-Moderate 3-High

CE 203 Environmental Engineering

L	T	P	C
3	1	2	5

1. Course Outcomes (COs)

At the end of Course, the students will be able to:

CO1	Analyze water quality and quantity requirements for given uses
CO2	Summarize the physical, chemical and biological characteristics of wastewater
CO3	Design water treatment plant based on the source water quality
CO4	Differentiate amongst various unit operations and processes for municipal wastewater treatment with design applications
CO5	Analyze different wastewater disposal options available

2. Syllabus

QUALITY AND QUANTITY OF WATER **(8 Hours)**
Water quality parameters – physical, chemical and microbiological, principles of their analysis. Drinking water quality standards. Water demand – types of demand, variation in demand, population forecast. Sources of water - Intake structures

WATER TREATMENT **(10 Hours)**
Need for water treatment. Process details and design considerations of treatment units such as aeration, sedimentation, coagulation and flocculation, filtration, disinfection, and water softening.

WATER DISTRIBUTION SYSTEMS **(4 Hours)**
Pumps and pumping stations. Pipes, Pipe appurtenances. Testing of water main - Distribution reservoirs - Distribution methods – Introduction to pipe network analysis -Planning of water supply project

MUNICIPAL WASTEWATER QUANTITY AND CHARACTERISTICS **(8 Hours)**
Wastewater Quantity - Classification of wastewater - Sewerage system for domestic wastewater and storm water - Collections, and appurtenances - Design and layout of sewerage systems - Maintenance of sewerage systems - Physical, Chemical & Biological characteristics and their significance.

TREATMENT OF MUNICIPAL WASTEWATER **(10 Hours)**
Objectives of Wastewater treatment- Treatment methods: Unit Operations and Processes Design criteria - Design of primary treatment System. Concepts of aerobic and anaerobic Biological treatment and removal mechanism, Design of various biological systems. Importance of nutrient removal, Sludge treatment methods

WASTEWATER DISPOSAL **(05 Hours)** Land disposal, Self purification of streams, Disposal standards, House drainage system, Septic tank application and design

(Total Lecture Hours 45, Tutorial: 15 hours)

3. Practicals

1. Water/wastewater quality: Determination of Turbidity, pH, alkalinity
2. Water quality: Hardness
3. Water quality: Fluoride
4. Water quality: Chlorides
5. Determination of Chlorine Demand and Chlorine Residual.
6. Determination of optimum coagulant dosage
7. Water quality: Bacteriological analysis of water.
8. Water and wastewater quality: Different types of solids
9. Water and wastewater quality: Sulphates and Phosphates

10. Wastewater: Chemical oxygen demand
11. Wastewater: Biochemical oxygen demand

4. Book Recommended

1. M L Davis, Water and Wastewater Engineering, McGraw-Hill, 2010.
2. Manual on Water Supply & Treatment 3rd Ed. Central Public Health & Environmental Engg. Organization, Ministry of Urban Development, Govt. of India, New Delhi, 1999.
3. G L Karia, R A Christian and N D Jariwala "Wastewater Treatment Concepts & Design Approach", PrenticeHall of India Pvt. Ltd., New Delhi, 2023.
4. Manual on Sewerage and Sewage Treatment, CPH and EE Organisation, Ministry of works and housing Govt. of India, New Delhi, 1991.
5. T J McGhee, "Water Supply & Sewerage", McGraw Hill International Edition, New Delhi,1991.

B. Tech. II (Civil) Semester – III

	L	T	P	C
CE231 Building Planning	**3**	**1**	**2**	**5**

1. Course Outcomes (COs)

Students will be able to

CO1- Comprehend the provisions of building bye-laws, National Building Code and relevant acts, guidelines, codes in respect of building planning.
CO2- Understand, interpret and prepare working drawings, foundation plans and perspective drawing
CO3- Plan buildings and prepare approval drawings.
CO4- Apply the knowledge of Building Planning in Infrastructure planning as civil engineer.
CO5- Design and plan residential areas considering socio-economic factors.

2. Syllabus

- **BUILDING SYSTEMS:** **(06 Hours)**
  Introduction to buildings, Classification of buildings, Factors affecting site selection and Housing Location choice, Passive Planning.

- **PLANNING APPROACH:** **(12 Hours)**
  Building by–laws as per National Building Code and as per local authority, Overview of URDPFI and RERA, Process of planning, Family requirements and analysis, Conceptual plan using bubble and line outlines, Residential building forms. Role of Different stockholders in Planning.

- **BUILDINGS PLANNING:** **(14 Hours)**
  Principles of building planning, significance of sun diagram, wind diagram, orientation, factors affecting, and criteria under Indian condition, Approach of activity analysis for Residential and public buildings, Plan preparation for residential and Public building. Elements of human scale, Size and dimension decisions, Furniture layouts.

- **ARCHITECTURAL COMPOSITION:** **(04 Hours)**
  Mass Composition, Principles of elevation development-techniques, Impacts of colour and structure character, landscaping.

- **BUILDING DRAWINGS:** **(09 Hours)**
  Overview of Working and approval drawings, overview of Plan permission process and ODPS, One and two Perspective drawings, building service drawings and Fundamentals of electrical and plumbing layouts, Building drawing software applications

LIST OF TUTORIALS

1. Comprehending the Technical terms
2. Study of Building bye-laws and National Building Code
3. Study of model house and comprehend the planning parameters adopted.
4. Study of planning parameters
5. Analyzing approved plan of building.
6. Sketching of Sub- units of Residential and Public Building
7. Understand and planning of Building services

LIST OF PRACTICALS

1. Sketching of own residential building.
2. Study of Typical building plan of given building.
3. Planning and design of residential buildings.
4. Planning and design of public buildings.
5. Planning and design of circulation space.
6. Planning and design of Building services and Landscape.
7. Perspective drawings.

BOOKS RECOMMENDED:

1. Modak N.V. and V.N. Ambdekar, “Town and Country Planning and Housing”, Orient Longman Ltd., New Delhi. (1995)
2. Hiraskar G.K. “Fundamentals of Town Planning”, Dhanpat Rai & Sons, Delhi (1993).
3. M G Shah, C M Kale and S Y Patki, Building Drawing: With an Integrated Approach to Built Environment, Tata McGraw-Hill Education, New Dehi, 2002.
4. S M Patil, Building Services, Sachin Printers, Mumbai, 2004.
5. Y S Sane, Planning and Designing of Building, Allies Book Stall, Poona, 1990.

Mapping of CO-PO-PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	1	0	1	2	2	2	1	1	1	2	1	1
CO2	1	3	1	1	0	2	0	2	2	1	1	1	2	2	2
CO3	1	3	3	2	2	3	1	3	3	2	2	3	3	3	3
CO4	3	2	3	2	3	2	1	3	3	3	3	3	3	3	3
CO5	2	3	1	1	0	1	2	2	2	2	1	1	2	1	1

Surveying II CE207	L	T	P	Credit
	3	1	2	05

1. Course Outcomes (COs)

At the end of the Course the students will be able to:

CO1	Understand the Concept of Alignment and importance of curve in route Survey
CO2	Illustrate preparation of topographic map of hilly region.
CO3	Criteria for establishment of horizontal control points
CO4	Analyze the error in evaluated measurement from field observations
CO5	Brief the Basics of Photogrammetry, Total Station and Geospatial Technologies

2. Syllabus

Setting Out Curve (10 Hours)

Introduction, classification of curves, Definition and Notations, Simple Circular Curves, Methods of Setting out Curves, Compound Curve, Transition Curves, Vertical Curves

Tacheometric Survey (08 Hours)

Purpose, Principles of Tacheometry, Different Systems of Tacheometry, Various instruments, stadia constants, analytic lens, subtense bar, field work in tacheometry, reduction of readings, errors and precisions, Tacheometric Traversing,

Geodetic Surveying (12 Hours)

Principles - Classification if triangulation systems - Selection of stations - Signals and towers - Baseline measurement and correction - Extension of base - base net - Satellite station - Reduction to center - Introduction to theory of errors and technical terms

Theory of Errors (06 Hours)

Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities.

Trilateration (04 Hours)

Introduction, use of triletration, Advantages and Disadvantages of Triletration, Comparison of Triletration with Triangulation, Reconnaissance, Geometrical Figures and Precision in Triletration, Adjustment of Triletration

Basics of Photogrammetry, Total Station and Geospatial Technologies (05 hours)

Concept of photogrammetry, Brief of EDM and Total Station Survey, Fundamental of Remote Sensing, Overview of GIS, Introduction to GPS

(Total Lecture Hours: 45)

3. PRACTICALS / DRAWING*:

1. Measurement of Vertical Angle with Vernier Theodolite
2. Measurement of Vertical Angle with Digital Theodolite
3. Tacheometric Exercise with different types of Theodolites I
4. Tacheometric Exercise with different types of Theodolites II
5. Determination of Tacheometric constant K and C

6. Exercise on Triangulation Work including satellite Station
7. Setting out of circular Curve by Offsets from the Long Chord
8. Setting out of circular Curve by Rankine (Deflection Angle) Method
9. Demonstration of total station and its uses
10. Comparison between aerial photographs and map.
11. Demonstration of GPS and its uses
12. Demonstration on GIS software
13. Demonstration on Remote Sensing software

Student has to prepare a journal with description of practical as well as to prepare drawing of given exercise in prescribed drawingsheet by the teacher and has to submit the same.

4. BOOKS RECOMMENDED:

1. Arora K.R., "Surveying and Levelling, Vol. II ", Standard Publications, Delhi (2000).
2. Kanitkar T.P. and Kulkarni S.V., "Surveying and Levelling, Vol. II", Vidyarthi Gruh Prakashan, Pune(1995).
3. Subramanian, R., "Surveying and Leveling" Oxford University Press, New Delhi
4. James M Anderson and Adward M Mikhail, "Surveying theory and practice" 7th Edition by Tata McGraw Hill Publication
5. W. Schofield, "Engineering Surveying", Butterworth-Heinemann Publication, New Delhi(2001)

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	3	1	2	1	3	1	2	1
CO2	2	1	2	1	2	3	3	3	1	1	3	3
CO3	3	2	2	3	1	1	3	2	2	1	3	3
CO4	1	2	3	1	3	2	2	3	3	2	3	3
CO5	3	2	2	2	1	3	1	3	3	2	1	2

1-Low 2-Moderate 3-High

5. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	2	1	1
CO3	2	1	3
CO4	2	2	3
CO5	1	2	3

1-Low 2-Moderate 3-High

Third Semester (2^{nd} year of UG)-Elective

B.Tech. II (CE) Semester – III ENGINEERING GEOLOGY CE251	Scheme	L	T	P	Credit
		3	0	0	03

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Understand the fundamental principles and processes in geology
CO2	Identify different type of rocks, their formation and mineral composition
CO3	Analyze the effect of different structural features on the design of civil engineering structures
CO4	Analyze geological data by using DIPS software and its applications
CO5	Design the structures under the given geological conditions

2.	**Syllabus**	
	INTRODUCTION	**(10 Hours)**
	General geology, Earth and Earth processes, Origin, Interior and age determination of Earth, Physical geology, Mineralogy, Petrology. Study of Igneous, Sedimentary, and Metamorphic rocks, Silicate structures, Symmetry elements, Mineral characteristics, and Families of minerals.	
	PROCESSES IN GEOLOGY	**(11 Hours)**
	Igneous processes, Bowen's reaction principle, textures and structures of plutonic and volcanic rocks, Weathering processes, Sedimentary processes, Structures of sedimentary rocks, Effects of pressure and temperature, Metamorphic rocks and structures, Geological work of Rivers, Sea/Oceans, Glaciers, Wind and Deposits	
	STRUCTURAL GEOLOGY	**(15 Hours)**
	Structural features, Beds, Folds, Joints, Faults, and their Influence on Civil structures, Rockmass description, Plate tectonics and Sea floor spreading, Continental drift, Mechanical behavior of soils and rocks, Principles of stratigraphy, Standard stratigraphic Time Scale, Indian stratigraphy, Distribution of various economic minerals, their composition and mode of occurrence.	
	SITE INVESTIGATION	**(09 Hours)**
	Geophysical Methods: Resistivity and Seismic Refraction methods, Earthquakes, Landslides, Subsidence, Erosion, Karst formations, Engineering properties of Rocks, Site selection for Slopes, Tunnels and Foundations, Rock as a construction material	
	(Total Lecture Hours: 45)	

3.	**Books Recommended**
1	L G de Vallejo, & M Ferrer, Geological Engineering, CRC Press, Balkema, 2011.

2	M P Billings, Structural Geology, 4th Edition, Pearson India, New Delhi, 2016.
3	F G Bell, Fundamentals of Engineering Geology, Butterworth-Heinemann, Oxford, 2016.
4	S Gangopadhyay, Engineering Geology, Oxford University Press, New Delhi, 2013.
5	A C Mclean, & C D Gribble, Geology for Civil Engineers, 2nd Edition, E. & F. N. Spon, London, 1995.

4.	**Mapping of COs and POs**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	2	1	2	3	1	1
CO2	3	2	2	1	3	1	1	1	3	2	1	1
CO3	3	2	2	2	2	2	2	3	3	3	2	1
CO4	2	2	2	3	3	2	1	1	3	2	2	2
CO5	3	3	3	3	3	2	3	3	3	3	3	2

1-Low 2-Moderate 3-High

5.	**Mapping of COs and PSOs**		
	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	3	2	3
CO4	3	2	3
CO5	3	3	3

1-Low 2-Moderate 3-High

B. TECH. II Year **L T P C**

CE252 RAILWAY ENGINEERING **3 1 0 4**

CO1: Identify the Components of Railway Track, different Railway Gauges

CO2: Design track Gradients as per given requirements and Discuss various Types of Track Turnouts

CO3: Describe purposes and facilities at Railway Stations

CO4: Understanding Interlocking and modern signal system

CO5: Describe Surface Defects on Railway Track and Their Remedial Measures

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- **PLANNING OF RAILWAY LINES NETWORK** **(05 Hours)**
  Railways operational system, historical background of Indian railways, plans and developments, policy and standards, traffic forecast and surveys, railway alignment, project appraisal, and organization setup.

- **COMPONENT OF RAILWAY TRACK AND ROLLING STOCK:** **(06 Hours)**
  Permanent way, forces acting, rails, the function of rails, rail fixtures and fastenings, sleepers and ballast, rail joints, elements of junctions and layouts, types of traction, locomotives and other rolling stock, brake systems, resistance due to friction, wave action, wind, gradient, curvature, starting, tractive effort of a locomotive, hauling power of a locomotive.

- **GEOMETRIC DESIGN OF RAILWAY TRACK:** **(08 Hours)**
  Right of way and formation, field investigation, geometric design elements, safe speed on curves, speeds computation, string lining of curves, gradients, grade compensation, railway cant and cant deficiency, traction.

- **TRACK CONSTRUCTION** **(06 Hours)**
  Specialconsiderations and construction practices, track laying, Introduction of the maintenance programme, Monsoon, Pre-Monsoon & Post-Monsoon Maintenance, Causes for Maintenance, Routine Maintenance, Tools for Railway Track Maintenance & Their Functions,Surface Defects and Their Remedial Measures, track drainage, track circuited lengths, track tolerances, mechanized method, off-track tampers, shovel packing, ballast confinement and directed track maintenance, bridge maintenance, renewal, classification of renewal works, through sleeper renewals, mechanized relaying, track renewal trains.

- **SIGNALING AND INTERLOCKING:** **(04 Hours)**
  Objectives, classification, fixed signals, stop signals, signaling systems, mechanical signaling systems, electrical signaling systems, systems for controlling train movement, interlocking, and modern signaling installations.

- **RAILWAY ACCIDENTS AND SAFETY:** **(06 Hours)**

Train accidents, collision and derailments and their causes, restoration of traffic, safety measures, disaster management, classification of level crossings, accidents at level crossings, remedial measures, and maintenance of level crossings.

- **RAILWAY STATION AND YARDS: (06 Hours)**
  Site selection, facilities, classification, platforms, building areas, types of yards, catch sidings, ship sidings, foot over bridges, subways, cranes, weighbridge, loading gauge, end loading ramps, locomotive sheds, ash-pits, water columns, turntable, triangles, traverser, carriage washing platforms, buffer stop, scotch block, derailing switch, sand hump, fouling mark.

- **HIGH-SPEEDED RAILWAYS: (04 Hours)**
  Modernization of railways, the effect of high-speed track, vehicle performance on track, high-speed ground transportation system, ballastless track, track requirement for bullet trains, elevated railways, underground and tube railways.

(Total contact hours: 45)

READING:

1. Satish Chandra and M. Agrawal, *Railway Engineering*, Second Edition, Oxford University Press, 2013.
2. Agarwal, M.M. *Indian Railway Track*, Prabha & Co., New Delhi, India, 1988.
3. Chandra S. and M.M. Agarwal *Railway Engineering*, Oxford University Press, New Delhi, India, 2007.
4. Gupta, B.L. *Text Book of Railway Engineering*, Standard Publishers, New Delhi, India, 1982.
5. S.C. Saxena and S.P. Arora, *A text book of Railway engineering*, Dhanpat Rai, 2001

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	1	1	1	1	0	2	0	0	1
CO2	3	2	2	1	1	2	2	0	1	0	1	1
CO3	2	2	3	2	2	1	0	2	0	1	0	0
CO4	2	3	2	0	0	1	1	1	1	0	2	1
CO5	3	2	2	1	0	2	1	0	0	1	1	2

Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	2	1	2
CO2	3	3	2
CO3	1	2	3
CO4	2	2	3
CO5	3	2	2

Note: 1: Slightly 2: Moderately 3: Substantially 0: None

B.Tech. II (CE) Semester – III BUILDING MAINTENANCE CE256	Scheme	L	T	P	Credit
		3	0	0	03

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Understand the principles of building maintenance.
CO2	Prepare a framework for asset and facility management.
CO3	Identify and control defects of building fabric.
CO4	Identify issues and control the defects of building services.
CO5	Develop the building management system.

2.	Syllabus	
	PRINCIPLES OF MAINTENANCE	**(06 Hours)**
	Terminology of maintenance and repairs, objective, Life expectancy of buildings, Property inspection and report, Types of maintenance, Aspects of building maintenance, Maintenance planning process and its assessment, work progress, means of effective maintenance and access for maintenance, Maintenance budget estimate, Agencies causing deterioration.	
	ASSET AND FACILITY MANAGEMENT	**(09 Hours)**
	Aspects of Asset and Facility Management, Organisation Structure, Methodology, Resource requirements, Procurement and classification, Preventive and corrective maintenance, Maintenance problem and root causes, Maintenance cost, Specifications for maintenance work, Quality Control, inspection and reporting, standard norms, responsibility of occupants, common area of maintenance.	
	BUILDING FABRIC MAINTENANCE	**(12 Hours)**
	Prevention of cracks, repairs, retrofitting and seismic strengthening of buildings, construction chemical, Functional, structural and aesthetical failures, Case studies, Methodology to investigate of failures in building, Diagnostic testing methods and equipment, Material test, NDT, Repair of cracks in concrete and masonry, grouting, Repair and maintenance of foundation, basement and DPC, The Efflorescence Triangle, Repair of building joints, Repair and maintenance of RCC element.	
	MAINTENANCE OF BUILDING SYSTEMS	**(12 Hours)**
	Common causes for maintenance problems, painting, building pathology, maintenance of plumbing systems, maintenance of drainage systems, maintenance of Heating, Ventilation and Air Conditioning (HVAC) systems, maintenance of electrical installations, operations and maintenance of lifts and escalators, maintenance of fire-fighting systems, roads and pathways maintenance and upkeep, maintenance of landscaping and horticulture works, solid waste management, pest and rodent control.	
	BUILDING MANAGEMENT SYSTEMS (BMS)	**(10 Hours)**
	Components, responsibilities related to BMS, good practices, Information Management, documentation and checklists, security services for building occupants and assets/facilities, Personal Protective Equipment (PPE),	

	maintenance tools, good practices.
	(Total Lecture Hours: 45)

3.	Books Recommended
1	National Building Code 2016, Volume 2, Part 12.
2	P. C. Varghese, Maintenance, Repair & Rehabilitation & Minor Works of Buildings, 1st Edition, PHI Learning Private Limited, 2015.
3	Pieter De Wilde, Building Performance Analysis, Wiley Blackwell, 2018.
4	Wolfgang FE Praiser and Jacqueline C Vischer, Assessing Building Performance, Elsevier, 2005.
5	David Watt, Building Pathology, 2nd Edition, Blackwell Publishing, 2007.
6	James Douglas and Bill Ransom, Understanding Building Failures, 4th Edition, Routledge, 2013.

4.	**Mapping of COs and POs**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	1	3	3	1	1	1	1	1
CO2	1	3	2	2	1	3	2	1	1	1	1	1
CO3	2	3	3	3	2	3	3	2	3	2	2	2
CO4	2	3	3	3	2	3	3	2	3	2	2	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3

1-Low 2-Moderate 3-High

5.	**Mapping of COs and PSOs**		
	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	2	1
CO3	2	3	2
CO4	2	3	2
CO5	3	3	3

1-Low 2-Moderate 3-High

B.TECH. (CIVIL ENGINEERING) SEMESTER 5	L	T	P	C
CE 257: ENVIRONMENTAL MANAGEMENT	3	0	0	3

Course Objectives

CO-1: Study of local and global environmental impact issues like water pollution, air pollution, noise pollution, global warming.
CO-2: Explain important Indian and global environmental protection acts and protocols.
CO-3: Introduction to EIA, Environmental Audit and ISO:14001 and their methodologies.
CO-4: Study of different national environmental policy and guidelines.

- **ENVIRONMENT & POLLUTION CONTROL** **(09 hours)**

Environment and ecology; Causes, effects and control measures for various types of pollution like air, water, land, noise; Global Warming, Climate Change, Green House Gas Effect, Acid Rains, Ozone Layer Depletion.

- **ENVIRONMENTAL MANAGEMENT & POLICY** **(09 hours)**

Sustainability and sustainable development; Environmental management plan; Disaster management; Environmental Audit; Life cycle assessment; National environmental policy; Beyond environmentalism and sustainability issues.

- **ENVIRONMENTAL IMPACT ASSESSMENT:** **(12 hours)**

Significant impacts of human activities / large projects; Evolution of EIA; EIA at project; regional and policy levels; Environmental clearance procedure in India; Rapid and Comprehensive EIA; significance of public participation / hearing in EIA; Post project monitoring; Resettlement and rehabilitation issues. EIA case studies / histories for different types of projects.

- **INDIAN ENVIRONMENTAL STANDARDS AND LEGISLATION:** **(09 hours)**

Significance of environmental standards, Various environmental standards such as water, waste water discharge, air emission, ambient air quality, noise etc; Significance and importance of legislation for environmental protection; Role of government, non-government organizations and citizens; Hierarchal structure of Governmental pollution control organizations in India; Important Indian environmental legislation and acts.

- **GLOBAL ENVIRONMENTAL STANDARDS** **(03 hours)**

ISO 14000 introduction – General description of ISO 14001 – Environment Management System (EMS) – Key elements of ISO 14001 and EMS

[Total hours: 42]

Text Books/References:

(1) Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science”, Third Edition, Pearson Prentice Hall Inc., 2008.
(2) Howard S Peavy and George Tchobanoglous, “Environmental Engineering”, McGraw Hill Co, New Delhi, 2004.
(3) Larry W. Canter, "Environmental Impact Assessment", Tata McGraw Hill Co, Singapore, 1996.
(4) Kailash Thakur, “Environmental protection law and policy in India”, Deep and Deep publishers, New Delhi, 1997.

Fourth Semester (2^{nd} year of UG) (Subjects)

B.Tech. II (CE) Semester – IV CONCRETE TECHNOLOGY CE202	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Evaluate the physical and mechanical properties of ingredients of concrete.
CO2	Conduct the experiments on fresh and hardened concrete.
CO3	Produce a concrete mix compatible to design stipulations.
CO4	Apply the knowledge of special concrete and concreting methods to field.
CO5	Assess in-situ strength of concrete performing the various non-destructive tests.

2.	Syllabus	
	PROPERTIES OF CEMENT	**(06 Hours)**
	Manufacturing of Portland cement, Chemical composition of Portland cement, Hydration of cement, Setting of cement, Physical and chemical test for cement, Different types of cement, Important properties and applications	
	PROPERTIES OF AGGREGATES	**(06 Hours)**
	Classification of aggregates, Important physical properties, Mechanical properties, Specific gravity, Bulk density, Moisture content and Water absorption of aggregates, Sieve analysis, Fineness modulus, Grading curves, Gap Grading, Deleterious Substances in aggregates, Alkali-aggregate reaction, Maximum size of aggregates.	
	MINERAL AND CHEMICAL ADMIXTURES	**(05 Hours)**
	Chemical Admixtures, Accelerators, Retarder, Water reducing agents (WRA) or Plasticizers, Air Entraining Agents, Corrosion Inhibitors, Water proofing compounds, Mineral Admixtures- Fly ash, Silica Fume, Ground Granulated Blast Furnace Slag (GGBFS), Metakaolin etc.	
	FRESH CONCRETE	**(05 Hours)**
	Definition of workability, Factors affecting workability, Measurement of workability - Slump test, Compacting factor test, Mixing of concrete ingredients, Types of mixtures, Vibration of concrete, Types of vibrators – Internal vibrators, External vibrators, Table vibrators, Segregation and bleeding.	
	STRENGTH OF CONCRETE	**(05 Hours)**
	Abram's water cement law, Factors affecting strength of concrete, Different methods of Curing, Steam Curing at Atmospheric Pressure and High-Pressure Curing, Warm water method, Maturity of concrete.	
	TESTING OF HARDENED CONCRETE	**(06 Hours)**
	Need for testing, Compression test – Cube, cylinder, Prism and equivalent cube test, Effects of various factors on test results (e.g. End conditions, Capping, Moisture content, Height/Diameter ratio, Shape of specimen, Size of	

	specimen), Rate of loading, Duration of loading, Comparison of strength of cube and cylinder specimens, Split-tensile test, Flexure test, Non-destructive testing, needs and applications of NDTs, Rebound hammer test, Ultrasonic Pulse Velocity test, Core test.
	MIX DESIGN **(06 Hours)**
	Definition and need for designing mixes - Methods of mix design – IS 10262 method of mix design in detail with examples.
	SPECIAL CONCRETE AND CONCRETING METHODS **(06 Hours)**
	Polymer Concrete, Geopolymer concrete, Fibre Reinforced Concrete, Light Weight Concrete, High Density Concrete, Hot and Cold weather Concreting, Ready mixed concrete, Self-compacting concrete, Pre placed aggregate concrete, Vacuum processed concrete, Shotcrete and Gunitting.
	(Total Lecture Hours: 45)

3.	**Practicals**
1	To determine fineness of cement.
2	To determine consistency, initial and final setting time of cement.
3	To determine soundness of cement.
4	To determine compressive strength of cement.
5	To determine mechanical properties of fine aggregates.
6	To determine mechanical properties of coarse aggregates.
7	To design a concrete mix of two different grades.
8	To determine workability of concrete and study of effect of super-plasticizers on it.
9	To determine setting time of concrete.
10	To conduct destructive and non-destructive tests on standard concrete cubes.
11	To determine elastic modulus and split tensile strength of concrete.
12	To determine flexural strength of plain concrete

4.	**Books Recommended**
1	A M Neville, Properties of Concrete, Pitman Publishing Company, Bath, U.K., 1973.
2	M S Shetty, Concrete Technology, Theory and Practice" 2nd ed., S. Chand and Company, New Delhi, 1986.
3	M L Gambhir, Concrete Technology, Tata McGraw Hill Company, New Delhi, 1986.
4	Shanthakumar, Concrete Technology, Tata McGraw Hill Company, New Delhi, 2006.
5	G E Troxell and H E Davis, Composition and Properties of Concrete, Mc Graw Hill Publication, 1998.

5.	**Mapping of COs and POs**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	1	2	0	0	0	0	0	0

CO2	2	2	2	1	1	1	0	0	0	0	0	0
CO3	3	3	2	2	2	1	2	3	1	0	0	0
CO4	1	2	3	3	3	1	1	1	0	0	0	0
CO5	2	2	3	3	2	2	0	2	2	1	0	0

1-Low 2-Moderate 3-High

6.	**Mapping of COs and PSOs**		
	PSO1	PSO2	PSO3
CO1	2	1	2
CO2	1	1	2
CO3	3	2	2
CO4	2	1	2
CO5	2	1	1

1-Low 2-Moderate 3-High

B. TECH. II (TEP) SEMESTER- IV **L T P C**

CE204 HIGHWAY MATERIALS AND CONSTRUCTION **3 0 2 4**

Students will be able to

CO1: Characterise different unbound and bound materials like soil, aggregate, bitumen and various mix specifications to check their suitability

CO2: Design the bituminous mix as per the Indian guidelines

CO3: Design the cementitious mixes used in road construction

CO4: Appraise the construction of pavement layers as per the Indian practices

CO5: Prepare quality assurance and quality control plans in an attempt to construct better performing pavements.

- **SOIL** **(06 Hours)**
  Role of soil testing in performance of road - Subgrade requirements in road constructions, Analysis of soil behavior, Characterisation of soil as subgrade and embankment material, Resilient modulus of soil
- **SOIL STABILIZATION** **(04 Hours)**
  Need of soil stabilisation, types, material requirements and design.
- **AGGREGATE** **(04 Hours)**
  Road making aggregates - Mechanical Properties of aggregates and their tests - Design of aggregate gradation
- **BITUMEN** **(06 Hours)**
  Bituminous binders for pavement, Penetration, Viscosity and Performance Grade of bitumen, Emulsion-properties, types, Cutbacks, modified binders
- **BITUMINOUS MIX** **(06 Hours)**
  Requirements of a bituminous mix, Mix design, Characterisation of mix properties used for pavement design
- **CEMENTITIOUS MIXES** **(06 Hours)**
  Types of cementitious mixes, Requirements of cement concrete mixes for pavement, Design of Pavement Quality Concrete, Design of Dry Lean Concrete, Design of cement treated bases and sub-bases
- **HIGHWAY CONSTRCUTION MACHINERIES** **(03 hours)**
  Hot mix plant, Cement concrete batching plant, Paving machineries
- **HIGHWAY CONSTRUCTION** **(07 hours)**
  Construction and preparation of subgrade, sub-base, base course, construction of bituminous layers, cement concrete surface course as per the specifications,
- **QUALITY CONTROL AND QUALITY ASSURANCE PLAN** **(03 hours)**
  Quality control tests during and after construction of each layer, frequency of quality control tests.

(Total contact hours: 45)

PRACTICALS

1. Determination of C.B.R. value of Subgrade soil.
2. Determination of Abrasion value and Shape Index.
3. Determination of Impact and Ten percent fines value.
4. Determination of soundness of aggregate.
5. Determination of polished stone value
6. Determination of ductility.
7. Determination of softening point.
8. Determination of penetration value.
9. Determination of viscosity.
10. Determination of bitumen content in bituminous mix by centrifuge extraction.
11. Marshal stability and flow test
12. Determination of Gmm and Gmb
13. Determination of compressive strength and flexural strength of the cement concrete

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REFERENCES:

1. Khanna S.K., Justo C.E.G., Veeraragavan A., Highway Engineering, Nem Chand and Sons, 2019.
2. Kadiyali L.R.Highway Engineering, Khanna Publishers, 2019.
3. Papagiannakis, A.T., Masad, E.A., Pavement Design and Materials, Wiley, 2008.
4. Kandhal, P.S., Bituminous Road Construction in India, PHI Learning Pvt.Ltd, 2016.
5. Hunter, R.N., Andy, S., John, R., The Shell Bitumen Handbook, ICE Publishing, 2015.

CODES

1. Ministry of Road Transport and Highways, Specifications for Road and Bridge Works, Indian Roads Congress, 2013.

Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	-	3	3	3	3	2	-	3
CO2	3	3	3	3	2	3	1	3	3	2	-	3
CO3	3	3	3	3	1	3	1	3	3	2	-	3
CO4	2	2	-	-	1	3	1	3	2	-	1	2
CO5	2	3	1	3	1	3	-	3	1	2	1	2

Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	2	3
CO2	3	2	3
CO3	3	2	3
CO4	3	3	3
CO5	3	3	3

B.Tech. II (CE) Semester – IV SOIL MECHANICS CE232	Scheme	L	T	P	Credit
		3	1	2	05

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Classify and identify soils and their engineering properties
CO2	Interpret the laboratory and field-testing results
CO3	Evaluate the permeability, seepage, and compaction characteristics of soil
CO4	Apply the knowledge of effective stress, stress distribution and consolidation to determine settlement of soil
CO5	Analyse the shear strength parameters of various types of soil and load carrying capacity of shallow and deep foundation.

2.	Syllabus	
	INTRODUCTION	**(01 Hour)**
	Need for Soil Engineering Studies- Soil as an Engineering Material -Scope of Geotechnical Engineering.	
	BASIC PROPERTIES OF SOIL	**(04 Hours)**
	Elementary properties and their measurements - Constituents of soil - Phase diagram – Definitions of varies parameters and their Interrelationship – In-situ determination of density	
	SOIL CLASSIFICATION, CONSISTENCY LIMITS & CLAY MINERALOGY	**(05 Hours)**
	Grain size analysis-Hydrometer method, Particle size distribution curve - Relative Density-Soil consistency limits - Soil indices –IS Classification of soil - Clay Mineralogy	
	COMPACTION	**(03 Hours)**
	Definition - objectives - Laboratory tests- Zero air void Line -Factors affecting compaction- Effect of compaction on properties of soil - Field compaction control - Relative compaction	
	PERMEABILITY AND SEEPAGE	**(04 Hours)**
	Permeability - Darcy's law - Laboratory tests - Field tests - Permeability of stratified deposits– Laplace's equation - Seepage - Flow net	
	EFFECTIVE STRESS ANALYSIS	**(04 Hours)**
	Effective stress principle- Effect of water table fluctuation on effective stress-Effective stress in soil mass due to hydrostatic conditions, capillary action, and steady seepage conditions-Effect of surcharge on effective stress-Quick sand condition	
	STRESS DISTRIBUTION	**(04 Hours)**
	Causes of stress in soil- Geostatic stress- Boussinesq's Equation-Stresses due to different types of loading- Isobar diagram and pressure bulb- New-mark's influence chart, Approximate Methods-Contact pressure distribution	

	CONSOLIDATION	**(05 Hours)**
	Significance of Consolidation - Initial, primary and secondary consolidation - Spring analogy for primary consolidation- Consolidation test- Various parameters - Terzaghi's theory of one-dimensional consolidation - Coefficient of consolidation – Preconsolidation pressure – Secondary consolidation-Field consolidation curve	
	SHEAR STRENGTH	**(05 Hours)**
	Shear parameters –Mohr-Coulomb's Failure Criterion – Various laboratory tests and their merits & demerits - Drainage conditions- Modified failure envelop– Pore Pressure Parameters.	
	SOIL EXPLORATION	**(02 Hours)**
	Objectives and methods of explorations-Sampling and its design features, SPT, Cone penetration test and in-situ vane shear test.	
	BEARING CAPACITY OF SOIL	**(08 Hours)**
	Introduction – Basic definitions – Bearing capacity theories – Types of shear failure – Effect of water table – Bearing capacity from field tests - plate load test; Introduction to deep foundations – Necessity of pile foundation – Classification of piles – Load carrying capacity of piles	
	(Total Lecture Hours: 45)	

3.	**Practicals**
1	Determination of moisture content, Specific gravity, In-situ density- Core cutter method, Sand replacement method.
2	Sieve Analysis
3	Hydrometer analysis
4	Consistency limits of soil
5	Compaction test on soil
6	Determination of coefficient of permeability of soil
7	Estimation of shear strength of non-cohesive soil by direct shear test.
8	Estimation of shear strength of cohesive by Vane shear test and Unconfined Compressive tests.
9	Computation of consolidation parameters
10	Demonstration of Triaxial shear test
11	Site Visit and Interaction with the practitioners in Geotechnical Engineering

4.	**Books Recommended**
1	K R Arora, Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Nai Sarak, Delhi, 2008.
2	J E Bowles, Foundation Analysis and Design, McGraw-Hill Education, New Delhi, 1996.
3	B M Das, & K Sobhan, Principles of Geotechnical Engineering, Cengage Learning, Boston, 2018.
4	D P Coduto, M R Yeung, & W A Kitch, Geotechnical Engineering: Principles and Practices, 2nd Ed, Pearson Education, USA, 2017.
5	M Datta, & S Gulati, Geotechnical Engineering, McGraw-Hill Education, New Delhi, 2017.

5.	**Mapping of COs and POs**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	0	3	2	0	3	2	2	3	2	3	3

CO2	0	0	3	2	0	3	2	2	3	2	3	3
CO3	0	0	0	2	0	2	1	1	2	0	3	0
CO4	0	0	0	0	0	1	0	0	0	2	1	0
CO5	0	0	3	2	0	3	2	2	3	2	3	3

1-Low 2-Moderate 3-High

6.	**Mapping of COs and PSOs**		
	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	3	3	3
CO3	2	2	3
CO4	2	2	2
CO5	2	2	2

1-Low 2-Moderate 3-High

B. Tech. – II (Civil), Semester - IV	L	T	P	C
CE 206 Elementary Structural Mechanics	**3**	**0**	**2**	**4**

1. **Course Outcomes:**

On Completion of the course, students are able to
CO-1: Find the shear and compressive stresses in structural member subjected to various loadings.
CO-2: Calculate principal stresses and strains for structural member
CO-3: Analyse statically determinate beams and frames with internal hinges
CO-4: Compute displacement of statically determinate trusses and beams
CO-5: Construct influence lines for determinate structures.

2. **Syllabus**

PRINCIPAL STRESSES & STRAINS **(04 Hours)**

Principal plane – Principal stress – Tangential and normal stress – Derivation of Major and Minor principal stresses for different cases – Mohr's circle graphical method

TORSION **(05 Hours)**

Basic theory of Torsion – Solid shaft – Hollow shaft – Power transmitted by shaft – Composite shafts

COLUMNS AND STRUTS **(05 Hours)**

Euler's theory for columns – Different end conditions – Rankine's formula – Limitations of Euler's theory

BASIC INTRODUCTORY CONCEPTS OF STRUCTURES **(03 Hours)**

Structural Systems – Degrees of Freedom - Determinate and indeterminate structures.

ANALYSIS OF STATICALLY DETERMINATE STRUCTURES **(04 Hours)**

Analysis of Beams with internal hinges – Analysis of frames.

DISPLACEMENT OF STATICALLY DETERMINE STRUCTURES **(12 Hours)**

Determination of slope and deflections of beams using successive integration method – Macaulay's Method- Conjugate Beam Method- Determination of deflection of trusses using virtual work method

INFLUENCE LINES FOR DETERMINATE STRUCTURES **(12 Hours)**

Concept of Influence lines – Influence lines for reactions, shear force and bending moment in beams – load position for maximum shear force and bending moment at a section in beam – Absolute maximum bending moment in beams- Influence lines for member forces in Trusses – Muller Breslau's Principle

(Total Lecture Hours: 45)

3. **Practicals:**
    1. Torsion Test on MS Specimen
    2. Compression test on CI Columns
    3. Deflection of simply supported beam
    4. Deflection of cantilever beam
    5. Reactions, Fixed end moment and deflection of a propped cantilever
    6. Clerks Maxwell reciprocal Theorem

7. Behaviour of three hinge arch with a point load at centre
8. Behaviour of two hinge arch with a point load at centre
9. Behaviour of two pinned arch for a uniformly distributed load
10. Behaviour of three pinned arch for a uniformly distributed load
11. Behaviour of two pinned arch due to moving load
12. Behaviour of three pinned arch due to moving load
13. Behaviour of simply supported beam due to moving load
14. Deflection of truss
15. Study of different 2D & 3D structural models

4. Books Recommended:

1 Timoshenko S & Young D H "Elements of Strength of Materials", Tata Mc Graw Hill, New Delhi,2006

2 Beer F. P. & Johnston S J, "Strength of Materials" Tata Mc Graw Hill Publication, New Delhi,2016.

3 Hibbler R C, "Structural Analysis",6th edition, Pearson Prentice Hall, New Delhi, 2018

4 Thandavamoorthy T S, " Structural Analysis", Oxford University Press, New Delhi, 2011

5 Gali A, Newville A M, Brown T G, "Structural Analysis – A Unified Classical and Matrix Approach, " Sixth Edition, spon Press, UK, 2009

5.	**Mapping of COs and POs**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	2	-	2	1	2	1	-	-	-
CO2	3	2	-	2	-	2	2	3	2	-	-	-
CO3	3	2	-	2	-	2	2	2	2	-	-	-
CO4	3	3	-	3	-	2	3	2	1	-	-	-
CO5	3	3	-	3	-	2	1	2	1	-	-	-

1-Low 2-Moderate 3-High

6.	**Mapping of COs and PSOs**		
	PSO1	PSO2	PSO3
CO1	2	2	3
CO2	2	2	3
CO3	3	2	2
CO4	3	2	3
CO5	3	2	2

1-Low 2-Moderate 3-High

Fourth Semester (2^{nd} year of UG)-Elective

B. TECH. II Year **L T P C**

CE253 AIRPORT ENGINEERING **3 1 0 4**

CO1: To do the planning of orientation of airport elements.

CO2: Analysing the requirement of airport layout with respect to international regulation.

CO3: Design Airport Pavement, Taxiway, and Apron.

CO4: To understand visual aid required for safe landing and takeoff operation from passenger and cargo terminal.

CO5: Summarise the concept of the terminal service facility.

- **AIRPORT PLANNING:** **(05 Hours)**
  Airport planning: commercial service aviation, air cargo, and general aviation; civil aviation airports; major acts and policies of the Ministry of Civil Aviation in India

  Aviation organizations and functions: Federal Aviation Administration, International Civil Aviation Organization, Directorate General of Civil Aviation, Airports Authority of India.

  Airport planning studies: airport system plan, airport site selection, airport master plan, airport project plan; continuous planning process.

- **AIRCRAFT CHARACTERISTICS:** **(06 Hours)**
  Landing gear configurations, aircraft weight, and engine types.

  Atmospheric conditions affecting aircraft performance: air pressure, temperature, wind speed, and direction.

  Aircraft performance characteristics: speed, payload, range, runway performance, declared distances, wingtip vortices.

- **AIR TRAFFIC MANAGEMENT:** **(06 Hours)**
  Air traffic separation rules: vertical separation, flight altitudes, longitudinal separation, and lateral separation.

  Navigational aids: ground-based systems, satellite-based systems.

- **GEOMETRIC DESIGN OF THE AIRFIELD:** **(10 Hours)**
  Airport classification: utility airports, transport airports.

  Runways: runway configurations, runway orientation, the wind rose, estimating runway length, sight distance, and longitudinal profile, transverse gradient, airfield separation requirements, obstacle clearance requirements.

  Taxiways and taxi lanes: widths and slopes, taxiway and taxi lane separation requirements, sight distance and longitudinal profile, exit taxiway geometry, location of exit taxiways, design of taxiway curves and intersections, and end-around taxiways.

- **STRUCTURAL DESIGN OF AIRPORT PAVEMENTS:** **(06 Hours)**

Soil investigation and evaluation: CBR, plate bearing test, Young's modulus, the effect of frost on soil strength, subgrade stabilization.

FAA pavement design methods: equivalent aircraft method, cumulative damage failure method.

Design of flexible pavements: CBR method, layered elastic design.

Design of rigid pavements: Westergaard's analysis, finite element theory, joints and joint spacing, continuously reinforced concrete pavements.

- **AIRPORT LIGHTING, MARKING, AND SIGNAGE: (06 Hours)**

Requirements of visual aids, approach lighting system configurations, visual approach slope aids, threshold lighting.

Runway lighting, taxiway lighting.

Runway and taxiway marking, airfield signage.

- **PLANNING AND DESIGN OF THE TERMINAL AREA: (06 Hours)**

Passenger terminal system and its components.

Design considerations: terminal demand parameters, facility classification, level of service criteria.

Terminal planning process: overall space requirements, concept development, horizontal distribution concepts, vertical distribution concepts.

Apron gate system: number of gates, ramp charts, gate size, aircraft parking type, apron layout, apron circulation, passenger conveyance to aircraft, apron utility requirements.

(Total contact hours: 45)

REFERENCES:

1) Khanna, S. K., Arora, M. G., and Jain, S. S. *Airport planning and Design*, Sixth Edition, Nem Chand and Bros, Roorkee, India, 2012.
2) Kumar, V., and Chandra, S. *Air Transportation Planning and Design*, Galgotia Publications Pvt. Ltd., New Delhi, India, 1999.
3) Ashford, N. J., Mumayiz, S. A., and Wright, P. H. *Airport Engineering: Planning, Design and Development of 21st Century Airports*, Fourth Edition, John Wiley & Sons, New Jersey, USA, 2011.
4) Horonjeff, R., McKelvey, F. X., Sproule, W. J., and Young, S. B. *Planning and Design of Airports*, Fifth Edition, McGraw-Hill, New York, USA, 2010.
5) Young, S. B., and Wells, A. T. *Airport Planning and Management*, Sixth Edition, McGraw-Hill, New York, USA, 2011.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	1	0	1	1	1	2	1	0	2

CO2	3	2	2	2	2	0	1	1	1	1	0	1
CO3	3	2	3	3	1	2	0	1	0	1	0	0
CO4	2	1	2	0	1	0	2	0	0	0	1	1
CO5	1	2	2	2	1	0	0	0	0	1	1	2

Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	2	3	1
CO2	2	2	2
CO3	3	3	3
CO4	1	1	2
CO5	2	2	2

Note: 1: Slightly 2: Moderately 3: Substantially 0: None

B. Tech. III (Civil) Semester - V

CE 254 TOWN PLANNING

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

At the end of the course the students will be able to:

CO 1: Perceive significance of town with respect to legislation and administration.
CO 2: Analyze urbanization growth with land use planning.
CO 3: Implement different guidelines, norms, land use planning policies, and survey techniques.
CO 4: Design of Housing Society based on development control regulations.
CO 5: Appraise the urban infrastructure projects under various Government Scheme.

2. Syllabus

- **TOWN PLANNING CONCEPT, EVOLUTION & DEVELOPMENT: (06 Hours)**
  Significance of town planning, Planning in Ancient, Medieval & Modern Periods, Contribution of noted urban planners, Planning legislation and administration.

- **URBAN SETTLEMENT CLASSIFICATION & STRUCTURE: (06 Hours)**
  India's Urbanization, Growth theories, Urban form, Activity structure, Land use and density structure, Town classification, Multi-nuclei urban development.

- **TOWN COMPONENT: (05 Hours)**
  Town Centre, Fringe Area, Impact of CBD on peripheral area development, issues and challenges of CBD and fringe area planning

- **INDUSTRIES: (02 Hours)**
  Types industries, Site selection criteria, environmental consideration.

- **PLANNING SURVEYS & APPLICATIONS: (05 Hours)**
  Significance of surveys, Types, Planning parameters, Analysis and applications of Planning Surveys.

- **URBAN PLANNING & DESIGN: (08 Hours)**
  Objectives & principals, Land use planning, Zonal planning, Neighborhood planning, Development plan and control regulations, T.P. Scheme norms & methodology, New towns, Metro regions, Concept of Urban Design.

- **HOUSING: (05 Hours)**
  Building Byelaws, Residential Area Planning, Income Groups, Building Forms and Density Pattern, Concept of Township, Neighbourhood, Special Area Planning.

- **URBAN INFRASTRUCTURES AND GOVERNMENT INITIATIVES: (08 Hours)**
  Brief about Social and Physical Infrastructures, Transport Infrastructure, Importance and challenges in providing Water Supply, Drainage, Storm Water, Solid Waste Management and other infrastructures at city level, Issues at National and International level.

3. Books Recommended

1. Modak N.V. and V.N. Ambdekar, “Town and Country Planning and Housing”, Orient Longman Ltd., New Delhi. (1995)
2. Hiraskar G.K. “Fundamentals of Town Planning”, Dhanpat Rai & Sons, Delhi (1993).
3. Gallion A., Eisner S., (2005), “The Urban Pattern: City planning and design”, CBS Publishers and Distributors Pvt.

Ltd, Delhi.
4. Ward S., (2002), “Planning the 20th Century City” John Willer & Sons.
5. Shivramakrishnan K. C., (2011), “Revisioning Indian Cities”, Sage Publications.

4. Mapping of COs with PSOs and POs

CO	Program Specific Outcome												Program Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	0	1	2	2	2	1	1	1	2	1	1
CO2	1	2	1	1	0	2	0	2	2	1	1	1	2	2	2
CO3	2	3	3	2	0	3	1	0	0	2	2	3	3	3	3
CO4	2	2	3	2	0	2	1	3	3	3	3	3	3	3	3
CO5	2	3	1	1	0	1	2	2	2	2	3	3	2	3	3

3=Fully Meet; 2=Partially Meet; 1= Poorly Meet; 0 = Not Meet

CE255: BUILDING FOR GREATER EFFICIENCY

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

At the end of the course, the students will be able to:

CO1	Understanding of building typologies, climatology, historical planning and development
CO2	Review of sustainable building planning policies, implementation and innovative materials
CO3	Assessing the building performance by applying sustainable techniques
CO4	Evaluating residential and commercial building at neighbourhood level
CO5	Making business case

2. Syllabus

- **SUSTAINABLE PLANNING AND DEVELOPMENT: (04 Hours)**

  Fundamentals of sustainability; Historical planning and development; Vernacular Architecture; climatic zones and parameters; Environmental impact on building cluster; Norms, guidelines, codes and policies; Stakeholder's role

- **SUSTAINABLE BUILDING PLANNING: (06 Hours)**

  Fundamentals of passive planning and design, climatology, thermal comfort, visual comfort and acoustic comfort, Minimization of natural resource utilization, Environment protection, site planning, energy conservation through planning and modeling, building technologies, indoor air quality, barriers to implementation of sustainable building measures

- **GREATER EFFICIENCY: (10 Hours)**

  Role of envelope, day light, daylight simulation, electric lighting and occupant behavior, thermal mass and Heat flow, thermal load, thermal simulation, heating cooling and ventilation (HVAC), role of planning and alternative material for reduction of operational energy in the building, life cycle cost, Net zero, Grid free, water & energy plus, checklist for sustainability, greater efficiency recommendations for sustainable buildings

- **BUILDING PERFORMANCE ASSESSMENT: (15 Hours)**

  Concept, tools at international and national level, Energy code ECBC requirement, NBC, Recent researches on sustainable building development, assessment tools – Open source, licensed software for performance assessment and energy compliance, Case studies of residential and commercial buildings

- **GREEN SERVICES: (06 Hours)**

  Climate and effect of built environment, Impact of urbanization on sustainability, Circular Economy through water and drainage network, Zero waste management, radiation budget, surface water balance, effect of trees and microclimate, modification through greening

- **MAKING THE BUSINESS CASE: (04 Hours)**

  Green building Evaluation Systems; LEED Certification; Green Certification, WGBC, GRIHA, IGBC, EDGE, ASSOCHAM and CPWD green rating, SBTool, process and certification

(Total Lectures: 45 hours)

3. References

1. Wheeler S. M. (2004), Planning for sustainability: creating livable, equitable and ecological communities, 2nd ed, Routledge, Taylor and Francis group, New York.
2. Maiellaro N. (2001), Towards sustainable building, Kluwer academic publishers, Netherlands,
3. "Sustainable building design manual: Sustainable building design practices" by The Energy and Resources Institute, New Delhi.
4. Takahiko Hasegawa T. (2003), Environmentally sustainable buildings: challenges and policies, Paris: Organisation for Economic Co-operation and Development, 2003.
5. Glavinich T.E., Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction, Wiley; 2008 Lo C.P. & Yeung A.K.W. (2006), Concepts and Techniques of Geographic Information Systems, 2nd ed, Prentice Hall of India, New Delhi.

4. CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	1	3	3	3	1	1	2	1	3	3	2
CO2	2	2	3	3	1	2	3	2	1	2	2	1	1	2	2
CO3	2	1	1	2	2	1	1	1	2	1	1	2	2	3	3
CO4	2	2	3	3	3	3	2	3	3	1	2	3	1	1	2
CO5	2	1	1	1	3	3	3	2	2	1	3	3	1	2	3

Advanced Surveying **CE258**	**L**	**T**	**P**	**Credit**
	3	**1**	**0**	**04**

1. Course Outcomes (COs)

At the end of the Course the students will be able to:

CO1	Analyze computation and measurement of relief displacement, development of mosaic etc. using principle of photogrammetry
CO2	Compute and detail Azimuth, Declination etc. of celestial bodies using principle of astronomy.
CO3	Analyze the problem and its remedial measures pertaining to hydrographic Survey
CO4	Explain the concept of EDM and Total Station Survey
CO5	Explain advanced surveying techniques of Terrain Data Collection including ALTM, LIDAR, DEM

2. Syllabus

Photogrammetric Survey Introduction, Technical terms, Aerial photogrammetry, Types of photographs, Vertical photographs, Uses of aerial photographs, Flying height & scale, Relief displacement, Stereoscopy, Measurement of parallax and height determination, Mosaic preparation	(12 Hours)
Principles of Field Astronomy Introduction, purposes, astronomical terms, determination of azimuth, latitude, longitude and time corrections to the observations.	(10 Hours)
Hydrographic Surveys Objects, Applications, Establishing controls, Shore line survey, Sounding, Sounding equipment, Methods of locating soundings, conventional and using GPS, Reduction of soundings, Plotting of soundings, Nautical sextant and its use, Three point problem and its use, solution of three point problem by all methods, Tides and tide gauges, determination of MSL	(08 Hours)
EDM and Total Station Survey General Process of EDM, Principle of EDM, Electromagnetic Waves, Phase and Types of Waves, Distance Measurement by Transit time and by Phase difference, Electro-optical, Infrared and Microwave, Total Station – Function and Process, Applications, Sources of Errors	(08 Hours)
Terrain Data Collection Airborne laser thematic mapper (ALTM), LIDAR, Profiles, Digital Elevation Models	(07 Hours)
(Total Lecture Hours: 45)	

4. BOOKS RECOMMENDED:

6. W. Schofield, “Engineering Surveying”, Butterworth-Heinemann Publication, New Delhi (2001)
7. Punmia B.C., “Surveying and Levelling, Vol. II & III”, Laxmi Publications Pvt. Ltd., New Delhi(1994)

8. Arora K.R., "Surveying and Levelling, Vol. III", Standard Publications, Delhi (2000).
9. Lille sand T. M. and Kiefer. R.W., "Remote Sensing and Image Interpretation", 4th Edition, John Wiley and Sons, New York, (2002).
10. Agrawal N.K., "Essentials of GPS" Spatial Network Pvt. Ltd., Hyderabad (1997).
11. Stan Aron off, "Geographic Information Systems: A management perspective", WDL Publications, Canada, (1989)

5. Mapping of COs and POs

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	1	1	2	3	2	3	1	1	2	1	1	2
CO-2	1	2	2	2	3	3	3	1	1	2	3	2
CO-3	2	2	2	2	1	1	3	3	3	3	3	1
CO-4	2	3	3	3	3	3	1	1	1	1	1	2
CO-5	3	2	3	2	3	1	1	1	2	3	3	2

6. Mapping of COs and PSOs

	PSO-1	PSO-2	PSO-3
CO-1	1	2	3
CO-2	2	2	3
CO-3	1	1	2
CO-4	2	1	2
CO-5	1	3	2

CE 259 Channel Hydraulics

L	T	P	C
3	0	0	3

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1. Course Outcomes (COs)

At the end of the course, the students will be able to:

CO1	Analyse uniform flow in open channels
CO2	Analyse non-uniform flow in open channels
CO3	Analyse spatially varied flow
CO4	Analyse unsteady flow in channels
CO5	Apply numerical methods for unsteady flow calculations

2. Syllabus

- **UNIFORM FLOW** **(10 Hours)**
  Specific energy, Specific energy curve and its limitations, critical depth and section factor for critical flow computations, open channel flow transitions, standing wave, venture flumes, control sections and hydraulic exponent for critical flow computations.

- **NON-UNIFORM FLOW** **(10 Hours)**
  Rapidly varied flow, specific force curve and its application in the analysis of hydraulic jump, hydraulic jump characteristics Assumptions in GVF analysis, dynamic equation of GVF, classification of channel slopes, GVF profiles, its identification and computation, applications

- **SPATIALLY VARIED FLOW** **(08 Hours)**
  Basic principles and assumptions, differential equations, analysis of flow profiles and flow through side weirs and bottom racks.

- **UNSTEADY FLOW** **(09 Hours)**
  Waves, classification of waves, waves celerity, occurrences of unsteady flow, height and celerity of gravity waves, governing equations for one dimensional flow, St. Vennant equation and numerical methods.

- **UNSTEADY FLOW NUMERICAL METHODS** **(08 Hours)**
  Method of characteristics, Finite difference methods, explicit and implicit finite difference schemes, consistency, stability.

(Total Lectures: 45 Hours)

3. Books Recommended

1. G L Asawa, “Fluid Flow in Pipes and Channels”, CBS Publishers, New Delhi, 2014.
2. H M Chaudhary., Open Channel flow, Prantice-Hall of India Pvt. Ltd. New Delhi, 1993.
3. V T Chow, Open Channel Hydraulics, McGraw-Hill Book Company, International editions, New Delhi, 1973.
4. K Subramanya, Flow in open channels, Sixth edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2001.
5. R Srivastava, Flow through open channels, Oxford Higher Education, Oxford University Press, Jericho, 2007.

4. Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	1	1	1	1	1	1	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	1	1	1	1	1	1	1	1	1
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1	1	1	1	1

1-Low 2-Moderate 3-High

5. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	1	1	1
CO3	1	1	1
CO4	1	1	1
CO5	1	1	1

1-Low 2-Moderate 3-High

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

Curriculum Scheme and Syllabus

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	First Semester (1st year of UG)				
1	Introduction to Computer Science	CS101	3-1-0	4	70
2	Introduction to Programming	CS103	3-0-2	4	85
3	Electrical Network Analysis	EE103	3-0-2	4	85
4	English and Professional Communication	HS110	3-1-0	4	70
5	Fundamentals of Engineering Mathematics	MA105	3-1-0	4	70
			Total	**20**	**380**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CSV01 / CSP01	0-0-10	5	200 (20 x 10)
	Second Semester (1st year of UG)				
1	Data Structures	CS102	3-1-2	5	100
2	Web Programming and Python	CS104	3-0-2	4	85
3	Digital Electronics and Logic Design	EC106	3-0-2	4	85
4	Energy and Environmental Engineering	EG110	3-0-2	4	85
5	Linear Algebra and Statistics	MA106	3-1-0	4	70
6	Indian Value System and Social Consciousness	HS120	2-0-0	2	35
			Total	**22**	**460**
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CSV02 / CSP02	0-0-10	5	200 (20 x 10)
	Third Semester (2nd year of UG)				
1	Computer Organization	CS201	3-1-0	4	70
2	Database Management Systems	CS203	3-0-2	4	85
3	Design and Analysis of Algorithms	CS205	3-1-0	4	70
4	Discrete Mathematics	CS207	3-1-0	4	70
5	Object Oriented Programming	CS231	3-0-2	4	85
			Total	**20**	**380**
	Fourth Semester (2nd year of UG)				
1	Microprocessor and Interfacing Techniques	CS202	3-0-2	4	85
2	Computer Networks	CS204	3-0-2	4	85
3	Automata and Formal Languages	CS206	3-1-0	4	70
4	Artificial Intelligence	CS232	3-0-2	4	85
5	Information Security	CS233	3-0-2	4	85
			Total	**20**	**410**
6	Minor / Honor (M/H#1)	CS2CC	3-X-X	4	70/85
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CSV04 / CSP04	0-0-10	5	200 (20 x 10)
	Fifth Semester (3rd year of UG)				

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

(Semester 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th) Curriculum SVNIT Surat (58th Senate, 31 May 2023)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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1	Operating Systems	CS301	3-0-2	4	85
2	Machine Learning	CS331	3-0-2	4	85
3	Professional Ethics, Economics and Business Management	MG210	3-1-0	4	70
4	Elective	CS3AA	3-X-X	3/4	55/70/85
5	Elective (Specialization#1)	CS3BB	3-X-X	3/4	55/70/85
			Total	**18-20**	**350-410**
6	Minor / Honor (M/H#2)	CS3CC	3-X-X	4	70/85
	Sixth Semester (3rd year of UG)				
1	System Software	CS302	3-0-2	4	85
2	Distributed Computing	CS332	3-0-2	4	85
3	Innovation, Incubation and Entrepreneurship	MG110	3-1-0	4	70
4	Elective	CS3DD	3-X-X	3/4	55/70/85
5	Elective (Specialization#2)	CS3EE	3-X-X	3/4	55/70/85
			Total	**18-20**	**350-410**
6	Minor / Honor (M/H#3)	CS3FF	3-X-X	4	70/85
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CSV06 / CSP06	0-0-10	5	200 (20 x 10)
	Seventh Semester (4th year of UG)				
1	Cyber Physical Systems	CS431	3-0-2	4	85
2	Elective	CS4AA	3-X-X	3/4	55/70/85
3	Elective	CS4BB	3-X-X	3/4	55/70/85
4	Elective (Specialization#3)	CS4CC	3-X-X	3/4	55/70/85
5	Elective (Specialization#4)	CS4DD	3-X-X	3/4	55/70/85
			Total	**16-20**	**305-425**
6	Minor / Honor (M/H#4)	CS4EE	3-X-X	4	70/85
	Eighth Semester (4th year of UG)				
1	Industrial Internship / Professional Experience (Mandatory)	CSP08	0-0-40	20	800 (20 x 40)
			Total	**20**	**800**

Sr. No.	**Optional Core**	**Code**	**Scheme L-T-P**
1	Object Oriented Programming	CS231	3-0-2
3	Artificial Intelligence	CS232	3-0-2
2	Information Security	CS233	3-0-2
4	Machine Learning	CS331	3-0-2
5	Distributed Computing	CS332	3-0-2
6	Cyber Physical Systems	CS431	3-0-2

Sr. No.	**Elective**	**Code**	**Scheme L-T-P**
1	Software Engineering	CS351	3-0-2
2	Foundations of Cryptography	CS352	3-1-0
3	Unmanned Aerial Vehicle Technology	CS353	3-0-2

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

(Semester 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th) Curriculum SVNIT Surat (58th Senate, 31 May 2023)

4	Data Structures and Algorithms (for Minor)	CS254	3-0-2
5	Network Security	CS355	3-0-2
6	Social Network Analysis	CS356	3-0-2
7	High Performance Computing	CS357	3-0-2
8	Unmanned Aerial Vehicles Information Systems	CS358	3-0-2
9	Artificial Intelligence for Robotics	CS359	3-0-2
10	Blockchain Technology	CS360	3-0-2
11	Data Science	CS361	3-0-2
12	Cyber Laws and Forensic Tools	CS451	3-0-2
13	Big Data Analytics	CS452	3-0-2
14	Drone Forensics	CS453	3-0-2
15	Software Security	CS454	3-0-2
16	System Analysis and Simulation	CS455	3-0-2
17	Security in Cyber Physical Systems	CS456	3-0-0
18	Deep Learning	CS457	3-0-2
19	Machine Learning for Security	CS458	3-0-2
20	Natural Language Processing	CS459	3-0-2
21	Network Reconnaissance	CS460	3-0-0
22	Motion Analytics	CS461	3-0-2

	B.Tech. I Semester – I/II (For other disciplines)				
1	Fundamentals of Computer and Programming	CS110	3-0-2	4	85
	Five Years Integrated M.Sc. Physics M.Sc. II Semester – IV				
1	Data Structures	CS102	3-1-2	5	100

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. I (CSE) Semester – I INTRODUCTION TO COMPUTER SCIENCE (CORE-1) CS101	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Acquire knowledge about computers and computational problem solving.
CO2	Design the solutions of computational problems using iterative and recursive methods using flowcharts and pseudo-codes.
CO3	Solve computational problems in different number systems.
CO4	Analyse the importance of different types of memory and evaluate the impact of different algorithms on memory.
CO5	Experiment with different operating systems such as Windows and Linux and write scripts to automate repetitive tasks.

2.	Syllabus	
	INTRODUCTION TO COMPUTER AND ITS ARCHITECTURE	**(04 Hours)**
	Introduction and Characteristics, Computer Architecture, Generations, Classifications, Applications, Central Processing Unit and Memory, Communication between various Units, Processor Speed, Multiprocessor System, Peripheral Buses, Motherboard Demonstration.	
	NUMBER SYSTEMS	**(06 Hours)**
	Introduction and type of Number System, Conversion between Number System, Arithmetic Operations in different Number System, Signed and Unsigned Number System.	
	COMPUTATIONAL PROBLEM SOLVING	**(08 Hours)**
	Program Development Cycle, Pseudocode, Flowchart, Representing Information as Bits, Binary System, Storing Integers, Storing Fractions, Examples of Computational Problems, Iterative and Recursive Approaches to Solve Computational Problems, Easy and Hard Computational Problems	
	MEMORY AND VARIOUS INPUT AND OUTPUT DEVICES	**(04 Hours)**

	Introduction to Memory, Input and Output Devices, Memory Hierarchy, Primary Memory and its Types, Secondary Memory, Classification of Secondary Memory, Various Secondary Storage Devices, and their Functioning.	
	INTRODUCTION TO SYSTEM SOFTWARES AND PROGRAMMING LANGUAGES	**(03 Hours)**
	Classification of Computer Languages, Introduction of Operating System, Evolution, Type and Function of OS, Unix Commands, Evolution and Classification of programming Language, Feature and Selection of good Programming Language, Development of Program, Algorithm and Flowchart, Program Testing and Debugging, Program Documentation and Paradigms, Characteristics of good Program.	
	WINDOWS OPERATING SYSTEM AND ITS ENVIRONMENT	**(03 Hours)**
	Introduction to GUI based OS, Configuration, Setup, Services, Network Configuration.	
	LINUX OPERATING SYSTEM AND ITS ENVIRONMENT	**(06 Hours)**
	Introduction to Linux OS, Configuration, Setup, Commands – Navigating File System, File Permissions (R/W/X), Access control and super user (sudo) privileges, Scripting basics, Bash Shell and Scripting, Network Configuration.	
	DEBUGGING TOOLS AND COMPILER OPTION	**(03 Hours)**
	Different Debugging tools, Commands, Memory dump, Register and Variable Tracking, Instruction and Function level debugging, Compiler Options, Profile Generation.	
	DATA COMMUNICATION, COMPUTER NETWORK AND INTERNET BASICS	**(04 Hours)**
	Data Communication and Transmission media, Multiplexing and Switching, Computer Network and Network Topology, Communication Protocols and Network Devices, Evolution and Basic Internet Term, Getting Connected to Internet and Internet Application, Email and its working, Searching the Web, Languages of Internet, Internet and Viruses.	
	SYSTEM AND NETWORK SECURITY BASICS	**(04 Hours)**
	Security Services, Security Attacks, and Security Mechanisms, Authentication, Password Strengths and Entropy, Access Control Mechanisms, Read/Write/Execute Permissions and Super User/Administrator Privileges, Introduction of HTTPS and Digital Certificates	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Number System
2	Problem Solving using Algorithms
3	Problem Solving using Flowcharts
4	Linux Commands
5	Bash Shell Scripting

4.	**Books Recommended**
1	Introduction to Computer Science", Fourth Impression, Pearson Education, ITL Education Solutions Limited, 2009.
2	Nell Dale and John Lewis, "Computer Science Illuminated", Jones and Bartlett Publishers.
3	Robert Sedgewick and Kevin Wayne, "Computer Science", Addison-Wesley.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. I (CSE) Semester – I INTRODUCTION TO PROGRAMMING (CORE-2) CS103	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Acquire knowledge about fundamentals of C programming language.
CO2	Apply the knowledge of C Programming to solve computational problems.
CO3	Debug, test, and analyse C Programs to find and correct errors and improve the solutions.
CO4	Learn various programming techniques such as iteration and recursion, and apply them to solve computational problems.
CO5	Learn and apply the advanced programming concepts such as modularization, memory management, and file handling to improve the efficiency of computational problems.

2.	**Syllabus**	
	OVERVIEW OF C PROGRAMMING LANGUAGE	**(02 Hours)**
	History of C, Importance of C, Basic Structure of a C Program, How to Compile a C Program, How to Run a C Program, Sample Programs.	
	CONSTANTS, VARIABLES, AND DATA TYPES	**(03 Hours)**
	Character Set in C, Keywords, Identifiers, Constants, Strings, Operators, Special Symbols, Variables, Data Types: Primary Data Types and User Defined Data Types, Declaration of Variables, Assigning Values to Variables, Initialization of Variables, Defining Symbolic Constants, Declaring Variables as Constants.	
	OPERATORS AND EXPRESSIONS	**(03 Hours)**
	Operators: Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, Bitwise, Comma Operator, sizeof Operator, Operators used in Pointers and Structures, Arithmetic Expressions, How C programming Evaluates Arithmetic Expressions, Precedence of Arithmetic Operators and Associativity Rule, Type Conversion: Implicit and Explicit.	
	LIBRARY FUNCTIONS: INPUT, OUTPUT, MATHEMATICS, DATE AND TIME	**(03 Hours)**
	Reading Character from Keyboard, Printing Character on Screen, Reading String from Keyboard, Printing String on Screen, Formatting input and Output, difftime, clock, time, Math Functions: abs, fmod, reminder, log, log2, pow, sqrt, ceil, floor.	

	DECISION MAKING AND BRANCHING	**(04 Hours)**
	Decision Making in C Programming, If Statement, Nested If Statement, Else .. If Ladder, Switch Statement, Conditional Operator Statement, Goto Statement, Decision Making with Logical Operators, Sample Programs.	
	DECISION MAKING AND LOOPING	**(05 Hours)**
	Introduction to Loops, While Loop, Do While Loop, For Loop, Break Statement, Goto Statement, Continue Statement, Sample Programs.	
	ARRAYS AND CHARACTER ARRAYS	**(05 Hours)**
	Introduction to Arrays, One Dimensional Array, Declaration and Initialization of One Dimensional Array, Two Dimensional Array, Declaration and Initialization of Two Dimensional Array, Multi-Dimensional Array, Sample Programs, Declaration and Initialization of Strings, Arithmetic Operations on Characters, String Functions: Strlen(), Strcat(), Strcpy(), Strstr(), Strcmp(), etc.	
	FUNCTIONS	**(05 Hours)**
	Function Declaration, Function Definition, Function Calls, Functions with No Arguments and No Return Values, Functions with Arguments and No Return Values, Functions with No Arguments and Return Values, Functions with Arguments and Return Values, Recursive Functions, Passing Arrays to Functions, Call by Value, Call by Reference, Scope and Lifetime of Functions: Local, Global, Static, and Register Declaration.	
	STRUCTURES AND UNIONS	**(04 Hours)**
	Structure Template, Structure Variable Declaration and Initialization, Structure Variable Assignment, Accessing Structure Variables, Arrays as Structure, Arrays with Structures, Passing Structure Members to Functions, Unions, Difference Between Structures and Unions, Bit Fields.	
	POINTERS AND MEMORY MANAGEMENT	**(05 Hours)**
	Declaration and Initialization of Pointers, Accessing Memory through Pointers, Dynamic Memory Allocation, Memory Management Functions: Malloc, Calloc, and Free, Using Pointers to Access Dynamically Allocated Memory Locations, Pointers with Arrays, Use of Pointers to Return Multiple Values From Functions, Sample Program: Linked List.	
	FILE MANAGEMENT	**(04 Hours)**
	Opening and Closing a File, Modes in File Opening: Read, Write and Append, Input and Output Operations on Files, File Handling Functions such as fseek(), ftell(), rewind().	
	PREPROCESSOR DIRECTIVES	**(02 Hours)**

	Macro Substitution, Importing a File, Compiler Control Directives.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	C Programming – How to write a program, compile a program, and execute a program
2	Read the input from a keyboard and write the output to computer screen
3	Variable declaration, initialization, and assignment, Constant declaration, Experiments with different data types
4	Experiments with different C Operators, Analysing the impact of precedence and associativity rules while evaluating expressions in C
5	Experiments with standard library functions related to math library, time library, standard input and output library etc.
6	Experiments with If, Else If, Switch, Goto statements
7	Experiments with While, Do…While, For Loops, and analysing the impact of Break, Goto and Continue statements on C Loops
8	Experiments with Arrays and Character Arrays
9	Experiments with Different Functions having Arguments/No Arguments and Return Values/No Return Values, Scope and Lifetime of Functions, and Understanding Local, Global, Static, and Register Declaration
10	Experiments with Structures and Unions, Analysing the difference between the structure and union with respect to memory
11	Experiments with Pointers with respect to Accessing Memory from the Stack and Heap Section of the RAM (i.e., Experiments with Static and Dynamic Memory Management)
12	Opening, Closing the Files using a C program, and accessing the files to get the input from the file and store the output to the file.
13	Experiments with pre-processor directives.

4.	**Books Recommended**
1	E. Balagurusamy, “Programming in ANSI C”, Mc-Graw Hill.
2	Brian W. Kernighan / Dennis Ritchie,“The C Programming Language”, Pearson.
3	Yashavant Kanetkar, “Let us C”, BPB Publications.
4	Harbison and Steele, “C: A Reference Manual”

B.Tech. I (CSE) Semester – I ELECTRICAL NETWORK ANALYSIS EE103	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	acquire knowledge about AC circuits, electrical network basics, transforms, wave form representation.
CO2	apply the fundamentals of electrical network basics to analyse different networks.
CO3	analyse electrical network using different theorems and different wave forms.
CO4	evaluate network performance using different parameters.
CO5	design and analyse different types of systems using network principles and network theorems.

2.	**Syllabus**	
	AC FUNDAMENTALS AND CIRCUITS	**(08 Hours)**
	Alternating Voltages and Currents through Purely Resistive Inductive and Capacitive Circuits, R-L, R-C, R-L-C Series Circuits, Impedance and Admittance, Circuits in Parallel, Series and Parallel Resonance, Complex Algebra and its Application to Circuit Analysis, Circuit Transient, Initial and Final Value Theorem, DC and Induction Machines, Electrical Measurements, Power System.	
	POLYPHASE CIRCUITS AND TRANSFORMES	**(05 Hours)**
	Balanced Three Phase Systems, Star and Mesh Connections, Relation between Line and Phase Quantities, Measurement of Power, Principle of Transformer, Construction, Transformer on no-load and with load, Phasor Diagram for Transformer under No-Load and Loaded Condition (with unity, lagging power factor load) Equivalent Circuit, Open Circuit and Short Circuit Test, Efficiency, Voltage Regulation.	
	NETWORK CONCEPTS	**(04 Hours)**
	Network Element Symbols and Conventions, Active Element Conventions, Current and Voltage Conventions, Loops and Meshes, Nodes, Coupled circuits and Dot Conventions.	
	MESH CURRENT AND NODE VOLTAGE NETWORK ANALYSIS	**(07 Hours)**
	Kirchhoff's Voltage Law, Kirchhoff's Current Law, Definitions of Mesh Current and Nodal Voltage, Choice of Mesh Currents or Nodal Voltages for Network Analysis, Self and Mutual Inductances,	

	Mesh Equation in the Impedance Matrix Form by Inspection, Solution of Linear Mesh Equations, Nodal Voltage Analysis Nodal Equations in the Form of Admittance Matrices by Inspection, Solution of Linear Nodal Equations.	
	NETWORK THEOREMS AND GRAPH	**(07 Hours)**
	Linearity and Superposition, Independent and Dependent Source and their Transformations, Thevenin, Norton, Reciprocity and Maximum Power Transfer Theorems, Use of these Theorems in Circuit Analysis, Duality and Dual of a Planner Network, Fundamental Concepts, Definition of Graph and Various Related Terms, Paths and Circuits Connections, Tree of a Graph, Cut Sets and Tie Sets, Non-separable Planner and Dual Graphs, Matrices of Oriented Graphs, Properties and Inter-Relationship of Incidence, Tie Set and Cut Set Matrices, Complete Analysis Using Tie Set and Cut Set Matrices.	
	WAVE FORM ANALYSIS BY FOURIER SERIES	**(06 Hours)**
	Trigonometric and Complex Exponential Forms, Frequency Spectra of Periodic Wave Forms, Fourier Integral and Continuous Frequency Spectra, Fourier Transform and their Relationship with Laplace Transform.	
	NETWORK FUNCTIONS AND TWO PORT PARAMETERS	**(08 Hours)**
	Poles and Zeros of a Function, Physical and Analytical Concepts, Terminal and Terminal Pairs, Driving Point Immitances, Transfer Functions, Definitions, Calculations and Interrelationship of Impedance, and Admittance, Hybrid and Transmission Line Parameters for four Terminal Networks. Image Impedance and its Calculations for Symmetrical and Unsymmetrical π, T and Ladder Networks.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	To study Ammeter and Voltmeter for current and voltage measurement in circuit.
2	To study Energy meter.
3	Verification of superposition theorem for electric circuit.
4	To study Power measurement method for three phase circuits using watt meter method.
5	Verification of Thevenin’s theorem of electric circuit.
6	Calculation and verification Norton’s theorem.
7	Open circuit and short circuit test for the transformers for efficiency calculation.
8	Verification of Kirchhoff’s current law and Kirchhoff’s voltage law for electric circuit.

9	Capacitance measurement of parallel plates.
10	Calculation of efficiency of auto transformer.

4.	**Books Recommended**
1	W.H.Hyat, J.E.Kemmerly, S.M.Durbin, “Engineering Circuit Analysis”, 6^{th}Edition, TMH, 2006.
2	Van Valkenburg M E, “Network Analysis”, 3^{rd}Edition, PHI, 2002.
3	Samarjit Ghosh, “Network Theory, Analysis & Synthesis”,3^{rd} Edition, PHI, 2005.
4	C.L.Wadhwa, “Network Analysis & Synthesis”, Revised 3^{rd}Edition, New Age International Publishers, 2007.
5	Kothari and Nagrath, “Basic Electrical Engineering”, 2^{nd}edition, Tata McGraw-Hill Education, 2007.

ADDITIONAL REFERENCE BOOKS	
1	V. N. Mittle & Arvind Mittal, “Basic Electrical Engineering”, 2^{nd} edition, Tata McGraw-Hill Education, 2005.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. I (CSE) Semester – I FUNDAMENTALS OF ENGINEERING MATHEMATICS MA105	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Accept the challenge to solve the problem with Mathematics.
CO2	Apply the knowledge of curve tracing to solve problem of engineering.
CO3	Identify, formulate and analyze complex engineering and affiliated field problems, specifically the differential equation concept in different engineering field.
CO4	Apply the knowledge of mathematics for model and analyze computational processes using analytic and combinatorial methods
CO5	Design solutions engineering industrial problems with effective mathematical skill.

2.	Syllabus	
	DIFFERENTIAL CALCULUS	**(09 Hours)**
	Differentiation of Hyperbolic and Inverse Hyperbolic functions. Successive Differentiation, standard forms, Leibnitz's theorem and applications, Power series, Expansion of functions, Taylor's and Maclaurin's series. Curvature, Radius of curvature for Cartesian curve with application.	
	PARTIAL DIFFERENTIAL CALCULUS	**(09 Hours)**
	Partial differentiation, Euler's theorem for homogeneous function, Modified Euler's theorem, Taylor's and Maclaurin's series for two variables. Tangent plane and Normal line, Error and Approximation, Jacobians with properties, Extreme values of function of two variables, Lagrange's methods of undetermined multipliers.	
	CURVE TRACING	**(06 Hours)**
	Cartesian, polar and parametric form of standard curves.	
	ORDINARY DIFFERENTIAL EQUATION	**(09 Hours)**
	Reorientation of differential equation first order first degree, exact differential equation and Integrating factors, first order higher degree odes, solvable for p, y and x, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficient, Method of variation of parameters.	
	APPLICATION OF DIFFERENTIAL EQUATION (MATHEMATICAL MODELLING)	**(06 Hours)**

	Modelling of Realworld problems particularly Engineering System, Electrical network models (LCR), spread of epidemic (SI, SIS, SIR), Newton's Law of cooling, Compartment modelling, Bending of beam models.	
	SERIES SOLUTION AND SPECIAL FUNCTIONS	**(06 Hours)**
	Regular point, Singular point, series solution of ODE of 2nd order with variable coefficient with special emphasis to differential equation of Legendre's and Bessel's for different cases of roots of indicial equations.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Problems on Array
2	Problems on Stack and Queue
3	Problems on Linked List
4	Problems on Trees
5	Problems on Graph

4.	**Books Recommended**
1	James Stewart, "Calculus", Thomson Asia, Singapore, 2003.
2	Kreyszing E., "Advanced Engineering Mathematics", John Wiley & Sons, Singapore, Int. Student Ed. 2015.
3	Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., New York Ed. 1993.
4	F. B. Hilderband, "Methods of Applied mathematics", PHI, New Delhi, 1968
5	Ramana D. V., "Higher Engg. Mathematics", The McGraw-Hill Inc., New Delhi, 2007.

ADDITIONAL REFERENCE BOOKS	
1	Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi, 2015.
2	Bali and Iyengar, "Engineering Mathematics", Laxmi Publications, New Delhi, 2004.
3	Mary L. Boas, "Mathematical Methods in the Physical Sciences", John Wiley & Sons, Ed. 2005.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. II (CSE) Semester – III DATA STRUCTURES (CORE-3) CS102	Scheme	L	T	P	Credit
		3	1	2	05

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	recognize the need of different data structures and understand its characteristics.
CO2	apply different data structures for given problems.
CO3	design and analyse different data structures, sorting and searching techniques.
CO4	evaluate data structure operations theoretically and experimentally.
CO5	give solution for complex engineering problems.

2.	**Syllabus**	
	INTRODUCTION TO DATA STRUCTURES	**(03 Hours)**
	Review of Concepts: Information and Meaning, Abstract Data Types, Internal Representation of Primitive Data Structures, Arrays, Strings, Structures, Pointers.	
	LINEAR LISTS	**(06 Hours)**
	Sequential and Linked Representations of Linear Lists, Comparison of Insertion, Deletion and Search Operations for Sequential and Linked Lists, Doubly Linked Lists, Circular Lists, Lists in Standard Template Library (STL), Applications of Lists.	
	STACKS	**(06Hours)**
	Sequential and Linked Implementations, Representative Applications such as Recursion, Expression Evaluation Viz., Infix, Prefix and Postfix, Parenthesis Matching, Towers of Hanoi, Wire Routing in a Circuit, Finding Path in a Maze.	
	QUEUES	**(06 Hours)**
	Operations of Queues, Circular Queue, Priority Queue, Dequeue, Applications of Queues, Simulation of Time Sharing Operating Systems, Continuous Network Monitoring System Etc.	
	SORTING AND SEARCHING	**(04 Hours)**

	Sorting Methods, Bubble Sort, Selection Sort, Quick Sort, Radix Sort, Bucket Sort, Dictionaries, Hashing, Analysis of Collision Resolution Techniques, Searching Methods, Linear Search, Binary Search, Character Strings and Different String Operations.	
	TREES	**(08 Hours)**
	Binary Trees and Their Properties, Terminology, Sequential and Linked Implementations, Tree Traversal Methods and Algorithms, Complete Binary Trees, General Trees, AVL Trees, Threaded Trees, Arithmetic Expression Evaluation, Infix-Prefix-Postfix Notation Conversion, Heaps as Priority Queues, Heap Implementation, Insertion and Deletion Operations, Heapsort, Heaps in Huffman Coding, Tournament Trees, Bin Packing.	
	MULTIWAY TREES	**(05 Hours)**
	Issues in Large Dictionaries, M-Way Search Trees, BTrees, Search, Insert and Delete Operations, Height of B-Tree, 2-3 Trees, Sets and Multisets in STL.	
	GRAPHS	**(07 Hours)**
	Definition, Terminology, Directed and Undirected Graphs, Properties, Connectivity in Graphs, Applications, Adjacency Matrix and Linked Adjacency Chains, Graph Traversal, Breadth First and Depth First Traversal, Spanning Trees, Shortest Path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	Practicals will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

3.	**Tutorials**
1	Problems on Array
2	Problems on Stack and Queue
3	Problems on Linked List
4	Problems on Trees
5	Problems on Graph

4.	**Practicals**
1	Implementation of Array and its applications

2	Implementation of Stack and its applications
3	Implementation of Queue and its applications
4	Implementation of Link List and its applications
5	Implementation of Trees and its applications
6	Implementation of Graph and its applications
7	Implementation of Hashing functions and collision resolution techniques
8	Mini Project (Implementation using above Data Structure)

5.	**Books Recommended**
1	Trembley & Sorenson: "An Introduction to Data Structures with Applications", 2/E, TMH, 1991.
2	Tanenbaum & Augenstein: "Data Structures using C and C++", 2/E, Pearson, 2007.
3	Horowitz and Sahani: "Fundamentals of Data Structures in C", 2/E, Silicon Press, 2007.
4	T. H. Cormen, C. E. Leiserson, R. L. Rivest: "Introduction to Algorithms",3/E, MIT Press, 2009.
5	Robert L. Kruse, C. L. Tondo and Brence Leung: "Data Structures and Program Design in C", 2/E, Pearson Education, 2001.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. I (CSE) Semester – II WEB PROGRAMMING AND PYTHON (CORE-4) CS104	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	acquire knowledge about the basics of web pages, need of web server, configuration, client and server side scripting, style of web pages and script programming.
CO2	install and configure the web server and apply the knowledge of programming to develop web application pages using html, style sheets, client and server side scripts using script programming.
CO3	analyse given problem for the requirement of html, style sheets, client side or server side script with different programming constructs.
CO4	evaluate web application programming solutions with different aspects like the presentation and working of the web application and usage of different scripting constructs.
CO5	utilize the standard tools for design and development of web project solution for given problems by integrating html, client and server pages with style and scripting.

2.	Syllabus	
	INTRODUCTION	**(03 Hours)**
	Basics of Internet, World Wide Web, HTTP Protocol, Universal Resource Locator, Web Server, Different Types of Web Servers, Domain Name Server, Web Server Configuration, Internet Browser, Web Document and Mark-Up Language, Hypertext Mark-Up Language, Hypermedia, Web Site Organization, Content Organization, Web Server on Different Operating System Platforms, Web Applications, Web Interface, Web Standards & Accessible Design.	
	STATIC AND DYNAMIC WEB PAGES, STYLE SHEETS AND WEB PUBLISHING	**(17 Hours)**
	Web Page, Static Web Page, Hypertext Mark-Up Tags, Handling Font Style, Types, Size, Colour Etc., Handling Table, List, Images, Graphics, Menu Etc; Forms, Input Text Box, Drop Down Menu, Name Variable, Cookie Management, Session Management, Animation, Structure Web Pages, Image Mapping, Link Setup In Image, Frames, Structuring Web Pages Using Frames, Multimedia Handling, Linking To Pages; Dynamic Web Pages and Scripting - Scripting Language, Dynamic Pages and Forms Validation, Validation of Input Text Box, Dynamic Drop Down Menu, Validation and Accessing Name Variable-Value Pair, Cookie Management Through Scripting, Session Management through Scripting, Animation through Scripting, Dynamic Image Mapping Through Scripting, Link Handling through Scripting, Multimedia Handling through Scripting; Web Page Designing using Style Sheet, Different Types of Style Sheet, Defining Different Styles,	

	Export and Importing Style Sheet, Cascade Style Sheet. Web Hosting and Publishing - Different Steps of Web Hosting and Publishing, Documents Interchange Standards, Website Evaluation, Components of Web Publishing, Document Management, Search Engines, and Registration of a Web Site on Search Engines, Publishing Tools.	
	PYTHON PROGRAMMING	**(25 Hours)**
	Basics of Python Programming: Variables, Keywords, Expressions, Data Types, Operators and Operands, Assignments, Order of Operations, Controlling Statements, Branching and Loops, Functions, Definitions, Arguments, Returning Values, Scopes, Recursive Functions, Modules and Import, Strings, Tuples, and Lists; Handling Exceptions – Try/Except, Standard Exceptions, Exceptions as Control Flow Mechanisms; Object Oriented Programming – Classes, Abstract Data Types, Inheritance, Encapsulation; Debugging – Syntax errors, Runtime Errors, Semantic Errors, Test Cases; Files – Reading, Iterating over Lines, Finding a File in File system, Writing Data to Files, CSV Format, Read and Write To/From CSV File; Dictionaries – Introduction, Dictionary Operations, Aliasing, Copying, Dictionary Accumulation, Introduction to Module Packages.	
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	To prepare the web page using hypertext markup language
2	To study and setup the web server for implementation
3	To learn client side scripting
4	To learn server side scripting
5	To apply style to the web pages
6	To implement functions for files
7	To implement dictionary

4.	**Books Recommended**
1	Martin C. Brown, “Python: The Complete Reference, Osborne, McGraw-Hill, 2018.
2	Thomas Powell and fritz Schneider, “JavaScript: The Complete Reference, McGraw-Hill, 2017.
3	J. Sklar, “Principles of Web Design”, 7/E, Cengage Learning, 2017.
4	H. Deitel, A. Deitel, “Internet and World Wide Web How to Program”, 5/E, Pearson, 2012.

5	John V. Guttag, "Introduction to Computation and Programming Using Python", MIT Press, 2013 Edition.

ADDITIONAL REFERENCE BOOKS	
1	Martin C. Brown, "Python: The Complete Reference, Osborne, McGraw-Hill, 2018.
2	1. M. L. Young," The Complete reference of Internet", Tata Mc Graw Hill, 2002.
3	2. W. G. Lehnert, "Internet 101, 1/E, Person Education, 2001.
4	B. Underdahle and K. Underdahle, "Internet and Web Page/ Website design", 2/E, IDG Books India (P) Ltd., 2001.
5	D. Comer, "The Internet Books," Prentice Hall of India, 2/E, 2001.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. I (CSE) Semester – II DIGITAL ELECTRONICS AND LOGIC DESIGN EC106	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	acquire knowledge about different types of diodes and circuits.
CO2	apply the knowledge of gates, Boolean algebra and operational amplifier in designing logical and integrated circuits.
CO3	analyse the logical, integrated, and operational amplifier based circuits.
CO4	evaluate the different circuits and compare their performance.
CO5	design ALU and control unit.

2.	**Syllabus**	
	PN DIODE AND TRANSITOR	**(07 Hours)**
	PN Diode Theory, PN Characteristic and Breakdown Region, PN Diode Application as Rectifier, Zener Diode Theory, Zener Voltage Regulator, Diode as Clamper and Clipper, Photodiode Theory, LED Theory, 7 Segment LED Circuit Diagram and Multi Colour LED, LASER Diode Theory and Applications, Bipolar Junction Transistor Theory, Transistor Symbols And Terminals, Common Collector, Emitter and Base Configurations, Different Biasing Techniques, Concept of Transistor Amplifier, Introduction to FET Transistor And Its Feature.	
	WAVESHAPING CIRCUITS AND OPERATIONAL AMPLIFIER	**(06 Hours)**
	Linear Wave Shaping Circuits, RC High Pass and Low Pass Circuits, RC Integrator and Differentiator Circuits, Nonlinear Wave Shaping Circuits, Two Level Diode Clipper Circuits, Clamping Circuits, Operational Amplifier OP-AMP with Block Diagram, Schematic Symbol of OP-AMP, 741 Package Style and Pinouts, Specifications of Op-Amp, Inverting and Non-Inverting Amplifier, Voltage Follower Circuit, Multistage OP-AMP Circuit, OP-AMP Averaging Amplifier, OP-AMP Subtractor.	
	BOOLEAN ALGEBRA AND SWITCHING FUNCTIONS	**(04 Hours)**
	Basic Logic Operation and Logic Gates, Truth Table, Basic Postulates and Fundamental Theorems of Boolean Algebra, Standard Representations of Logic Functions- SOP and POS Forms, Simplification of Switching Functions-K-Map and Quine-Mccluskey Tabular Methods, Synthesis of Combinational Logic Circuits.	
	COMBINATIONAL LOGIC CIRCUIT USING MSI INTEGRATED CIRCUITS	**(07 Hours)**

	Binary Parallel Adder; BCD Adder; Encoder, Priority Encoder, Decoder; Multiplexer and Demultiplexer Circuits; Implementation of Boolean Functions Using Decoder and Multiplexer; Arithmetic and Logic Unit; BCD to 7-Segment Decoder; Common Anode and Common Cathode 7-Segment Displays; Random Access Memory, Read Only Memory and Erasable Programmable ROMS; Programmable Logic Array (PLA) and Programmable Array Logic (PAL).	
	INTRODUCTION TO SEQUENTIAL LOGIC CIRCUITS	**(04 Hours)**
	Basic Concepts of Sequential Circuits; Cross Coupled SR Flip-Flop Using NAND or NOR Gates; JK Flip-Flop Rise Condition; Clocked Flip-Flop; D-Type and Toggle Flip-Flops; Truth Tables and Excitation Tables for Flip-Flops; Master Slave Configuration; Edge Triggered and Level Triggered Flip-Flops; Elimination of Switch Bounce using Flip-Flops; Flip-Flops with Preset and Clear.	
	SEQUENTIAL LOGIC CIRCUIT DESIGN	**(06 Hours)**
	Basic Concepts of Counters and Registers; Binary Counters; BCD Counters; Up Down Counter; Johnson Counter, Module-N Counter; Design of Counter Using State Diagrams and Table; Sequence Generators; Shift Left and Right Register; Registers with Parallel Load; Serial-In-Parallel-Out (SIPO) And Parallel-In-Serial-Out (PISO); Register using Different Type of Flip-Flop.	
	REGISTER TRANSFER LOGIC	**(04 Hours)**
	Arithmetic, Logic and Shift Micro-Operation; Conditional Control Statements; Fixed-Point and Floating-Point Data; Arithmetic Shifts; Instruction Code and Design Of Simple Computer.	
	PROCESSOR LOGIC DESIGN	**(03 Hours)**
	Processor Organization; Design of Arithmetic Logic Unit; Design of Accumulator.	
	CONTROL LOGIC DESIGN	**(04 Hours)**
	Control Organization; Hard-Wired Control; Micro Program Control; Control Of Processor Unit; PLA Control.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Study of BJT Characteristics
2	Study of CE Amplifier
3	Study of RC Coupled / Tuned Amplifier
4	Study of FET Characteristics

5	Study of Diode Clipper Circuits
6	Study of Diode Clamper Circuits
7	Study and Implement RC Low Pass and High Pass Filter Circuits
8	Study and Implement RC Integrator Circuits
9	Study and Implement RC Differentiator Circuits
10	Full and Half-Adder/ Half-subtarctor Circuits using a serial Input
11	4-Bit Gray to Binary/ Binary to Gray Code convertor using Select input
12	Logic expression with the Help of MUX IC 74153
13	Flip-flops using NAND/ NOR Gate
14	Modulo-7 Ripple Counter
15	4-Bit Shift Left/Right Register
16	Sequence Generator

4.	**Books Recommended**
1	Schilling Donald L. and Belove E., "Electronics Circuits- Discrete and Integrated", 3rd Ed., McGraw-Hill, 1989, Reprint 2008.
2	Millman Jacob, Halkias Christos C. and Parikh C., "Integrated Electronics", 2nd Ed., McGraw-Hill, 2009.
3	Taub H. and Mothibi Suryaprakash, Millman J., "Pulse, Digital and Switching Waveforms", 2nd Ed., McGraw-Hill, 2007.
4	Mano Morris, “Digital Logic and Computer Design”, 5th Ed., Pearson Education, 2005.
5	Lee Samual, “Digital Circuits and Logic Design”, 1st Ed., PHI, 1998.

ADDITIONAL REFERENCE BOOKS	
1	Malvin Albert & David J. Bates, "Electronic Principles", 7th edition, Tata McGraw Hill, 2007.
2	De Debashis, "Basic of Electronics", 1st Ed., Pearson Education, 2008.
3	Floyd and Jain, “Digital Fundamentals”, Pearson Education, 2006.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. I (CSE) Semester – II ENERGY AND ENVIRONMENTAL ENGINEERING EG110	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Explain the components of ecosystems, various biogeochemical cycles and importance of different urban network services.
CO2	Differentiate between various types of environmental pollution along with their impacts and regulatory standards.
CO3	Examine various global environmental issues and their management.
CO4	Discuss the fundamental principles of energy, including classification, conservation and related policy frameworks and regulations.
CO5	Get acquainted with the concept of energy systems and their components.

2.	Syllabus	
	ENVIRONMENT AND ECOSYSTEMS	**(10 Hours)**
	Introduction: Concept of an ecosystem - structure and functions of ecosystem; Components of ecosystem - producers, consumers, decomposers; Food chains, food webs, ecological pyramids, energy flow in ecosystem; Bio-geochemical cycles, hydrologic cycle, Components of environment and their relationship, impact of technology on environment, environmental degradation, environmental planning of urban network services such as water supply, sewerage, solid waste management; closed loop cycle, concepts of sustainability.	
	ENVIRONMENTAL POLLUTION	**(10 Hours)**
	Water, air, soil, noise, thermal and radioactive, marine pollution - sources, effects and engineering control strategies; Centralized and decentralized treatment system, Drinking water quality and standards, ambient air and noise standards.	
	GLOBAL ENVIRONMENTAL ISSUES AND ITS MANAGEMENT	**(10 Hours)**
	Engineering aspects of climate change, concept of carbon credit, CO_2 sequestration, concepts of environmental impact assessment and environmental audit, life cycle assessment.	
	BASICS OF ENERGY AND ITS CONSERVATION	**(07 Hours)**
	Classification of energy sources, Global and national energy scenario, Fossil and alternate fuels and its characterization. General aspects of energy conservation and management; Energy conservation act, Energy policy of company; Need for energy standards and labelling; Energy building codes.	

	INTRODUCTION TO ENERGY CONSERVATION SYSTEMS	**(08 Hours)**
	Energy conversion systems: Working principle, Basic components, General functioning and normal rating specifications of various energy conversion systems like Power plant, Pump, Refrigerator, Air-conditioner, Internal combustion engine, Solar PV cell, Solar water heating system, Biogas plant. Wind turbine, Fuel cells.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Performance Test on a computerised single cylinder diesel engine
2	Performance Test on Three-cylinder petrol engine
3	Determination of COP of vapor compression refrigeration system
4	Study of General Motors Cruze Vehicle Automotive System
5	Study of MG Hector Vehicle Automotive Systems
6	Measurement of direct and diffused Solar radiation using pyranometer
7	Determination of I-V Characteristics of solar PV Panel
8	Study of electricity and or gas bill
9	Study of pollutants from diesel Engine
10	Study of pollutants from petrol Engine

4.	**Books Recommended**
1	Daniel B. Botkin & Edward AKeller, Environmental Sciences, John Wiley & Sons.
2	R. Rajagopalan, Environmental Studies, Oxford University Press.
3	Benny Joseph, Environmental Studies, TMH Publishers.
4	Dr. Suresh K. Dhameja, Environmental Studies, S. K. Kataria & Sons, 2007.
5	U. K. Khare, Basics of Environmental Studies, Tata McGraw Hill, 2011.

ADDITIONAL REFERENCE BOOKS	
1	C. S. Rao, Environmental Pollution Control Engineering, New Age International Publishers, 2018.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. I (CSE) Semester – II LINEAR ALGEBRA AND STATISTICS MA106	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	accept the challenge to solve the problem with statistics
CO2	apply the knowledge of Linear Algebra to solve problem of engineering.
CO3	identify, formulate and analyze complex engineering and affiliated field problems, specifically the Partial differential equation concept in different engineering field
CO4	apply the knowledge of vector calculus and analyze computational processes
CO5	design solutions to work on engineering industrial problems with effective mathematical skill.

2.	Syllabus	
	PROBABILITY THEORY AND RANDM PROCESS	**(09 Hours)**
	Fundamentals of Probability Theory: - views of probability, Random variables and Joint distributions, Marginal distribution, Conditional probability, Conditional independence, Expectation and variance, Probability distributions Central limit theorem, Functions of random variable, Sum of independent random variable, Correlation and regression, Random process, Stationary random process, Autocorrelation and cross correlation, Ergodic process, Markov process, Birth and death process, Poisson process, Markov chain, Chapman Kolmogorov theory, Spectral analysis of random processes, power spectral density.	
	ESTIMATION AND STATISTICS	**(08 Hours)**
	Sampling theory, Population and sample, Statistical interference, Sampling distribution, Sample mean, Bias estimation, Unbiased estimator, Confidence interval, Point estimation and interval estimates, Statistical decision, Hypothesis testing, Statistical hypotheses, Null hypotheses, Significance test, Type I and types II errors, Level of significance, One tail and two tailed test, Chi square test, Maximum likelihood estimate, Least square estimate, MAP estimate, Minimum mean square estimate.	
	INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATION	**(09 Hours)**
	Introduction to Partial differential equation, Formation of partial differential Equation, Partial differential Equation of first order, Linear partial differential equation of first order (Pp + Qq =R)	

	and method of obtaining its general solution, Non-linear partial differential equation of first order f(p, q)=0, f(z, p, q)=0, f(x, p)= g(y, q), z= px + qy + f(p,q).	
	BASIC CONCEPTS OF VECTOR CALCULUS	**(08 Hours)**
	Scalar and vector point function, differential operator, gradient, directional derivative, divergence, curl and Laplacian operator with their properties.	
	LINEAR ALGEBRA	**(11 Hours)**
	Linear systems, Elementary row and column transformation, rank of matrix, consistency of linear system of equations, Linear Independence and Dependence of vectors, Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method; Vector spaces, Subspace, Field, Ring, Norm and distance, Linear Mapping, Orthogonality, Eigenvectors and Eigenvalues, Least square, Least square data fitting, Constrained least square applications.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Books Recommended**
1	Kreyszing E., “Advanced Engineering Mathematics”, John Wiley & Sons, Singapore, Int. Student Ed. 2015.
2	Wiley C. R., “Advanced Engineering Mathematics”, McGraw Hill Inc., New York Ed. 1993.
3	Gilbert Strang, “Introduction to Linear Algebra”, Wellesley Cambridge Press, 4th Ed., 2009.
4	David C. Lay, “Linear Algebra and its applications”, 3rd Ed., Pearson, 2006.
5	A. Papoulis and S. U. Pillai, “Probability, Random Variables and Stochastic Processes”, 4th Ed., Mc-Graw Hill, 2002.

ADDITIONAL REFERENCE BOOKS	
1	Ramana D. V., “Higher Engg. Mathematics”, McGraw-Hill Inc., New Delhi, 2007.
2	Srimanta Pal, Subodh C. Bhunia, “Engineering Mathematics”, Oxford University Press, New Delhi, 2015.
3	Mary L. Boas, “Mathematical Methods in the Physical Sciences”, John Wiley & Sons, Ed.2005.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. I Semester – I/II FUNDAMENTALS OF COMPUTER AND PROGRAMMING CS110	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	acquire knowledge about computer architecture, network and software development.
CO2	install an operating system and configure the network along with programming skills to solve the given problem.
CO3	debug network and operating system related issues and analyse the given problem.
CO4	evaluate programming solutions with different aspects.
CO5	design and develop solution for given problems.

2.	**Syllabus**	
	INTRODUCTION TO COMPUTER AND ITS ARCHITECTURE	**(02 Hours)**
	Introduction and Characteristics, Computer Architecture, Generations, Classifications, Applications, Central Processing Unit and Memory, Communication between various Units, Processor Speed, Multiprocessor System, Peripheral Buses, Motherboard Demonstration.	
	MEMORY AND VARIOUS INPUT AND OUTPUT DEVICES	**(02 Hours)**
	Introduction to Memory, Input and Output Devices, Memory Hierarchy, Primary Memory and its Types, Secondary Memory, Classification of Secondary Memory, Various Secondary Storage Devices and their Functioning.	
	NUMBER SYSTEMS	**(01 Hour)**
	Introduction and type of Number System, Conversion between Number System, Arithmetic Operations in different Number System, Signed and Unsigned Number System.	
	INTRODUCTION TO SYSTEM SOFTWARES AND PROGRAMMING LANGUAGES	**(04 Hours)**
	Classification of Computer Languages, Introduction of Operating System, Evolution, Type and Function of OS, Unix Commands, Evolution and Classification of programming Language, Feature and Selection of good Programming Language, Development of Program, Algorithm and Flowchart, Program Testing and Debugging, Program Documentation and Paradigms, Characteristics of good Program.	

	WINDOWS OPERATING SYSTEM AND ITS ENVIRONMENT	**(02 Hours)**
	Introduction to GUI based OS, Configuration, Setup, Services, Network Configuration.	
	LINUX OPERATING SYSTEM AND ITS ENVIRONMENT	**(02 Hours)**
	Introduction to Unix based OS, Configuration, Setup, Services, Scripting, Network Configuration.	
	DEBUGGING TOOLS AND COMPILER OPTION	**(04 Hours)**
	Different Debugging tools, Commands, Memory dump, Register and Variable Tracking, Instruction and Function level debugging, Compiler Options, Profile Generation.	
	DATA COMMUNICATION, COMPUTER NETWORK AND INTERNET BASICS	**(02 Hours)**
	Data Communication and Transmission media, Multiplexing and Switching, Computer Network and Network Topology, Communication Protocols and Network Devices, Evolution and Basic Internet Term, Getting Connected to Internet and Internet Application, Email and its working, Searching the Web, Languages of Internet, Internet and Viruses.	
	PROGRAMMING USING 'C' LANGUAGE – INTRODUCTION	**(06 Hours)**
	Characteristics of C Language, Identifiers and Keywords, Data Types Constants and Variables, Declarations and Statements, Representation of Expressions, Classification of Operators and Library Functions for Data Input and Output Statements, Formatted Input and Output Statements.	
	PROGRAMMING USING 'C' LANGUAGE – CONTROL STATEMENTS, STRUCTURES, ARRAYS, POINTERS	**(12 Hours)**
	Conditional Control Statements, Loop Control Statements, One Dimensional Array of Numbers and Characters, Two-Dimensional Array, Introduction and Development of User Defined Functions, Different Types of Variables and Parameters, Structure and Union, Introduction to Pointers, Pointer Arithmetic, Array of Pointers, Pointers and Functions, Pointers and structures, File Handling Operations.	
	PROGRAMMING USING 'C' LANGUAGE – FUNCTIONS	**(06 Hours)**
	Functions, Passing the arguments, Return values from functions, Recursion, Header Files Design, File handling operations, Read and Write to Secondary Devices, Read and Write to Input and Output Ports.	
	PROGRAMMING USING 'C' LANGUAGE – GRAPHICS, DEBUGGING	**(02 Hours)**
	Include Graphics Library, Debugging, Linking, Compilation Option for Optimization, Make file.	

	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Basic commands of Windows and Linux
2	Flow chart drawing and writing pseudo steps or algorithms steps
3	Programming for logic development using different control statements
4	Programming for familiarity with control statement, array, pointers
5	Programming using structures, pointers, programming using functions

4.	**Books Recommended**
1	"Introduction to Computer Science", Fourth Impression, Pearson Education, ITL Education Solutions Limited, 2009.
2	Gottfried B.S., "Programming with C Schaum's outline Series", Outline Series, 2nd Edition, Tata McGraw-Hill, 2006.
3	Brian W. Kernighan, Dennis M. Ritchie, "The C Programming language", 2nd Edition, Prentice Hall PTR publication, 1988.
4	E. Balagurusamy, "Programming in ANSI C", 6th Edition, Tata Mc-Graw Hill, 2012.
5	Pradip Dey, "Programming in C", 2nd Edition, Oxford University Press, 2012.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. I / M.Sc. I Semester I/ II **ENGLISH AND PROFESSIONAL COMMUNICATION** **HS110**	Scheme	L	T	P	Credit
		3	1	0	04

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	show enhanced reception towards the use of English language.
CO2	choose and employ appropriate words for professional communication.
CO3	develop sentences and text in English coherently and formally.
CO4	demonstrate overall improvement in oral communication.
CO5	analyze and infer from written and oral messages.

2.	**Syllabus**	
	COMMUNICATION	**(05 Hours)**
	Introduction to Communication, Different forms of Communication, Barriers to Communication and some remedies, Non-Verbal Communication – Types, Non-Verbal Communication in Intercultural Context.	
	VOCABULARY AND USAGE OF WORDS	**(05 Hours)**
	Common Errors, Synonyms, Antonyms, Homophones, and Homonyms; One Word Substitution; Misappropriations; Indianisms; Redundant Words.	
	LANGUAGE THROUGH LITERATURE	**(09 Hours)**
	Selected short stories, essays, and poems to discuss nuances of English language.	
	LISTENING AND READING SKILLS	**(06 Hours)**
	Types of listening, Modes of Listening-Active and Passive, Listening and note taking practice, Practice and activities. Reading Comprehension (unseen passage- literary /scientific/technical) Skimming and scanning, fact vs opinion, Comprehension practice.	
	SPEAKING SKILLS	**(10 Hours)**
	Effective Speaking, JAM, Presentation Skills- types, preparation and practice. Interviews-types, preparation and mock interview; Group Discussion- types, preparation and practice.	

	WRITING SKILLS	**(10 Hours)**
	Prerequisites of effective writing, Memo-types, Letter Writing- types, Email etiquette and Netiquette, Résumé-types, Report Writing and its types, Editing.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Letter and Resume
2	Group Discussion
3	Presentation Skills (Individual)
4	Role Play on Nonverbal communication
5	Group Presentation
6	Debate
7	Body language and intercultural communication
8	Listening Activities
9	Editing
10	Report Writing
11	Mock interviews
12	JAM

4.	**Books Recommended**
1	Kumar, Sanjay and Pushp, Lata. *Communication Skills*, 2nd Edition, OUP, New Delhi, 2015.
2	Raman, Meenakshi & Sharma Sangeeta. *Technical Communication Principles and Practice*, 3rd Edition, OUP, New Delhi, 2015.
3	Raymond V. Lesikar and Marie E Flatley. *Basic Business Communication skills for Empowering the Internet generation.* Tata McGraw Hill publishing company limited. New Delhi 2005.
4	Courtland L. Bovee, John V. Thill, and Mukesh Chaturvedi. “Business Communication Today.” Ninth Edition. Pearson, 2009.
5	Mike Markel. “Practical Strategies for Technical Communication,” Bedford/ St. Martin's Second Edition, 2016
6	Laura J. Gurak and John M. Lannon. “Strategies for Technical Communication in the Workplace,” Pearson, 2013.

B.Tech. I / M.Sc. I Semester I/ II **INDIAN VALUE SYSTEM AND SOCIAL CONSCIOUSNESS** **HS120**	**Scheme**	**L**	**T**	**P**	**Credit**
		2	**0**	**0**	**02**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	interpret the important values that need to be cultivated
CO2	analyse the cultures depicted in Ramayana, Mahabharata, Jainism and Buddhism
CO3	review the structure of Indian knowledge system
CO4	discuss the significance of constitution of India
CO5	demonstrate social responsibility

2.	**Syllabus**	
	HUMAN VALUES AND CONSCIOUSNESS	**(08 Hours)**
	Human Values Definition and Classification of Values; The Problem of Hierarchy of Values and their Choice; Self-Exploration; 'Basic Human Aspirations; Right understanding, Relationship and Physical Facility; fulfilment of aspirations; Understanding Happiness and Prosperity, Harmony at various levels. What Is Consciousness? ; Can We Build A Conscious Machine?; Levels Of Consciousness; Mind, Matter And Beyond; Holistic Lifestyle; Dealing With Anxiety; Connecting Mind To Brain; Minds, Brains, And Programs.	
	INDIAN CULTURE AND HERITAGE	**(07 Hours)**
	Culture and its salient features: The Vedic – Upanishadic Culture and society, Human aspirations in those societies; Culture in Ramayana and Mahabharata: The Ideal Man and Woman, Concepts Maitri, Karuna, Seela, Vinaya, Kshama, Santi, Anuraga – as exemplified in the stories and anecdotes of the Epics; The Culture of Jainism: Jaina conception of Soul, Karma and liberation, Buddhism as a Humanistic culture; The four Noble truths of Buddhism; Vedanta and Indian Culture;	
	INDIAN KNOWLEDGE SYSTEM	**(08 Hours)**
	Indian knowledge as a unique system, Place of Indian knowledge in mankind's evolution, Relevance of Indian knowledge to present day and future of mankind, Nature of Indian Knowledge; Structure of Indian Knowledge: Types of knowledge (para, apara), The scientific and the unscientific, Instruments for gaining and verifying knowledge, Knowledge traditions: Lineages, Instruments - debate, epistemology and pedagogy, The inverted tree – axiomatic,	

	deductive, empirical knowledge, and evolution of knowledge; Disciplines of Study: A brief outline of the subjects, the major contributions and theories along with timelines where relevant: Mathematics; Astronomy; Physical Sciences; Cosmogony; Language studies; Astrology; Moral studies/righteousness; Statecraft and political philosophy	
	INDIAN CONSTITUTION	**(04 hours)**
	History of Making of the Indian Constitution; Philosophy of the Indian Constitution: Preamble; Salient Features; Contours of Constitutional Rights & Duties; Organs of Governance: Parliament; Composition; Qualifications and Disqualifications; Powers and Functions	
	SOCIAL RESPONSIBILITY	**(03 Hours)**
	Social Responsibility: Meaning and Importance, Different Approaches of Social Responsibility. Social Responsibility of Business towards different Stakeholders. Evolution and Legislation of CSR in India.	
		(Total Contact Time: 30 Hours)

3.	**Books Recommended**
1	D. K. Chaturvedi, Professional Ethics Values and Consciousness, Ane Books Pvt. Ltd., 2023.
2	R.R. Gaur, R Sangal, G. P. Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010.
3	A.N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
4	P R Rao, Indian Heritage and Culture, Sterling Publishers Pvt. Ltd, 1988.
5	D. Singh, Indian Heritage and Culture, APH Publishing Corporation, 1998.
6	Sri Prashant Pole, Treasure Trove of Indian knowledge, Prabhat Prakashan, 2021.
7	Sri Suresh Soni, Sources of our cultural heritage, Prabhat Prakashan, 2018.
8	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. II (CSE) Semester – III COMPUTER ORGANIZATION CS201	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Acquire knowledge of basics of computer architecture, its components with peripheral devices, instruction set architecture, instruction execution using data path, and control unit interface.
CO2	Apply knowledge of combinational and sequential logic circuits to mimic simple computer architecture to solve the given problem.
CO3	Analyze the performance of various instruction set architecture, control unit, memories, various processor architectures.
CO4	Evaluate programming solutions to implement fast methods of ALU, FP unit implementations, processor architectures and instruction set architectures.
CO5	Implement fast methods of ALU, FP unit implementations and to design and develop hardware solution for given instruction coding scheme of an Instruction Set Architecture or vice versa using available technology tools.

2.	Syllabus	
	PROCESSOR BASICS	**(08 Hours)**
	Basics CPU Organization - Functional Units, Data Paths, Registers, Stored Program Concept, Data Representation - Basic Formats, Fixed and Floating Point Representation, Instruction Sets, Instruction Types, Instruction Formats, Addressing Modes, Designing of an Instruction Set, Data path Design, Concepts of Machine Level Programming, Assembly Level Programming and High Level Programming.	
	ARITHMETIC AND LOGIC UNIT	**(08 Hours)**
	Arithmetic and Logical Operation and Hardware Implementation, Implementation of some Complex Operation: Fixed-Point Arithmetic Multiplication Algorithms-Hardware Algorithm, Booth Multiplication Algorithm, Division Algorithm, Divide Overflow Algorithm, Combinational ALU and Sequential ALU, Floating Point Arithmetic Operations.	
	CONTROL UNIT	**(07 Hours)**

	Basic Concepts, Instruction Interpretation and Execution, Hardwired Control, Microprogrammed Control, CPU Control Unit Design, Performance.	
	SUBROUTINE MANAGEMENT	**(03 Hours)**
	Concepts of Subroutine, Subroutine Call and Return.	
	MEMORY ORGANIZATION	**(06 Hours)**
	Concepts of Semiconductor Memory, CPU-Memory Interaction, Organization of Memory Modules, Cache Memory and Related Mapping and Replacement Policies, Virtual Memory.	
	SYSTEM ORGANIZATION	**(05 Hours)**
	Introduction to InputAnd Output Processing, Working with Video Display Unit and Keyboard and Routine to Control them, Programmed Controlled I/O Transfer, Interrupt Controlled I/O Transfer, DMA Controller, Secondary Storage and Type of Storage Devices, Introduction to Buses and Connecting I/O Devices to CPU and Memory.	
	PIPELINE CONTROL AND PARALLEL PROCESSING	**(08 Hours)**
	Instruction Pipelines, Pipeline Hazards, Pipeline Performance, Superscalar Processing, Introduction to Parallel Processing, Processor-Level Parallelism, Multiprocessor.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Problems on data conversion in various formats and floating-point representation.
2	Solving computations involving complex arithmetic operations and hardware implementation of the same.
3	Interpretation of basic instruction execution and various addressing modes possible.
4	Learning instruction set architecture level instructions for the high level language programming.
5	Problems on memory management, mapping and replacement policies.

4.	**Books Recommended**

1	John L. Hannessy, David A. Patterson, "Computer organization and Design", 3/E, Morgan Kaufmaan, reprint -2003.
2	Andrew S. Tanenbaum, "Structured Computer Organization", 6/E, PHI EEE, reprint 1995.
3	William Stallings, "Computer Organization & Architecture: Designing For Performance", 6/E, PHI, 2002.
4	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5/E, McGraw-Hill, 2002.
5	Morris Mano, "Computer Systems Architecture", 3/E, PHI, reprint 1997.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. II (CSE) Semester – III DATABASE MANAGEMENT SYSTEMS CS203	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Understand different database models and query languages to manage the data for given real life application scenario
CO2	Apply the concept of database model, relational tables, normalization to solve different problems.
CO3	Analyze the problems for designing the effective solution using procedural and nonprocedural languages and/or index.
CO4	Evaluate the solution using transaction management, concurrency management, query performance and optimization, or recovery.
CO5	Implement an efficient solution using industry standards for real life problems.

2.	Syllabus	
	INTRODUCTORY CONCEPTS OF DBMS	**(02 Hours)**
	Introduction, Applications of DBMS, Purpose of Database, Data Independence, Database System Architecture, Data Abstraction, Database users and DBA.	
	ENTITY RELATIONSHIP MODEL	**(06 Hours)**
	Basic Concepts, Design Process, Constraints, Keys, Design Issues, E-R Diagrams, Attribute Types, Mapping Cardinality, Types of Relationship, Weak/Strong Entity Sets, Extended E-R Features – Generalization, Specialization, Aggregation.	
	RELATIONAL MODELS	**(05 Hours)**
	Structure of Relational Databases, Domains, Relations, Mapping of ER Model to Relational Model, Relational Algebra – Fundamentals, Operators and Syntax, Relational Algebra Queries, Tuple Relational Calculus.	
	RELATIONAL DATABASE DESIGN	**(08 Hours)**
	Functional Dependency – Definition, Trivial and Non-trivial FD, Closure of FD Set, Closure of Attributes, Irreducible Set of FD, Normalization – 1Nf, 2NF, 3NF, Decomposition using FD-Dependency Preservation, BCNF, Multi- Valued Dependency, 4NF, Join Dependency and 5NF.	

	QUERY PROCESSING AND OPTIMIZATION	**(05 Hours)**
	Overview of Query Processing, Measures of Query Cost, Select Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Overview of Query Optimization, Transformation of Relational, Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views, Advanced Topics in Query Optimization.	
	TRANSACTION MANAGEMENT	**(06 Hours)**
	Transaction Concepts, Properties of Transactions, Serializability of Transactions, Testing for Serializability, Concurrent Executions of Transactions and Related Problems, Locking Mechanism, Solution to Concurrency Related Problems, Two-phase Locking Protocol, Deadlock, Isolation, Intent Locking, System Recovery, Recovery and Atomicity, Log-based Recovery.	
	SQL CONCEPT	**(05 Hours)**
	Basics of SQL, DDL,DML,DCL, Structure – Creation/Alteration, Defining Constraints – Primary Key, Foreign Key, Unique, Not Null, Check, IN Operator.	
	PL-SQL CONCEPT	**(04 Hours)**
	Cursors, Stored Procedures, Stored Function, Database Triggers	
	ADVANCED TOPICS	**(04 Hours)**
	Data Security: Introduction, Discretionary Access Control, Mandatory Access Control, Data Encryption, Semi Structured Data and XML, Object Oriented and Object Relational DBMS, Distributed DBMS, NOSQL DBMS.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Implementation for Physical data storage (Sequential, Index Sequential..)
2	Practicing DDL and DML Queries for database creation and managing the data
3	Develop a Database system for the real life application scenario by managing the storage constrains
4	Practicing PL/SQL with the designed databases
5	Design considering Transaction management and concurrency control
6	Design of ER model based example

7	Design of Relational model based example
8	Design of Normalized form of database

4.	**Books Recommended**
1	A Silberschatz, H. F. Korth, and S Sudarshan, "Database System Concepts", 6/E, TMH, 2010.
2	McFadden, F.Hoffer, Prescott : M. B "Modern database management", 8/E, Benjamin/Cummings Inc,2006.
3	C.J Date, "An Introduction to Database Systems", Publisher: Addison, Wesley, 8/E, 2003.
4	Raghu Ramakrishnan and Gehrke: "Database Management System", 3/E, WCB/McGraw-Hill, 2003.
5	Margaret H. Dunham, "Data Mining: Introductory and advanced topics", Pearson Education, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. II (CSE) Semester – III DESIGN AND ANALYSIS OF ALGORITHMS CS205	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Acquire knowledge about the application of mathematical formula and technique to solve the problem and computational complexity analysis.
CO2	Apply the different algorithm design techniques for designing a solution of different applications.
CO3	Analyse the performance of algorithms using different algorithmic design techniques based on asymptotic or amortized or probabilistic methods.
CO4	Evaluate the correctness and implementation of algorithms using different methods of performance evaluation.
CO5	Design and innovate efficient algorithms in the field of computer science & engineering and industry related applications using the different algorithm design techniques.

2.	Syllabus	
	INTRODUCTION	**(05 Hours)**
	Introduction to Algorithms, Analysis and Design Techniques, Analysis Techniques: Mathematical, Empirical and Asymptotic Analysis. Recurrence Relations and Solving Recurrences, Mathematical Proof Techniques, Amortized Analysis, Probabilistic Analysis.	
	DIVIDE AND CONQUER APPROACH	**(08 Hours)**
	Sorting & Order Statistics, Divide and Conquer Technique, Various Comparison based Sorts, Analysis of the Worst-Case and the Best-Cases, Randomized Sorting Algorithms, Lower Bound on Sorting, Non-comparison based Sorts, Medians and Order Statistics, Min-Max Problem, Polynomial Multiplication, Fast Fourier Transform.	
	GREEDY DESIGN TECHNIQUES	**(08 Hours)**
	Basic Greedy Control Abstraction, Motivation, Thirsty Baby Problem, Formalization, Activity Selection and its Variants, Huffman Coding, Horn Formulas, Tape Storage Problem, Container Loading Problem, Knapsack Problem, Graph Algorithms, Graph algorithms: All-pairs Shortest Paths, Topological Ordering of DAG, DFS in Directed Graphs, Strongly Connected Components, Minimum Spanning Trees, Single Source Shortest Paths, Maximum Bipartite Cover Problem,	

	Network Flows: Ford Fulkerson Algorithm, Max-flow Min-cut Theorem, Polynomial Time Algorithms for Max-flow.	
	DYNAMIC PROGRAMMING	**(08 Hours)**
	Motivation, Matrix Multiplication Problem, Assembly Line Problem, Coin Changing Problem, Longest Common Subsequence, 0/1 Knapsack problem, All-pairs Shortest Path Problems, Dynamic Programming Control Abstraction, Optimal Binary Search Tree.	
	SEARCHING ALGORITHMS	**(04 Hours)**
	Backtracking, N-Queens Problem, Sum of Subset Problem, Complexity Analysis, Branch & Bound, Least Cost Branch & Bound (LCBB), LCBB Complexity Analysis, 15-Puzzle Problem, Traveling Sales Person Problem.	
	NUMBER THEORETIC ALGORITHMS	**(06 Hours)**
	Number Theoretic Notions, GCD, Modular Arithmetic, Chinese Remainder Theorem, Generators, Cyclic Groups, Galois Fields, Applications in Cryptography, Primality Testing.	
	NP-COMPLETE PROBLEMS	**(06 Hours)**
	Polynomial Time, Verification, NP-completeness, Search Problems, Reductions, Dealing with NPCompleteness, Approximation Algorithms, Local Search Heuristics.	
	Tutorials will be based on the coverage of the above topics.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Books Recommended**
1	Cormen, Leiserson, Rivest, Stein,” Introduction to Algorithms”, 3/E, MIT Press, 2009.
2	J. Kleinberg, E. Tardos, “Algorithm Design”, 1/E, Pearson Education, Reprint 2006.
3	Sartaj Sahni, “Data Structures, Algorithms and Applications in C++”, 2/E, Universities Press/Orient Longman, 2005.
4	Sara Baase, Allen van Gelder,” Computer Algorithms: Introduction to Design & Analysis, 3/E, Pearson Education, 2000.
5	Knuth, Donald E., “The Art of Computer Programming, Vol I &III”, 3/E, Pearson Education, 1997.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. II (CSE) Semester – III DISCRETE MATHEMATICS CS207	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Acquire knowledge of sets, group and functions, graphs.
CO2	Apply group theory, relations and lattice.
CO3	Analyse functions, counting and based on mathematical logic.
CO4	Evaluate formal verification of computer programmes.
CO5	Design solutions for various types of problems in different disciplines like information security, optimization, mathematical analysis.

2.	Syllabus	
	INTRODUCTION	**(04 Hours)**
	Introduction to set theory, Basics of functions, Application of Functions in Computer Science Areas.	
	GROUP THEORY	**(08 Hours)**
	Basic Properties of Group, Groupoid, Semigroup & Monoid, Abelian Group, Subgroup, Cosets, Normal Subgroup, Lagrange's Theorem, Cyclic Group, Permutation Group, Homomorphism & Isomorphism of Groups, Basic Properties, Error Correction & Detection Code.	
	RELATION & LATTICES	**(05 Hours)**
	Definition & Basic Properties, Graphs of Relation, Matrices of Relation, Equivalence Relation, Equivalence Classes, Partition, Partial Ordered Relation, Posets, Hasse Diagram, Upper Bounds, Lower Bound, GLB & LUB of Sets, Definition & Properties of Lattice, Sub Lattice, Distributive & Modular Lattices, Complemented & Bounded Lattices, Complete Lattices & Boolean Algebra.	
	MATHEMATICAL LOGIC AND PROGRAM VERIFICATION	**(05 Hours)**
	Induction, Propositions, Combination of Propositions, Logical Operators & Propositional Algebra, Equivalence, Predicates & Quantifiers, Interaction of Quantifiers with Logical	

	Operators, Logical Interference & Proof Techniques, Formal Verification of Computer Programs (Elements of Hoare Logic).	
	COUNTING AND RECURRENCE RELATION	**(05 Hours)**
	First Counting Principle, Second Counting Principle, Permutation, Circular Permutations, Combination, Pigeonhole Principle, Recurrence Relations, Linear Recurrence Relations, Inclusion And Exclusion, Generating Functions.	
	BASICS OF GRAPHS	**(08 Hours)**
	Graph Definition, Graph Representation, Basic Concepts Of Finite & Infinite Graph, Incidence and Degree, Isomorphism, Subgraph, Walk, Path and Circuits, Cliques, Cycles and Loops, Operations on Graphs, Connected Graph, Disconnected Graph and Components, Complete Graph, Regular Graph, Bipartite Graph, Planar Graphs, Weighted Graphs, Directed and Undirected Graphs, Connectivity of Graphs.	
	GRAPHS ALGORITHMS	**(10 Hours)**
	Flows, Combinatorics, Euler's Graph, Hamiltonian Paths & Circuits, Activity Planning and Critical Path, Planar Graphs: Properties, Graph Coloring, Vertex Coloring, Chromatic Polynomials, Edge Coloring, Planar Graph Coloring, Matching and Factorizations: Maximum Matching In Bipartite Graphs, Maximum Matching In General Graphs, Hall's Marriage Theorem, Factorization; Networks: Max-Flow Min-Cut Theorem, Menger's Theorem, Graph and Matrices; Probabilistic Graphical Models:Graphical models, Directed models: Bayesian network, Undirected model: Markov Random Fields, Dynamic model: Hidden Markov Model, Learning in Graphical models: Parameter estimation, Expectation Maximization.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Books Recommended**
1	Rosen K.H., "Discrete Mathematics and Its Applications", 6/E, MGH, 2006.
2	Liu C.L., "Elements of Discrete Mathematics", MGH, 2000.
3	Deo Narsingh., "Graph theory with applications to Engineering & Computer Science", PHI, 2000.
4	J. A.Bondy and U. S. R.Murty, "Graph Theory", Springer, 2008.
5	V. K. Balakrishnan, "Theory and Problems of Graph Theory", Tata McGraw-Hill, 2007.

ADDITIONAL REFERENCE BOOKS	
1	Kolman B., Busby R.C. & Ross S., "Discrete Mathematical Structure", 5/E, PHI, 2003.
2	Tremblay J. P. & Manohar R., "Discrete Mathematical structure with applications to computer science", MGH, 1999.
3	D. B. West, "Introduction to Graph Theory", 2nd Edition, PHI 2002.
4	G. Chatrand and O.R. Ollermann, "Applied and Algorithmic Graph Theory", McGraw Hill, 1993.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. II (CSE) Semester – III OBJECT ORIENTED PROGRAMMING CS231	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Acquire knowledge of object oriented programming.
CO2	Apply the knowledge of object oriented concepts to solve the real world problems.
CO3	Analyse object oriented concepts to solve the problem efficiently.
CO4	Evaluate the object oriented features' suitability for the implementation of the problem.
CO5	Design and implement the efficient object oriented program using various object oriented concepts.

2.	Syllabus	
	INTRODUCTION	**(06 Hours)**
	Review of High Level Language, Difference between Procedure Oriented and Object Oriented Approach; Characteristics of Object-Oriented Languages Object Oriented Concepts: Objects, Classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism; Dynamic Binding, Message Passing; , Types of Operators, Operator precedence and associativity, Data type conversions; Selection and Loops	
	CLASSES AND OBJECTS	**(08 Hours)**
	Abstract data types, Object and classes, attributes, methods, Class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.	
	INHERITANCE	**(08 Hours)**
	Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs. classification hierarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.	
	POLYMORPHISM	**(07 Hours)**

	Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions, Late Binding, Abstract Classes.	
	STRINGS, FILES AND EXCEPTION HANDLING	**(04 Hours)**
	Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration, unexpected exceptions, exception when handling exceptions, resource capture and release.	
	DYNAMIC MEMORY MANAGEMENT	**(04 Hours)**
	Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.	
	STANDARD TEMPLATE LIBRARY	**(08 Hours)**
	Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors, Usage of Template Library for the Implementation of Data Structure.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
		(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3.	**Practicals** (using C++/JAVA)
1	Creation of objects in programs.
2	Experiments with private, public member variables and functions and friend functions.
3	Experiments for the usage of constructors and destructors.
4	Experiments for the working of operator overloading.
5	Experiments with abstract classes, interfaces and inheritance to access objects.
6	Experiments with polymorphism and virtual functions.
7	Experiments for strings manipulation.
8	Experiments on file handling.
9	Implementing common data structures, such as trees, lists and hash tables.
10	To deal with runtime errors using exception handling mechanism.
11	Implementation of mini project using object oriented concepts.

4.	**Books Recommended**
1	E. Balagurusamy, “Object Oriented Programming with C++”, McGraw Hill Education (India).
2	E. Balagurusamy, “Programming with JAVA“, McGraw Hill.
3	Yashwant Kanetkar, “Object Oriented Programming using C++”, BPB, 2004.
4	R. Lafore, “Object Oriented Programming using C++”, BPB Publications, 2004.
5	Naughton P. and Schildt H., “Java2 Complete Reference”, Eighth Edition, Tata McGraw Hill, 2011.

ADDITIONAL REFERENCE BOOKS	
1	Parasons, “Object Oriented Programming with C++”, BPB Publication, 1999.
2	Steven C. Lawlor, “The Art of Programming Computer Science with C++”, Vikas Publication, 2002.
3	Jaime Nino, Fredrick A. Hosch, “An Introduction to Programming and Object Oriented Design using Java”, Wiley India Private Limited, 2010.

B.Tech. II (CSE) Semester – IV MICROPROCESSOR AND INTERFACING TECHNIQUES CS202	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Acquire knowledge of different architectures, addressing modes and instructions of 8085/86.
CO2	Interface memory, I/O devices and interrupt controller with 8085/86 microprocessors.
CO3	Analyse and compare the features of microprocessors and microcontrollers.
CO4	Describe the internal architecture and different modes of operations of a typical peripheraldevice.
CO5	Design and develop assembly language programs using 8085/86 instructions, software interrupts, subroutines, macros.

2.	**Syllabus**	
	INTRODUCTION TO MICROPROCESSOR EVOLUTION	**(02 Hours)**
	Introduction to Microprocessor and Development and its Operation.	
	ARCHITECTURE FEATURES OF 8085	**(06 Hours)**
	8085 Architecture and Pin out diagram, 8085 Operations.	
	INTRODUCTION SET AND PROGRAMMING OF 8085	**(06 Hours)**
	Data Transfer instructions, Arithmetic instructions and its examples, Logical Instructions and its examples, Branch, Stack, and I/O related instructions, How to write, assemble and execute assembly language programmes, Assembly language programming Practice Based on above instructions for 8085, Design Counters in 8085, Design Time delays in 8085, Stack & Subroutines: Restart, Conditional and Unconditional Call and Return Instructions, Advanced Subroutine Concepts, Code Conversion, 16-bit Data Operation.	
	PERIPHERAL & MEMORY INTERFACING WITH 8085	**(08 Hours)**
	Basic I/O Interfacing Concepts: Interfacing Display devices, Interfacing Input devices, Memory Interfacing: Absolute decoding, Partial Decoding, Shadow Memory, Interfacing Peripherals:	

	8255A Programmable Peripheral Interface, Examples of Interfacing Keyboard and seven-segment Display, Examples of Bidirectional Data transfer Between Two Microcomputer, The 8254 (8253) Programmable Interval Timer, The 8259A Programmable Interrupt Controller, Direct Memory Access and 8237 DMA Controller, The 8279 Programmable Keyboard/Display Interface, Interfacing Scanned Multiplexed Displays and Liquid Crystal Displays, Interfacing a Matrix Keyboard, Serial I/O and Data Communication: Basic concepts in Serial I/O, Software-Controlled Asynchronous Serial I/O, The 8085-Serial I/O lines: SOD and SID, Hardware Controlled Serial I/O Using Programmable Chips.	
	8085 INTERRUPT MANAGEMENT	**(04 Hours)**
	Interrupts and its Types in 8085, Interrupt Vector Table, Priority of Interrupts, Programming usingInterrupts.	
	8086 ARCHITECTURE	**(03 Hours)**
	8086 Architecture, Pin Out Diagram and its Features, Registers of 8086.	
	INSTRUCTION SET OF 8086	**(06 Hours)**
	Data Transfer Instructions and Examples based on it, Arithmetic Instructions and Examples based on it, Logical Instructions, Comparison Instructions, Jump Instructions, Examples based on Logical, Comparison, Jump Instructions, Various 8086 Assembler Directives, Examples based on Various Assembler Directives, What are Procedures in 8086?, Procedure-based Examples in 8086, What are Macros in 8086? Macros-based Examples in 8086.	
	PERIPHERAL & MEMORY INTERFACING WITH 8086	**(04 Hours)**
	Interfacing Peripherals:- 8255A: Examples of Interfacing Keyboard and Seven-segment Display, Interfacing with Alphanumeric Displays, Examples of Bidirectional Data Transfer Between Two Microcomputer, 8254, 8259A, and 8279 Interfacing with 8086.	
	8086 INTERRUPTS MANAGEMENT AND APPLICATIONS	**(03 Hours)**
	8086 Interrupts and Interrupts Responses, Interrupt Pointer Table, Hardware Interrupt, SoftwareInterrupts, Interrupt Applications.	
	RECENT TRENDS IN MICROPROCESSORS	**(03 Hours)**
	Practicals will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Introduction of 8085 kit and Installation 0f 8085 simulator
2	Assembly Language Programming based on Data transfer and Arithmetic and Logic instructions
3	Assembly Language Programming based on Branch operations
4	Assembly Language Programming based on stack and subroutines
5	Assembly Language Programming based on Code conversions
6	Assembly Language Programming based on counter and time delays
7	Introduction of 8086 Microprocessor and Installation of TASM,TLINK, TD, and DEBUG
8	Assembly Language Programming based on 8086 instruction and assembler directives
9	Practical based on 8085 interfacing

4.	**Books Recommended**
1	Sentilkumar N, Saravanan M and Jeevananthan S, “Microprocessors and Microcontrollers” 2/E, Oxford University Press, 2018.
2	Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085", 6/E,Penram International Publishing (India) Pvt. Ltd., 2013.
3	Douglas V Hall, "Microprocessors and Interfacing: Programming & Hardware", 3/E, TMH, 2013.
4	Brey, “The Intel Microprocessors", 8/E, Pearson Education, 2009.
5	A K Ray and K M Bhurchandi, "Advanced Microprocessors & Peripherals: Architecture Programming& Interfacing", 2/E, TMH, 2006.

ADDITIONAL REFERENCE BOOKS	
1.	Abel Peter and Nizamuddin, "IBM PC Assembly Language and Programming", 5/E, Pearson Education, 2001.

B.Tech. II (CSE) Semester – IV **COMPUTER NETWORKS** **CS204**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Understand computer network models and services offered at different layers of network protocol stack.
CO2	Apply knowledge of data communication, data transmission techniques using various transmission media to deliver error free data and communicate with multiple nodes.
CO3	Analyse various routing methods to identify effective routing protocols.
CO4	Evaluate network performance by means of transport and flow control protocols, CongestionControl protocols and Quality of services.
CO5	Create a computer network application using modern network tools and simulation softwares.

2.	**Syllabus**	
	INTRODUCTION	**(06 Hours)**
	Overview of Computer Networks and Data Communication, Computer Networking Protocols and Standards, Types of Computer Networks, Network Topology, Protocol Hierarchies and Design Issues, Interfaces and Services, Networking Devices, OSI and TCP/IP Reference Models.	
	PHYSICAL LAYER	**(06 Hours)**
	Physical Layer Design Issues, Data Transmission Techniques, Multiplexing, Transmission Media, Asynchronous Communication, Wireless Transmission, ISDN, ATM, Cellular Radio, Switching Techniques and Issues.	
	LOGICAL LINK CONTROL LAYER	**(06 Hours)**
	LLC Design Issues, Framing, Error and Flow Control, Framing Techniques, Error Control Methods,Flow Control Methods, PPP and HDLC.	
	MEDIUM ACCESS CONTROL LAYER	**(07 Hours)**
	MAC Layer Design Issues, Channel Allocation Methods, Multiple Access Protocols - ALOHA, CSMA, CSMA/CD Protocols, Collision Free Protocols, Limited Contention Protocols, LAN Architectures, IEEE-802 Standards, Ethernet (CSMA/CD), Token Bus, Token Ring, DQDB, FDDI, Bridges and Recent Developments.	
	NETWORK LAYER	**(08 Hours)**

	Network Layer Design Issues, Routing Algorithms and Protocols, Congestion Control Algorithms andQoS, Internetworking, Addressing, N/W Layer Protocols and Recent Developments.	
	TRANSPORT LAYER	**(06 Hours)**
	Transport Layer Design Issues, Transport Services, Sockets, Addressing, Connection Establishment,Connection Release, Flow Control and Buffering, Multiplexing, Transport Layer Protocols, Real TimeTransport Protocol (RTP), Stream Control Transmission Protocol (SCTP), Congestion Control, QoS and Recent Developments, Virtualization, Network Functions Virtualization (NFV), Software DefinedNetworks.	
	APPLICATION LAYER	**(06 Hours)**
	Client Server Model, Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP) and Recent Developments.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
		(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3.	**Practicals**
1	Study network configuration commands and computer network setup.
2	Implementation of different Data Link and MAC Layer protocols.
3	Implementationof different Network Layer protocols.
4	Implementation of different Transport and Application Layer protocols.
5	Design and configure a network systems using modern network simulator softwares.
6	Implementation of Secured Socket Layer protocol.
7	Implementation of ICMP based message transmission over network.
8	Implementation of SMTP protocol for mail transfer.

4.	**Books Recommended**
1	William Stalling, "Data and Computer Communication", 10/E, Pearson India, 2017.
2	B. Forouzan, "Data Communication and Networking", 5/E, McGraw Hill, 2017.
3	Douglas E. Comer, "Internetworking with TCP/IP Volume – I", 6/E Pearson India, 2015.
4	Andrew S. Tanenbaum, "Computer Network", 5/E, Pearson India, 2013.
5	W. Richard Stevens, "TCP/IP Illustrated Volume - I", 2/E, Addison Wesley, 2011.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. Computer Science and Engineering

B.Tech. II (CSE) Semester – IV AUTOMATA AND FORMAL LANGUAGES CS206	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Acquire knowledge about AC circuits, electrical network basics, transforms, wave form representation.
CO2	Apply the fundamentals of electrical network basics to analyse different networks.
CO3	Analyse electrical network using different theorems and different wave forms.
CO4	Evaluate network performance using different parameters.
CO5	Design and analyse different types of systems using network principles and network theorems.

2.	Syllabus	
	INTRODUCTION	**(05 Hours)**
	Basic Mathematical Objects: Sets, Logic, Functions, Relations, Strings, Alphabets, Languages; Mathematical Induction: Inductive Proofs, Principles, Recursive Definitions, Set Notation.	
	FINITE AUTOMATA AND REGULAR EXPRESSION	**(12 Hours)**
	Finite State Systems, Deterministic Finite Automata; Nondeterministic Finite Automata, Nondeterministic Finite Automata with Epsilon, Applications, Kleene' Theorem; Two-way Finite Automata, Finite Automata with Output, Regular Languages & Regular Expressions, Properties of Regular Sets: The Pumping Lemma for Regular Sets, Closure Properties, Decision Properties of Regular Languages, Equivalence and Minimization of Automata, Moore and Mealy Machines.	
	CONTEXT FREE GRAMMARS	**(15 Hours)**
	Definition, Derivation Trees & Ambiguity, Inherent Ambiguity, Parse Tree, Application of CFG, Simplification of CFG, Normal Form of CFG, Chomsky Normal Form and Chomsky Hierarchy, Unrestricted Grammars, Context-Sensitive Languages, Relations between Classes of Languages, Properties of Context Free Languages: The Pumping Lemma, Closure Properties, Decision Propertiesof CFL.	
	PSHDOWN AUTOMATA	**(07 Hours)**
	Definitions, Languages of PDA, Equivalence of PDA and CFG , Deterministic PDA.	

	TURING MACHINES	**(06 Hours)**
	Turing Machine Model, Language of a Turing Machine (TM), Programming Techniques of the TM, Variations of TM, Multiple TM, One-Tape and Multi-Tape TM, Deterministic and Non-Deterministic TM, Universal TM, Churche Thesis, Recursively Enumerable Languages, Decidability, Reducibility, Intractable Problem Classes of Problems NP Hard, NP Complete.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Problem statements based on Regular Language and Finite Automata.
2	Questions based on Context Free Grammar.
3	Problems regarding Push Down Automata.
4	Solving Problems for Turing Machine.
5	Decidable and Undecidable Problems.

4.	**Books Recommended**
1	Michael Sipser, “Introduction to the Theory of Computation”,Cengage Learning, 3/E, 2013.
2	John C Martin, “Introduction to Languages & the Theory of Computation”, 3/E, Tata McGraw-Hill,2011.
3	John E. Hopcroft, Rajeev Motwani, Jeffrey Ullman, “Introduction to Automata theory, languages computation, 3/E, Pearson India, 2008.
4	Daniel I A Cohen, “Introduction to Computer Theory”, John Wiley & Sons, 2/E, Reprint 2008.
5	Andrew Ilachinski, “Cellular Automata”, 1st Ed., World Scientific, 2001.

ADDITIONAL REFERENCE BOOKS	
1	Sushil Kumar Azad, “Theory of Computation, An introduction to /automata, Formal Languages And Computability”, Dhanpat Ray & Co., New Delhi, 2005.
2	A.M. Natarajan, A. Tamilarasi, “Theory of computation”, New Age Publication, 1/E, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. Computer Science and Engineering

B.Tech. II (CSE) Semester – IV ARTIFICIAL INTELLIGENCE CS232	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Understand the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals
CO2	Apply various knowledge representation technique, searching techniques, constraint satisfaction problem and example problems- game playing techniques.
CO3	Analyse the current scope, potential, limitations, and implications of intelligent systems.
CO4	Evaluate the AI techniques suitable for recent areas of applications like expert systems, neural networks, fuzzy logic, robotics, natural language processing, and computer vision.
CO5	Create AI based solutions for complex engineering problems.

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Turing Test, Foundation and History of Artificial intelligence (AI), Possible Approaches in AI, Application Domains and Modern AI, Risk and benefits of AI. Intelligent Agents: Agent and Environment, Rationality, Rational Agent, Nature of Environment, PEAS, Structure of Agents, Complex Problems and AI, Problem Representation in AI.	
	PROBLEM SOLVING BY SEARCHNG	**(12 Hours)**
	Problem solving agents, Search algorithms, Uninformed Search, Breadth first search, uniform cost search, depth first search, depth limited and iterative deepening search, Informed (Heuristic) Search, greedy best first search, A* and its varients, Heuristic function, Search in complex environment Local Search and optimization problems, hill climbing search, simulated aneling, local beam search, Evolutionary algorithms, Genetic Algorithm, Local search in continuous space and nondeterministic actions, Constraint Satisfaction Problems, Constraint propagation	
	ADVERSARIAL SEARCH AND GAMES	**(04 Hours)**
	Game theory, game tree, optimal decision in games, Minimax search, multiplayer, alpha-Beta, Expectimax, Monte Carlo tree search, stochastic games	

	KNOWLEDGE REPRESENTION	**(04 Hours)**
	Logical agent, Knowledge based agent, representing simple facts in Logic, Propositional logic First order logic, Predicate Logic, Inference in first order logic, Forward & Backward Chaining, unification, Inferencing By Resolution Refutation	
	UNCERTAINTY KNOWLEDGE AND REASONING	**(08 Hours)**
	Quantifying Uncertainty, Basic Probability notation, Independence, Bayes Rule and its uses Probabilistic reasoning, Bayesian Network, Fuzzy Logic, Probabilistic reasoning over time, Hidden Markov models, Kalman filters, Making simple decision, Decisions Theory, Utility Function, Decision Network, Algorithms for Markov Decision Process, Multiagent decision making cooperative and non-cooperative game theory.	
	LEARNING AGENTS	**(05 Hours)**
	Learning Agent, Types of learning, Learning from experience: Reinforcement Learning (RL), Rewards, policy, Model based and Model free learning, Temporal difference learning (TD-Learning) and Q Learning, RL Applications, Learning from Example: Supervised learning Introduction, Perceptron, Introduction to Neural Network and Deep Learning	
	AI APPLICATIONS AND ETHICS	**(08 Hours)**
	Algorithms for Classing planning, Motion planning and navigation, Robot introduction, Steps in Robot Motion Planning, simultaneous localization and mapping (SLAM), Configuration space, Roadmap based and cell decomposition path planning, Probabilistic Roadmap, exploring random tree (RRT). Natural language understanding, Computer Vision, AI in Healthcare, Philosophy, Ethics and safety of AI, Advance topics in AI	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Introduction to Prolog programming
2	Types of agents and Problem Representation in AI
3	Searching in graph based problem space, exploring Uninformed search Techniques
4	Exploring Informed search Techniques (Vacuum world and Maze Problem)
5	Exploring Uninformed and Informed search Techniques (PACMAN Search Space)

6	Multi agent in a search space
7	Introduction Logical Agent and Knowledge representation using Prolog
8	Reasoning Under Uncertainty using Bayesian Learning
9	Reinforcement Learning using Q-Learning
10	Introduction to Machine Learning and Python libraries for Data Analysis (Pandas, NumPy, Matplotlib)

4.	**Books Recommended**
1	Stuart Russell, Peter Norvig, Artificial intelligence : A Modern Approach, Prentice Hall, Fourth edition, 2020.
2	Elaine Rich, Kevin Knight, Shivashankar B Nair Artificial Intelligence
3	Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan-Kaufmann, 1998.
4	Judea Pearl, Heuristics: Intelligent Search Strategies for Computer Problem Solving, Addison-Wesley Publishing Company, 1984.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. Computer Science and Engineering

B.Tech. II (CSE) Semester – IV INFORMATION SECURITY CS233	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Understand the concepts related to Information Security and Cryptography.
CO2	Apply the concept of security services and mechanisms from the application developers and network administrator's perspective.
CO3	Analyse the security schemes for their use in different application scenarios.
CO4	Evaluate and asses the computer and network systems for associated risks.
CO5	Design the security schemes depending on the organisation's requirements.

2.	Syllabus	
	INTRODUCTION	**(04 Hours)**
	Security Introduction, Characteristics of Information: Availability, Accuracy, Authenticity, Confidentiality, Integrity, Utility, Possession, CIA Traid, Reference Model of Information Assurance & Security (RMIAS), Components of an Information System: Software, Hardware, Data, People, Procedures, Networks, Securing Components, Balancing Information Security and Access, Approaches to Information Security Implementation.	
	NEED FOR SECURITY	**(04 Hours)**
	Business Needs: Protecting the Functionality, Enabling Safe Operation, Protecting Data, Safeguarding Technology Assets, Threats, Attacks: Malicious Code, Backdoors, Password Crack, Brute Force, Dictionary, DoS and DDoS, Spoofing, Man-in-the-Middle, Spamming, Sniffing, Social Engineering, Buffer Overflow, Timing Attack.	
	DIGITAL WATERMARKING AND STEGANOGRAPHY	**(04 Hours)**
	Properties of Watermarking: Embedding Effectiveness, Fidelity, Data Payload, Blind or Informed Detection, False Positive Rate, Robustness, Keys etc. Properties of Steganography: Embedding, Steganographic Capacity, Embedding Capacity, Embedding Efficiency, and Data Payload, Blind or Informed Extraction, Blind or Targeted Steganalysis, Statistical Undetectability, False Alarm Rate, Robustness, Security, Stego Key, Evaluating and Testing Steganographic Systems.	
	SECURITY RISK ASSESSMENT AND MITIGATION	**(04 Hours)**

	Vulnerability, Threat and Risk, Risk Assessment and Mitigation + Quick Fixes, Introduction to BCP / DRP / Incident Management, Segregation and Separation of Duties & Roles and Responsibilities, IT ACT 2000.	
	INTRODUCTION TO SYMMETRIC KEY CRYPTOGRAPHY AND PUBLIC KEY CRYPTOGRAPHY	**(06 Hours)**
	Traditional and Modern Symmetric Key Ciphers, Block Ciphers and Stream Cipher, Block Cipher Modes of Operations, Security Analysis, Public Key Characteristics, PKC Applications, Public Key Requirements, RSA, Diffie-Hellman Key Agreement Protocol, Security Analysis.	
	TYPES OF ASSESSMENTS FOR INFORMATION SECURITY	**(05 Hours)**
	VAPT of Networks, Web Appln Audits, IT Assessments or Audits, Assessment of Network Equipment, Assessment of Security Devices (Web Filtering, Firewalls, IDS / IPS, Routers, Data Centre Assessment, Security of Application Software, SAP Security, Desktop Security, RDBMS Security, BCP / DRP assessments, Policy Reviews, Network Security & Common and Popular Tools Used.	
	OPERATING SYSTEMS SECURITY	**(06 Hours)**
	Windows and Linux Security, Types of Audits in Windows Environment: Server Security, Active Directory (Group Policy), Anti-Virus, Mails, Malware, End Point Protection, Shadow Passwords, SUDO Users, UNIX File Access Control, Access Control Lists in UNIX, Windows Security: Access Control Scheme, Access Token, Security Descriptors, Operating Systems Hardening.	
	WEB APPLICATION SECURITY	**(06 Hours)**
	Web Application Security: Common Issues in Web Apps, Basic Web Security Model, Cross Side Scripting, SQL Injection, Password Vulnerabilities, Session Hijacking, Local and Remote File Inclusion, Audit Trails, HTTPS, OWASP Security Knowledge Framework, CAPTCHA, User Authentication and Session Management for Web Apps, The Security Architecture of Web Browsers.	
	CURRENT TRENDS IN INFORMATION SECURITY	**(06 Hours)**
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours=75 Hours)	

3.	**Books Recommended**
1	William Stallings, Cryptography and Network Security – Principles and Practice, 7th Edition, PearsonEducation, 2013.

2	Forouzan and Mukhopadhyay, Cryptography and Network Security, 3rd Edition, McGraw Hill, 2015.
3	Menezes Bernard, Network Security and Cryptography, 1st Edition, Cengage Learning India, 2010.
4	Douglas Stinson, Cryptography: Theory and Practice, 3rd Edition, CRC Press, 2006.
5	William Stallings, Network Security Essentials: Applications and Standards, 3rd Edition, PearsonEducation, 2009.

ADDITIONAL REFERENCE BOOKS	
1	Menezes, Oorschot and Vanstone, Handbook of Applied Cryptography, CRC Press, 1996.
2	Dhiren Patel, Information Security: Theory and Practice, PHI, 2008.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. Computer Science and Engineering

B.Tech. III (CSE) Semester – V OPERATING SYSTEMS CS301	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Understand the significance of operating system in computing devices, exemplify the communication between application programs and hardware devices through system calls.
CO2	Compare and illustrate various process scheduling algorithms.
CO3	Apply appropriate memory and file management schemes.
CO4	Illustrate various disk scheduling algorithms.
CO5	Design access control and protection based modules for an operating system.

2.	**Syllabus**	
	OPERATING SYSTEM OVERVIEW	**(03 Hours)**
	Operating System (OS) Objectives, Evolution, Types, Major Achievements, Modern Operating Systems, Virtual Machines, OS Design Considerations for Multiprocessor and Multicore.	
	PROCESSES AND THREADS	**(05 Hours)**
	Process Concept, Process States, Process Description, Process Control Block, PCB as a Data Structure in Contemporary Operating Systems, Process Hierarchy, Processes vs Threads, Types of Threads, Multicore and Multithreading, Case Study: Linux & Windows Process and Thread Management and its Related System Calls.	
	CONCURRENCY: MUTUAL EXCLUSION AND SYNCHRONIZATION	**(06 Hours)**
	Principles of Concurrency, Mutual Exclusion, Semaphores, Monitors, Message Passing, Readers/Writers Problem.	
	CONCURRENCY: DEADLOCK AND STARVATION	**(05 Hours)**
	Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Dining Philosopher's Problem, Case Study: Linux & Windows Concurrency Mechanism.	
	SCHEDULING	**(08 Hours)**

	Uniprocessor Scheduling: Long Term Scheduling, Medium Term Scheduling, Short Term Scheduling, Scheduling Algorithms: Short Term Scheduling Criteria, Use of Priorities, Alternative Scheduling Policies, Performance Comparison, Fair-Share Scheduling. Multiprocessor Scheduling: Granularity, Design Issue, Process Scheduling, Thread Scheduling, Real-Time Scheduling: Characteristics of RTOS, Real-Time Scheduling, Deadline Scheduling, Rate Monotonic Scheduling, Priority Inversion. Case Study: Linux & Windows Scheduling.	
	MEMORY MANAGEMENT	**(05 Hours)**
	Memory Hierarchy, Static and Dynamic Memory Allocation, Overview of Swapping, Multiple Partitions, Contiguous and Non-Contiguous Memory Allocation, Concepts of Simple Paging, SimpleSegmentation.	
	VIRTUAL MEMORY	**(05 Hours)**
	Virtual Memory Concepts, Paging and Segmentation using Virtual Memory, Protection and Sharing, Fetch Policy, Placement Policy, Replacement Policy, Resident Set Management, Cleaning Policy, Load Control, Case Study: Linux & Windows Memory Management.	
	I/O MANAGEMENT AND DISK SCHEDULING	**(04 Hours)**
	I/O Device, Organisation of the I/O Function, Operating System Design Issue, I/O Buffering, DiskScheduling, RAID, Disk Cache, Case Study: Linux & Windows I/O.	
	FILE MANAGEMENT	**(04 Hours)**
	Overview of : Files & File Systems, File Structure, File Management Systems, File Organisation and Access, B-tree, File Directories, File Sharing, Record Blocking, Secondary Storage Management, FileSystem Security, Case Study: Linux & Windows File System.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Introduction to Basic and Advance commands of Linux.
2	Introduction to Shell Script and programs based on it.
3	Practical based on different Memory management scheme.
4	Practical based on different Process scheduling algorithm.
5	Practical based on different Disk scheduling algorithm.

6	Process synchronization and deadlock.
7	Practical based on file management system.
8	Practical based on input output device management.

4.	**Books Recommended**
1	Silberschatz, Galvin and Gagne, "Operating System Concepts", 10/E, John Wiley & Sons, 2018.
2	W. Stallings, "Operating Systems: Internals and Design Principles", 9/E, Pearson Pub., 2017.
3	W Richard Stevens, Stephen A Rago, "Advanced Programming in the UNIX Environment"; 3/E,Addison Wesley Professional, 2013.
4	Kernighan & Pike, "UNIX programming Environment", 2/E, PHI-EEE, 2001.
5	A Tanenbaum, A Woodhull, "Operating Systems - Design and Implementation", 3/E, PHI EEE, 2006.

ADDITIONAL REFERENCE BOOKS	
1	Crawley, "Operating Systems - A Design Oriented Approach", 1/E, McGraw Hill, 1998.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. III (CSE) Semester – V MACHINE LEARNING CS331	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Acquire knowledge of pattern recognition, regression, classification, clustering algorithms and statistics.
CO2	Apply different classification, regression, machine learning algorithms and modelling.
CO3	Analyze the data patterns and modelling for applying the learning algorithms.
CO4	Evaluate the performance of an algorithm and comparison of different learning techniques.
CO5	Design solution for real life problems like biometric recognition, natural language processing and its related applications using various tools and techniques of machine learning.

2.	**Syllabus**	
	INTRODUCTION	**(09 Hours)**
	Pattern Representation, Concept of Pattern Recognition and Classification, Feature Extraction, Feature Selection, Basics of Probability, Bayes Decision Theory, Maximum-Likelihood and Bayesian Parameter Estimation, Error Probabilities, Learning of Patterns, Modelling, Regression, Discriminant Functions, Linear Discriminant Functions, Decision Surface, Learning Theory, Fisher Discriminant Analysis.	
	SUPERVISED LEARNING ALGORITHMS	**(10 Hours)**
	Linear Regression, Gradient Descent, Support Vector Machines, Artificial Neural, Networks, Decision Trees, ML and MAP Estimates, K-Nearest Neighbor, Naive Bayes, Bayesian Networks, Classification, Overfitting, Regularization, Multilayer Networks, Back-propagation, Bayes Classification, Nearest Neighbor Classification, Cross Validation and Attribute Selection, K Means Clustering, Agglomerative Hierarchical Clustering.	
	UNSUPERVISED LEARNING ALGORITHMS	**(10 Hours)**
	K-Means Clustering, Gaussian Mixture Models, Learning with Partially Observable Data, Expectation Maximization Approach. Dimensionality Reduction, Principal Component Analysis, Model Selection and Feature Selection.	

	TRANSFORM DOMAIN PATTERN ANALYSIS	**(06 Hours)**
	Signal Transformation, Frequency Domain Representation of Signal, Feature Extraction and Analysis, Multiresolution Representation, Wavelet Transform, Discrete Cosine Transform.	
	APPLICATIONS	**(10 Hours)**
	Signal Processing Application, Image Processing, Biometric Recognition, Face and Speech Recognition, Information Retrieval, Natural Language Processing.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time:45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Implement classification and regression techniques.
2	Implement clustering and statistical modeling methods.
3	Implement various dimensionality reduction techniques.
4	Implement neural networks and non-parametric techniques.
5	Implement mini-project based on machine learning approaches.

4.	**Book Recommended**
1	Geoff Dougherty, “Pattern Recognition and Classification: An Introduction”, 1st Edition, Springer, 2013.
2	Theodoridis and K.Koutroumbas, “Pattern Recognition”, 4th Ed., Academic Press, 2009.
3	Christopher M. Bishop, “Pattern Recognition and Machine Learning”, 1st Edition, Springer, 2006.
4	Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, 2nd Edition, Wiley, 2001.
5	K. Fukunaga, “Introduction to Statistical Pattern Recognition”, 2nd Edition, Academic Press, 2000.

ADDITIONAL REFERENCE BOOKS	
1	Ranjjan Shinghal, “Pattern Recognition Techniques and Application”, 1st Edition, Oxford university press, 2006.

B.Tech. III (CSE) Semester – V **PROFESSIONAL ETHICS, ECONOMICS AND BUSINESS MANAGEMENT** **MG210**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Develop knowledge regarding Professional ethics.
CO2	Develop knowledge of Economics in engineering.
CO3	Develop managerial skills to become future engineering managers.
CO4	Develop skills related to various functional areas of management (Marketing Management, Financial Management, Operations Management, Personnel Management etc.)
CO5	Build knowledge about modern management concepts.
CO6	Develop experiential learning through Assignments, Management games, Case study discussion, Group discussion, Group presentations etc.

2.	**Syllabus**	
	PROFESSIONAL ETHICS	**(06 Hours)**
	Introduction, Meaning of Ethics, Approaches to Ethics, Major attributes of Ethics, Business Ethics, Factors influencing Ethics, Importance of Ethics, Ethics in Management, Organizational Ethics, Ethical aspects in Marketing, Mass communication and Ethics - Television, Whistle blowing, Education – Ethics and New Professional, Intellectual Properties and Ethics, Introduction to Professional Ethics, Engineering Ethics.	
	ECONOMICS	**(09 Hours)**
	Introduction to Economics, Applications & Scopes Of Economics, Micro & Macro Economics, Demand Analysis, Demand Forecasting, Factors Of Production, Types Of Cost, Market Structures, Break Even Analysis.	
	MANAGEMENT	**(15 Hours)**
	Introduction to Management, Features Of Management, Nature Of Management, Development of Management Thoughts – Scientific Management By Taylor & Contribution of Henry Fayol, Coordination & Functions Of Management, Centralization & Decentralization, Decision Making; Fundamentals of Planning; Objectives & MBO; Types of Business Organizations: Private Sector,	

	Public Sector & Joint Sector; Organizational Behavior: Theories of Motivation, Theories of Leadership.	
	FUNCTIONAL MANAGEMENT	**(12 Hours)**
	Marketing Management: Core Concepts of Marketing, Marketing Mix (4p), Segmentation – Targeting – Positioning, Marketing Research, Marketing Information System, Concept of International Marketing, Difference Between Domestic Marketing & International Marketing; Operations Management: Introduction to Operations Management, Types of Operation Systems, Types of Layouts, Material Handling, Purchasing & Store System, Inventory Management; Personnel Management: Roles & Functions of Personnel Manager, Recruitment, Selection, Training; Financial Management: Goal of Financial Management, Key Activities In Financial Management, Organization of Financial Management, Financial Institutions, Financial Instruments, Sources of Finance.	
	MODERN MANAGEMENT ASPECTS	**(03 Hours)**
	Introduction to ERP, e – CRM, SCM, RE – Engineering, WTO, IPR etc	
	Tutorial: Case Study Discussion, Group Discussion, Management games and Assignments / Mini projects & presentation on related Topics.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Case Study Discussion
2	Group Discussion
3	Management games
4	Assignments / Mini projects & presentation on related Topics

4.	**Books Recommended**
1	Balachandran V. and Chandrasekaran, Corporate Governance, Ethics and Social Responsibility, PHI, 2nd Edition, 2011.
2	Prasad L.M., Principles & Practice of Management, Sultan Chand & Sons, 8th Edition, 2015.
3	Banga T. R. & Sharma S.C., Industrial Organisation & Engineering Economics, Khanna Publishers, 25th Edition, 2015.
4	Everett E. Adam, Ronald J. Ebert, Production and Operations Management, Prentice Hall of India, 5th edition, 2012.

5	Kotler P., Keller K. L, Koshi A.& Jha M., Marketing Management – A South Asian Perspective, Pearson, 14th Edition, 2014.
6	Tripathi P.C., Personnel Management & Industrial Relations, Sultan Chand & sons, 21st Edition, 2013.
7	Chandra P., Financial Management, Tata McGraw Hill, 9th Edition, 2015.

ADDITIONAL REFERENCE BOOKS	
1	Crane A. & Matten D., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Oxford University, 2010.
2	Fritzsche D. J., Business Ethics: a Global and Managerial Perspectives, McGraw Hill Irwin, Singapore, 2004.
3	Mandal S. K., Ethics in Business and Corporate Governance, Tata McGraw Hill, 2011.

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B.Tech. III (CSE) Semester – VI SYSTEM SOFTWARE CS302	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Understand systems software components, finite automata, regular expression and context free grammar.
CO2	Apply the knowledge of assembler and macro processors to convert assembly language into machine code.
CO3	Analyze working phases of Compiler, various parsing techniques, semantic analysis, Error handling, code generation and code optimization techniques to undertake meaningful language translation.
CO4	Evaluate Linkers, Loaders, interpreters and debugging methods to manages system memory and provide a portable runtime environment.
CO5	Create a language translator application and mimic a simple compiler.

2.	**Syllabus**	
	INTRODUCTION	**(05 Hours)**
	Introduction to System Software, Utility Software, Systems Programming, Recent Trends in Software Development, Programming Languages and Language Processors, Data Structures for Language Processing.	
	ASSEMBLERS	**(06 Hours)**
	Overview of the Assembly Process, Cross Assembler, Micro Assembler, Meta Assembler, Single Pass Assembler, Two Pass Assembler, Design of Operation Code Table, Symbol Table, Literal Table, Advanced Assembly Process .	
	MACRO PROCESSORS	**(06 Hours)**
	Introduction of Macros, Macro Processor Design, Forward Reference, Backward Reference, Positional Parameters, Keyword Parameters, Conditional Assembly, Macro Calls within Macros, Implementation of Macros Within Assembler. Designing Macro Name Table, Macro Definition Table, Kew Word Parameter Table, Actual Parameter Table, Expansion Time Variable Storage.	
	COMPILERS	**(16 Hours)**

	Phases of Compiler, Analysis-Synthesis Model of Compilation, Interface with Input, Parser and Symbol Table, Token, Lexeme, Patterns and Error Reporting in Lexical Analysis, Programming Language Grammars, Classification of Grammar, Ambiguity in Grammatical Specification, Top Down Parsing, Recursive Descent Parsing, Transformation on The Grammars, Predictive Parsing, Bottom Up Parsing, Operator Precedence Parsing, LR Parsers, Language Processor Development Tools – LEX & YACC, Semantic Gap, Binding and Binding Times, Memory Allocation, Compilation of Expression, Intermediate Representations, Basic Code Optimization.	
	LINKERS AND LOADERS	**(06 Hours)**
	Design of a Linker, Program Relocation, Linking of Overlay Structured Programs, Dynamic Linking, General Loader Schemes, Absolute Loader, Relocating Loader, Dynamic Loader, Bootstrap Loader, Linking Loader, other Loading Schemes, Linkers v/s Loaders.	
	INTERPRETERS & DEBUGGERS	**(06 Hours)**
	Overview of Interpretation and Debugging Process, Types of Errors, Classification of Debuggers, Dynamic/Interactive Debugger, The Java Language Environment, Java Virtual Machine and Recent Developments.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Study, install and setup various system software tools.
2	Implementation of single pass and two pass assembler.
3	Design and implement scanner using lexical analyzer (LEX) tool.
4	Design and implement parser using YACC tools.
5	Design and configure a compiler application using modern tools and softwares.
6	Implementation of different stages of compiler.
7	Implementation of interpreter and debugger.
8	Implementation of optimization based compiler design.

4.	Books Recommended
1	D. M. Dhamdhere, "Systems Programming", 1/E, McGraw Hill, 2011.
2	Leland L. Beck, "System Software - An Introduction to System Programming", 3/E, Pearson Education, 2002.
3	John Donovan, “Systems programming”, 1/E, McGraw Hill, 2017.
4	Santanu Chattopadhyay, “System Software” 1/E, Prentice-Hall India, 2007.
5	A. V. Aho, R. Sethi & J D. Ullman, "Compilers-Principles, Techniques and Tools", 2/E, Pearson India, 2013.

ADDITIONAL REFERENCE BOOKS	
1	Allen. Holub, "Compiler Design in C", 1/E, Pearson India, 2015.
2	Ronald Mak, “Writing Compilers and Interpreters: A Software Engineering Approach”, 3/E, Wiley, 2009.

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B.Tech. III (CSE) Semester – IV DISTRIBUTED COMPUTING CS332	Scheme	L	T	P	Credit
		3	1	0	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Understand the concepts of distributed System and design and implementation issues.
CO2	Define key mechanism for designing distributed algorithms for different primitives like mutualexclusion, deadlock detection, agreement etc.
CO3	Analyze different types of faults and fault handling techniques in order to implement faulttolerant systems.
CO4	Correlate different election algorithm, file system, time synchronization and naming services.
CO5	Design and develop distributed programs subject for specific design and performance constraints.

2.	**Syllabus**	
	INTRODUCTION TO DISTRIBUTED SYSTEMS	**(06 Hours)**
	Review of Networking Protocols, Point to Point Communication, Operating Systems, Concurrent Programming, Characteristics and Properties of Distributed Systems, Goals of Distributed Systems,Multiprocessor and Multicomputer Systems, Distributed Operating Systems, Network Operating Systems, Middleware Concept, The Client-Server Model, Design Approaches-Kernel Based-Virtual Machine Based, Application Layering.	
	COMMUNICATIONIN DISTRIBUTED SYSTEMS	**(04 Hours)**
	Layered Protocols, Message Passing-Remote Procedure Calls-Remote Object Invocation, Message Oriented Communication, Stream Oriented Communication, Case Studies.	
	PROCESS MANAGEMENT	**(05 Hours)**
	Concept of Threads, Process, Processor Allocation, Process Migration and Related Issues, SoftwareAgents, Scheduling in Distributed System, Load Balancing and Sharing Approaches, Fault Tolerance, Real Time Distributed System.	
	SYNCHRONIZATION	**(06 Hours)**

	Clock Synchronization, Logical Clocks, Global State, Election Algorithms-The Bully algorithm-A Ring algorithm, Mutual Exclusion-A Centralized Algorithm-A Distributed Algorithm-A token ring Algorithm, Distributed Transactions.	
	CONSISTENCY AND REPLICATION	**(06 Hours)**
	Introduction to Replication, Object Replication, Replication as Scaling Technique, Data Centric Consistency Models-Strict-Linearizability and Sequential-Causal-FIFO-Weak-release-Entry, Client Centric Consistency Models-Eventual Consistency-Monotonic Reads and Writes-Read your Writes- Writes Follow Reads, Implementation Issues, Distribution Protocols-Replica Placement-UpdatePropogation-Epidemic Protocols, Consistency Protocols.	
	FAULT TOLERANCE	**(04 Hours)**
	Introduction, Failure Models, Failure Masking, Process Resilience, Agreem in Faulty Systems, Reliable Client Server communication, Group communication, Distributed Commit, Recovery.	
	DISTRIBUTED OBJECT BASED SYSTEMS	**(06 Hours)**
	Introduction to Distributed Objects, Compile Time Vs Run Time Objects, Persistent and Transient Objects, Enterprise JAVA Beans, Stateful and Stateless Sessions, Global Distributed Shared Objects,Object Servers, Object Adaptors, Implementation of Object References, Static And Dynamic Remote Method Invocations, Replica Framework.	
	DISTRIBUTED FILE SYSTEMS	**(04 Hours)**
	Introduction, Architecture, Mechanisms for Building Distributed File Systems-Mounting-Caching- Hints-Bulk Data Transfer-Encryption, Design Issues-Naming and Name Resolution-Caches on Disk or Main Memory-Writing Policy-Cache consistency-Availability-Scalability-Semantics, Case Studies,Log Structured File Systems.	
	DISTRIBUTED WEB BASED SYSTEMS	**(04 Hours)**
	Architecture, Processes, Communication, Naming, Synchronization, Web Proxy Caching, Replication of Web Hosting Systems, Replication of Web Applications.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Implementation of concepts of communication protocols using UDP and TCP IP.
2	Implement the remote procedure call with an application.

3	Implementation of object based system using RMI or CORBA.
4	Implementation of distributed system for file sharing and message passing.
5	Implementation of Socket programming.
6	Implementation of distributed client-server application.
7	Implementation of client-server application with scheduling in distributed environment.
8	Implementation of distributed load balancing and resource sharing.

4.	**Books Recommended**
1	Andrew S Tanenbaum, "Distributed systems: Principles and Paradigms", Second Edition, Pearson Education. Inc 2007.
2	Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems", TMH, McGraw-Hill, Inc. New York, USA 1994.
3	Pradeep K. Sinha, "Distributed Operating System: Concept and design", PHI, New Delhi 2019.
4	W Richard Stevens, "Unix Network Programming: Vol 1, Networking APIS: Sockets & XTI", Second Edition E, Pearson Education, 1998.
5	Colouris, Dollimore, Kindberg, "Distributed Systems Concepts & Design", Fourth Edition, Pearson Ed. 2005.

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B.Tech. III (CSE) Semester – VI INNOVATION, INCUBATION AND ENTREPRENEURSHIP MG110	Scheme	L	T	P	Credit
		3	1	0	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Explain the concepts of entrepreneurship.
CO2	Develop skills related to various functional areas of management (Marketing Management, Financial Management, Operations Management, Personnel Management etc.).
CO3	Develop skills related to Project Planning and Business Plan development.
CO4	Demonstrate the concept of Innovation, Intellectual Property Rights (IPR) and Technology Business incubation.
CO5	Build knowledge about Sources of Information and Support for Entrepreneurship.
CO6	Develop experiential learning through Assignments, Management games, Case study discussion, Group discussion, Group presentations etc.

2.	**Syllabus**	
	CONCEPTS OF ENTREPRENEURSHIP	**(08 Hours)**
	Scope of Entrepreneurship, Definitions of Entrepreneurship and Entrepreneur, Entrepreneural Traits, Characteristics and Skills, Entrepreneurial Development models and Theories, Entrepreneurs Vs Managers, Classification of Entrepreneurs; Major types of Entrepreneurship – Techno Entrepreneurship, Women Entrepreneurship, Social Entrepreneurship, Intrapreneurship (Corporate entrepreneurship), Rural Entrepreneurship, Family Business etc.; Problems for Small Scale Enterprises and Industrial Sickness; Entrepreneurial Environment – Political, Legal, Technological, Natural, Economic, Socio – Cultural etc.	
	FUNCTIONAL MANAGEMENT AREA IN ENTREPRENEURSHIP	**(15 Hours)**
	Marketing Management: Basic concepts of Marketing, Development of Marketing Strategy and Marketing plan. Operations Management: Basic concepts of Operations management, Location problem, Development of Operations strategy, and plan. Personnel Management: Main operative functions of a Personnel Manager, Development of H R strategy and plan. Financial Management: Basics of Financial Management, Ratio Analysis, Investment Decisions, Capital Budgeting and Risk Analysis, Cash Flow Statement, Break Even Analysis.	
	PROJECT PLANNING	**(09 Hours)**

	Search for Business Idea, Product Innovations, New Product Development – Stages in Product Development; Sequential stages of Project Formulation; Feasibility analysis – Technical, Market, Economic, Financial etc.; Project report; Project appraisal; Setting up an Industrial unit – procedure and formalities in setting up an Industrial unit; Business Plan Development.	
	PROTECTION OF INNOVATION THROUGH IPR	**(02 Hours)**
	Introduction to Intellectual Property Rights – IPR, Patents, Trademarks, Copy Rights.	
	INNOVATION AND INCUBATION	**(07 Hours)**
	Innovation and Entrepreneurship, Creativity, Green Technology Innovations, Grassroots Innovations, Issues and Challenges in Commercialization of Technology Innovations, Introductionto Technology Business Incubations, Process of Technology Business Incubation.	
	SOURCES OF INFORMATION AND SUPPORT FOR ENTREPRENEURSHIP	**(04 Hours)**
	State level Institutions, Central Level institutions and other agencies.	
	Tutorial: Case Study Discussion, Group Discussion, Management games and Assignments / Mini projects & presentation on related Topics	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Case Study Discussion
2	Group Discussion
3	Management games
4	Assignments / Mini projects & presentation on related Topics

4.	**Books Recommended**
1	Desai Vasant, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House, India, 6th Revised Edition, 2020.
2	Charantimath P. M., “Entrepreneurial Development and Small Business Enterprises”, Pearson Education, 3rd Edition, 2018.
3	Holt David H., “Entrepreneurship: New Venture Creation”, Pearson Education, 2016.
4	Chandra P., “Projects: Planning, Analysis, Selection, Financing, Implementation and Review”, TataMcGraw Hill, 9th Edition, 2019.

5	Banga T. R. & Shrama S.C., "Industrial Organisation& Engineering Economics", Khanna Publishers, 25th Edition, 2015.

ADDITIONAL REFERENCE BOOKS	
1	Prasad L. M., "Principles & Practice of Management", Sultan Chand & Sons, 8th Edition,2015.
2	Everett E. Adam, Ronald J. Ebert, "Production and Operations Management", Prentice Hall of India, 5th edition, 2012.
3	Kotler P., Keller K. L, Koshi A.& Jha M., "Marketing Management – A South Asian Perspective", Pearson, 14th Edition, 2014.
4	Tripathi P.C., "Personnel Management & Industrial Relations", Sultan Chand & sons, 21st Edition, 2013.
5	Chandra P., "Financial Management", Tata McGraw Hill, 9th Edition, 2015.

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B.Tech. IV (CSE) Semester – VII CYBER PHYSICAL SYSTEMS CS431	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Understand principles of design and implementation of cyber physical systems.
CO2	Apply the cyber physical systems design principles, modelling and associated tools in different application areas and simulate models of physical and cyber components.
CO3	Analyze cyber physical system with different models.
CO4	Evaluate cyber physical systems with respect to computational resources and other parameters to control physical processes
CO5	Design the cyber physical system using different concepts of sensors, operating system, memory interface,and communication interface.

2.	**Syllabus**	
	INTRODUCTION	**(06 Hours)**
	Introduction to Cyber Physical System, Motivating examples, Design Process of Cyber Physical System	
	MODELLING DYNAMIC BEHAVIOUR	**(10 Hours)**
	Continuous Dynamics - Newtonian Mechanics, Actor Models, Properties Of Systems, Feedback Control, Discrete Dynamics - Discrete Systems, The Notion Of Finite-State Machines, Extended State Machines, Nondeterminism, Behaviors And Traces, Hybrid Systems - Modal Models, Categories, State Machines, Concurrent Models And Computations	
	DESIGN OF EMBEDDED SYSTEMS	**(10 Hours)**
	Sensors, Actuators, Embedded Processors, Memory Architectures, Input-Output, Multitasking, Scheduling	
	ANALYSIS AND VERFIFICATION OF CYBER PHYSICAL SYSTEMS	**(08 Hours)**
	Invariants and temporal logic, equivalence and refinement, reachability analysis and model checking, quantitative analysis	
	SECURITY AND PRIVACY IN CYBER PHYSICAL SYSTEMS	**(06 Hours)**
	Cryptographic Primitives, Security Vulnerability and Attacks on Cyber Physical Systems, Security Protocols, Network Security, Software Security, Information Flow, Privacy Risk Analysis and Mitigation	
	CASE STUDIES AND ADVANCED TOPICS	**(06 Hours)**

	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	R. Rajkumar, D. de. Niz and M. Klein, Cyber Physical Systems, Addision-Wesely, 2017.
2	E.A.Lee and S A Shesia, Embedded system Design: A Cyber-Physical Approach, Second Edition, Second Edition, MIT Press, 2017.
3	A.Platzer, Logical Foundations of Cyber Physical Systems, Springer, 2017.
4	Rajeev Alur , Principles of Cyber-Physical Systems, The MIT Press, 2023.
5	Walid M. Taha , Abd-Elhamid M. Taha , Johan Thunberg, Cyber-Physical Systems: A Model-Based Approach, Springer, 2021.

B.Tech. III/IV (CSE) CYBER LAWS AND FORENSICS TOOLS CS451 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Understand the basics of cyber law and cyber forensics with respect to Indian IT Act.
CO2	Apply knowledge of cyber law to provide solutions to cyber security.
CO3	Analyze various computer forensics technologies and systems.
CO4	Evaluate and assess the methods for data recovery and digital evidence collection.
CO5	Give solutions to real life problems using state of the art cyber forensics tools and techniques.

2.	Syllabus	
	INTRODUCTION	**(09 Hours)**
	Cyber Security and its Problem-Intervention Strategies: Redundancy, Diversity and Autarchy, Cyber-Crime and The Legal Landscape Around the World, Why Do We Need Cyber Laws, Cyber Forensics Fundamentals, Benefits of Forensics, Cyber Forensics Evidence and Courts, Legal Concerns and Private Issues.	
	CYBER LAWS -1	**(08 Hours)**
	The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of NotAddressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Cybercrime and Punishment, Cyber Law, Technology and Students: Indian Scenario.	
	CYBER LAWS -2	**(08 Hours)**
	Private Ordering Solutions, Regulation and Jurisdiction For Global Cyber Security, Copyright Source of Risks, Pirates, Internet Infringement, Fair Use, Postings, Criminal Liability, First Amendments, Data Losing, Cyber Ethics - Legal Developments, Cyber Security in Society, Security in Cyber Laws Case Studies, General Law and Cyber Law-A Swift Analysis.	
	CYBER FORENSICS -1	**(10 Hours)**
	Cyber Investigation - Procedure for Corporate High-Tech Investigations, Understanding Data Recovery Workstation and Software, Conducting and Investigations, Data Acquisition - Understanding Storage Formats and Digital Evidence, Determining the Best Acquisition Method, Acquisition Tools, Validating Data Acquisitions, Performing RAID Data Acquisitions,	

	Remote Network Acquisition Tools, Other Forensics Acquisitions Tools.	
	CYBER FORENSICS -2	**(10 Hours)**
	Current Cyber Forensics Tools- Software and Hardware Tools, Validating and Testing Forensic Software, Addressing Data-Hiding Techniques, Performing Remote Acquisitions, E-Mail Investigations- Investigating Email Crime and Violations, Understanding E-Mail Servers, SpecializedE-Mail Forensics Tool.	
	Practicals will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Introduction to various software tools related to cyber law and cyber forensics.
2	Practical based on disk forensics.
3	Practical based on network forensics.
4	Practical based on device forensics.
5	Practical based on email security.
6	Practical using forensic tools for image and video fraud.
7	Practical using on e-commerce related cyber-attacks.
8	Practical based on social network and online transactions related cyber threats.

4.	**Books Recommended**
1	Sunit Belapure and Nina Godbole, Cyber “Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, 1st Edition, Wiley India Pvt. Ltd, 2011.
2	Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, 1st Edition, Cambridge University Press, 2006.
3	Jonathan Rosenoer, “Cyber Law: The law of the Internet”, 1st Edition, Springer-Verlag, 1997.
4	Warren G. Kruse II and Jay G. Heiser, “Computer Forensics: Incident Response Essentials”, 1st Edition, Addison Wesley, 2002.
5	B. Nelson, A. Phillips, F. Enfinger, C. Stuart, “Guide to Computer Forensics and Investigations, 2nd Edition, Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

B.Tech. III/IV (CSE) **SOFTWARE ENGINEERING** **CS351** **(Elective)**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Understand various phases of software development lifecycle.
CO2	Apply appropriate software modelling and testing techniques for the given application scenario.
CO3	Analyze various tools and techniques used in software development lifecycle.
CO4	Evaluate the software for quality and risk factors.
CO5	Design and develop software systems using appropriate software processes.

2.	**Syllabus**	
	INTRODUCTION	**(02 Hours)**
	Software Process - Software Development Life Cycle – Software Qualities - Problems with Software Production – Brooke's No Silver Bullet.	
	SOFTWARE LIFE-CYCLE MODELS	**(05 Hours)**
	Build-and-Fix, Waterfall, Rapid Prototyping, Incremental, Spiral, Agile, Comparison, ISO 9000 – CMM levels, Comparing ISO 9000 and CMM.	
	SOFTWARE REQUIREMENTS AND ANALYSIS	**(08 Hours)**
	Techniques, Feasibility Analysis, Requirements Elicitation, Validation, Rapid Prototyping, OO Paradigms vs. Structured Paradigm, OO Analysis (Modules, Object, Cohesion, Coupling, Objects and Reuse), CASE tools.	
	SOFTWARE SPECIFICATIONS	**(12 Hours)**
	Specification Document, Specification Qualities, Uses, Classification, Operational Behavioural, DFD, Overview of UML Diagrams, Finite State Machines, Petri nets, Descriptive Specifications, ER Diagrams, Logic, Algebraic Specs, Comparison of Various Techniques and CASE Tools.	
	FORMAL METHODS IN SOFTWARE ENGINEERING	**(06 Hours)**

	Formal Specifications, Software Verification & Validation, Clean Room Engineering, Formal Approaches, Model Checking, SPIN Tool for Distributed Software.	
	CASE TOOLS, ISO AND CAPABILITY MATURITY MODEL	**(04 Hours)**
	CASE Tools, Stepwise Refinement, Cost-Benefit Analysis, Scope of CASE, Versions Control, Current State of the Art in Software Engineering.	
	SOFTWARE TESTING PRINCIPLES	**(06 Hours)**
	Non-execution & Execution based Testing, Automated Static Analysis, Test-Case Selection, Black-Box and Glass-Box Testing, Testing Objects, Testing vs. Correctness Proof.	
	ADVANCED TOPICS	**(02 Hours)**
	Practicals will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	Rajib Mall: "Fundamentals of Software Engineering", 4/E, PHI Learning, 2015.
2	Sommerville: "Software Engineering", 9/E, Pearson Education, 2010.
3	Stephen R. Schach: "Object Oriented and Classical Software Engineering", McGraw-Hill 8/E, 2010.
4	Roger S. Pressman: "Software Engineering – A Practitioner's Approach", McGraw-Hill 7/E, 2010.
5	Pankaj Jalote: "An Integrated approach to Software Engineering", Narosa, 3/E, 2005.

ADDITIONAL REFERENCE BOOKS	
1	Ghezzi, Jazayeri, Mandrioli: "Fundamentals of Software Engineering", 2/E, Pearson Education, 2002.
2	Stephen R. Schach: "Software Engineering with JAVA", TMH, 1999.

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B.Tech. III/IV (CSE) FOUNDATIONS OF CRYPTOGRAPHY CS352 (Elective)	Scheme	L	T	P	Credit
		3	1	0	04

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Understand formal security definitions, security assumptions, security proofs and number theoretic principles of modern cryptosystems.
CO2	Demonstrate familiarity with modern day cryptosystems and prove its security strengths with respect to the state of the art cryptanalytic attacks.
CO3	Analyse the security strengths of newer cryptosystems.
CO4	Evaluate the security strengths with respect to various parameters
CO5	Design a secure cryptosystem as per the requirement of an organization.

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Classical Cryptography and Modern Cryptography, Principles of Modern Cryptography, formal Definitions, Precise Assumptions, Proofs of Security, Provable Security and Real World Security	
	PERFECTLY SECRET ENCRYPTION	**(04 Hours)**
	Formal Definitions, Shannon's Theory, one-Time Pad, Limitations of Perfect Secrecy.	
	PRIVATE-KEY ENCRYPTION	**(06 Hours)**
	Defining Computationally Secure Encryption, Semantic Security, Constructing Secure Encryption Schemes-Pseudorandom Generators and Stream Ciphers, Proofs by Reduction, Cryptanalytic Attacks-Chosen-Plaintext Attacks and CPA-Security, Constructing CPA-Secure Encryption Schemes, Pseudorandom Functions and Block Ciphers, Cpa-Secure Encryption From Pseudorandom Functions, Chosen-Ciphertext Attacks- Defining CCA-Security	
	HASH FUNCTIONS AND APPLICATIONS	**(04 Hours)**
	Hash Functions-one-Wayness and Collision Resistance, Merkle–Damgard Construction, Attacks on Hash Functions-Birthday Attacks, Random-oracle Model, Merkle Trees.	
	MESSAGE AUTHENTICATION CODES	**(04 Hours)**

	Message Authentication Codes – formal Definitions, Design, and Proof of Security, HMAC, CBC-MAC, Authenticated Encryption, information-Theoretic Macs, Limitations on information-Theoretic Macs	
	ALGORITHMS FOR FACTORING AND COMPUTING DISCRETE LOGARITHMS	**(06 Hours)**
	Algorithms for Factoring-Pollard's P − 1 Algorithm, Pollard's Rho Algorithm , Quadratic Sieve Algorithm, Algorithms for Computing Discrete Logarithms- Pohlig–Hellman Algorithm, BabyStep/Giant-Step Algorithm, Discrete Logarithms From Collisions, index Calculus Algorithm.	
	PUBLIC-KEY ENCRYPTION	**(06 Hours)**
	RSA Encryption, Security Against Chosen-Plaintext Attacks, Security Against ChosenCiphertext Attacks, RSA Implementation Issues and Pitfalls, Computational DiffieHellman/Decisional Diffie-Hellman Based Encryption, Elliptic Curve Cryptography-Elliptic Curve Over Finite Fields and Binary Fields, Point Addition Operation, Elliptic Curve Discrete Logarithm Problem, Cryptosystems Based on Elliptic Curve.	
	ADVANCED TOPICS	**(08 Hours)**
	Zero-Knowledge Proofs, Secret Sharing Schemes, Lattices and Cryptography	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Books Recommended**
1	Katz & Lindell, introduction to Modern Cryptography: Principles and Protocols, Second Edition, Publisher: Chapman & Hall/CRC, 2014.
2	Douglas R. Stinson, Cryptography: Theory and Practice, Third Edition, Publisher: Chapman and Hall/CRC, 2005.
3	Goldreich, Foundations of Cryptography, Cambridge University Press, 2005 (Volume 1 and 2).
4	William Stallings, "Cryptography and network security: principles and practice", 7th Edition, Upper Saddle River: Pearson, 2017.
5	Forouzan and Mukhopadhyay, "Cryptography and Network Security", 3/E, McGraw Hill, 2015.

ADDITIONAL REFERENCE BOOKS

1	Schneier, Bruce, “Applied cryptography: protocols, algorithms, and source code in C”, 2nd Edition, john wiley & sons, 2007.

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B.Tech. III/IV (CSE) **UNMANNED AERIAL VEHICLE TECHNOLOGY** **CS353** **(Elective)**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	understand various components of Unmanned Aerial Vehicle.
CO2	apply appropriate software tool for the given application scenario.
CO3	analyze various techniques and implementation steps required used in Unmanned Aerial Vehicle technology development.
CO4	evaluate the model for quality and risk factors.
CO5	design and develop hardware/software systems for the given problem.

2.	**Syllabus**	
	INTRODUCTION TO UNMANNED AERIAL VEHICLES SYSTEMS	**(06 Hours)**
	History of UAV, Classification, Introduction to Unmanned Aircraft Systems, System Composition, Basics of UAV Aerodynamics Applications of UAVs - Military and Civilian Use, Overview of UAV Systems: Air vehicle, Mission Planning and Control Station, Launch and Recovery Equipment, Payloads, Data Links, Ground Support Equipment, Introduction to Multi-Rotor UAVs.	
	UAS SUB-SYSTEMS AND MISSION PLANNING	**(07 Hours)**
	Introduction to Navigation, Guidance and Control of UAV, Sensors and Controllers, Guidance of UAVs; Controls of UAVs. Path planning algorithms: Dubin's curves, way-points. Path Following and Guidance: Straight Line and curve Following, Vision based Guidance, Studying Area Maps, Geometry of Vertical Image, Designing a Flight Route.	
	INTRODUCTION TO UAV HARDWARE AND SOFTWARES	**(10 Hours)**
	Programming of UAV, Simulation Frameworks like Gazebo, VR/AR and Speech Interfaces, ROS Software Stacks, Hardware for Sensor and Actuator Systems, 3D Design and Prototyping for UAVs, and Game Engine Programming.	
	IMAGE PROCESSING	**(10 Hours)**
	Elements and representation of Digital Image, Processing systems, Sampling and Quantization; Image Segmentation, Morphological Image Processing, Feature selection,	

	Pattern Matching, Image Visualization, Software for Image Processing and Visualization.	
	EXPLORING UAVS WITH THE RASPBERRY Pi	**(10 Hours)**
	Basic functionality of the Raspberry Pi board and its Processor, setting and configuring the board, differentiating Raspberry Pi from other platform like Arduino, Communication facilities on Raspberry Pi (I2C, SPI, UART), working with RPil. GPIO library, Interfacing of Sensors and Actuators. Communication Using Raspberry PI: Wired and Wireless communication, TCP /IP configurations, SSH, Putty Terminal usage. Robotic Motion PI: Motors, Motor Drivers, Motor Shields, ADC, DAC and PWM, Camera Interfacing, remote data logging.	
	DGCA REGULATIONS	**(02 Hours)**
	Classification, Basic Air Regulations, Salient Points, Do's and Don'ts, No Drone Zones, Operations/Procedural Requirements.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Study of UAV hardware components with its usage for different situations.
2	Study of UAV software and usage.
3	Designing of UAV flight using software and experience the flight.
4	Identification of UAV data sources and its analysis.
5	Experiment with the raspberry pi for simulation of different situations.

4.	**Books Recommended**
1	Richard K. Barnhart, Stephen B. Hottman, Douglas M. Marshall, Eric Shappee, "Introduction to Unmanned Aircraft Systems", CRC Press, 2012.
2	Randal W. Beard and Timothy W. McLain: Small Unmanned Aircraft: Theory and Practice, Princeton University Press, 2012.
3	Jay Gundlach, Designing Unmanned Aircraft Systems: A Comprehensive Approach, AIAA Education Series, 2012.
4	Reg Austin, Unmanned Aircraft Systems: UAVS Design, Development and Deployment, Wiley, 2012.
5	Wolf, P., DeWitt, B., and Wilkinson, B. 2014. Elements of Photogrammetry with Applications in GIS, 4th edition. McGraw-Hill.

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B.Tech. II (CSE) DATA STRUCTURES AND ALGORITHMS CS254 (for Minor)	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Recognize the need of different data structures and understand its characteristics.
CO2	Apply different data structures for given problems.
CO3	Design and analyse different data structures, sorting and searching techniques.
CO4	Evaluate data structure operations theoretically and experimentally.
CO5	Give solution for complex engineering problems.

2.	**Syllabus**	
	INTRODUCTION TO DATA STRUCTURES	**(02 Hours)**
	Review of Concepts: Information and Meaning, Abstract Data Types, Internal Representation of Primitive Data Structures, Arrays, Strings, Structures, Pointers.	
	LINEAR LISTS	**(06 Hours)**
	Sequential and Linked Representations of Linear Lists, Comparison of Insertion, Deletion and Search Operations for Sequential and Linked Lists, Doubly Linked Lists, Circular Lists, Lists in Standard Template Library(STL), Applications Of Lists.	
	STACKS	**(06 Hours)**
	Sequential and Linked Implementations, Representative Applications such as Recursion, Expression Evaluation Viz., Infix, Prefix and Postfix, Parenthesis Matching, Towers of Hanoi, Wire Routing in a Circuit, Finding Path in a Maze.	
	QUEUES	**(06 Hours)**
	Operations of Queues, Circular Queue, Priority Queue, Dequeue, Applications of Queues, Simulation of Time Sharing Operating Systems, Continuous Network Monitoring System Etc.	
	SORTING AND SEARCHING	**(06 Hours)**

	Sorting Methods, Bubble Sort, Selection Sort, Quick Sort, Radix Sort, Bucket Sort, Dictionaries, Hashing, Analysis of Collision Resolution Techniques, Searching Methods, Linear Search, Binary Search, Character Strings and Different String Operations.	
	TREES	**(08 Hours)**
	Binary Trees and Their Properties, Terminology, Sequential and Linked Implementations, Tree Traversal Methods and Algorithms, Complete Binary Trees, General Trees, AVL Trees, Threaded Trees, Arithmetic Expression Evaluation, Infix-Prefix-Postfix Notation Conversion, Heaps as Priority Queues, Heap Implementation, Insertion and Deletion Operations, Heapsort, Heaps in Huffman Coding, Tournament Trees, Bin Packing.	
	MULTIWAY TREES	**(04 Hours)**
	Issues in Large Dictionaries, M-Way Search Trees, B-Trees, Search, Insert and Delete Operations, Height of B-Tree, 2-3 Trees, Sets and Multisets in STL.	
	GRAPHS	**(07 Hours)**
	Definition, Terminology, Directed and Undirected Graphs, Properties, Connectivity in Graphs, Applications, Adjacency Matrix and Linked Adjacency Chains, Graph Traversal, Breadth First and Depth First Traversal, Spanning Trees, Shortest Path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Implementation of Array and its applications
2	Implementation of Stack and its applications
3	Implementation of Queue and its applications
4	Implementation of Link List and its applications
5	Implementation of Trees and its applications
6	Implementation of Graph and its applications
7	Implementation of Hashing functions and collision resolution techniques
8	Mini Project (Implementation using above Data Structure)

4.	**Books Recommended**
1	Trembley & Sorenson: "An Introduction to Data Structures with Applications", 2/E, TMH, 1991
2	Tanenbaum & Augenstein: "Data Structures using C and C++", 2/E, Pearson, 2007.
3	Horowitz and Sahani: "Fundamentals of Data Structures in C", 2/E, Silicon Press, 2007.
4	T. H. Cormen, C. E. Leiserson, R. L. Rivest: "Introduction to Algorithms",3/E, MIT Press, 2009.
5	Robert L. Kruse, C. L. Tondo and Brence Leung: "Data Structures and Program Design in C", 2/E, Pearson Education, 2001.

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B. Tech. III/IV (CSE) NETWORK SECURITY CS355 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Gain knowledge of network and system security attacks and its prevention mechanisms.
CO2	Apply different security mechanisms for given application scenario.
CO3	Perform security analysis of network and system security protocols.
CO4	Evaluate security protocols for different metrics like functionality, cost and efficiency.
CO5	Design and integrate security protocols depending on organization's requirement.

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Introduction to Network and System Security, Security Attacks, Security Requirements, Confidentiality, Integrity, and Availability, Security Mechanisms, NIST Security Standards, Assets and Threat Models.	
	REVIEW OF CRYPTOGRAPHIC TOOLS	**(06 Hours)**
	Number Theory, Prime Numbers, Modular Arithmetic, Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers.	
	SYSTEM SECURITY	**(10 Hours)**
	User Authentication - Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Access Control-Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, Example: UNIX File Access Control, Role-Based Access Control, Database Security-The Need for Database Security, Database Access Control, Inference, Statistical Databases, Database Encryption, Cloud Security, Malicious Software, Intruders, Denial of Service and Distributed Denial of Service attacks, Intrusion Detection and Prevention.	
	SOFTWARE SECURITY AND TRUSTED SYSTEMS	**(12 Hours)**
	Buffer Overflow-Stack Overflows, Defending Against Buffer Overflows, Other Forms of Overflow Attacks, Software Security-Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs, Handling Program	

	Output, Operating System Security-System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security, Windows Security, Virtualization Security, Trusted Computing and Multilevel Security-The Bell-LaPadula Model for Computer Security, Other Formal Models for Computer Security, The Concept of Trusted Systems, Application of Multilevel Security, Trusted Computing and the Trusted Platform Module, Common Criteria for Information Technology Security Evaluation, Assurance and Evaluation.	
	INTERNET SECURITY	**(10 Hours)**
	Internet Security Protocols and Standards-Secure E-mail and S/MIME, Pretty Good Privacy (PGP), Domain Keys Identified Mail, Secure Sockets Layer (SSL) and Transport Layer Security (TLS), HTTPS, IPv4 and IPv6 Security, IPSec Protocol, Internet Authentication Applications Kerberos, X.509, Public-Key Infrastructure, Federated Identity Management, Wireless Network Security-Wireless Security Overview, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security, Network Management Security-SNMP Protocol.	
	ADVANCED TOPICS	**(03 Hours)**
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
		(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3.	**Books Recommended**
1	William Stallings, Computer Security: Principles and Practice, 2/E, Pearson, 2012.
2	John Vacca, Network and System Security, 2/E, Elsevier, 2013.
3	William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.
4	Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, 2001.
5	William Stallings, Cryptography and Network Security, 7/E, Pearson, 2018.

B. Tech. III/IV (CSE) SOCIAL NETWORK ANALYSIS CS356 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Understand basic concepts of social network and its structure
CO2	Apply appropriate social network measures for solving a given task
CO3	Analyse large scale data that are derived from social network structure
CO4	Evaluate different techniques for social network analysis
CO5	Solve real life problems using network science principles.

2.	Syllabus	
	INTRODUCTION TO SOCIAL NETWORKS AND APPLICATIONS	**(03 Hours)**
	Social Networks – Types, Structure and Representation, Different Types of Graphs, Levels of Analysis-Microscopic, Mesoscopic, Macroscopic, Dyadic Level, Triadic Level, Introduction to Graph Visualization Tools.	
	NETWORK MEASURES	**(08 Hours)**
	Degree Distribution, Clustering Coefficient, Centrality Measures-Degree, Closeness, Betweenness, Eigenvector Centrality, Path and Diameter, Edge Density, Reciprocity And Assortativity, Connected Components, Giant Components, Group Centralities.	
	NETWORK GROWTH MODELS	**(07 Hours)**
	Need for Synthetic Network Models, Real Network Properties – Small World, Scale-Free, High Average Clustering Coefficient, Erdos-Renyi Random Model, Watts-Strogatz Model, Barabasi-Albert Preferential Attachment Model.	
	LINK PREDICTION IN SOCIAL NETWORKS	**(07 Hours)**
	Signed Network and Link Analysis, Balance Theory, Status Theory, Strong And Weak Ties, Strength of Weak Ties, Local Bridges, Neighbourhood Overlap, Triadic Closure, Embeddedness, PageRank and Random Surfer Model, Similarity Rank, Path Based Similarity of Nodes.	
	COMMUNITY DETECTION IN SOCIAL NETWORKS	**(06 Hours)**

	Homophily, Emergence of Community in Social Network, Link Partition, Algorithms for Community Detection.	
	INFORMATION DIFFUSION AND CASCADE BEHAVIOUR IN SOCIAL NETWORKS	**(05 Hours)**
	Information Diffusion in Social Network, Cascade Models, Probabilistic Cascades, Epidemic Models, Cascade Prediction.	
	GRAPH REPRESENTATIONAL LEARNING	**(06 Hours)**
	Machine Learning Pipeline, Objectives and Benefits of Representational Learning, Methods for Graph Representational Learning.	
	CASE STUDIES	**(03 Hours)**
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	Albert-László Barabási, "Network Science", Cambridge University Press, 2016, SBN: 978-1107076266.
2	Tanmoy Chakraborty, "Social Network Analysis", Wiley, 2021, ISBN: 978-9354247835.
3	David Easley and Jon Kleinberg, "Networks, crowds, and markets", Cambridge University Press, 2010, ISBN: 978-0521195331
4	Borgatti, S. P., Everett, M. G. & Johnson, J. C., "Analyzing social networks", SAGE Publications Ltd; 1/E, 2013, ISBN: 9781446247419.
5	John Scott, "Social Network Analysis: A Handbook", SAGE Publications Ltd; 2/E, 2000, ISBN: 9780761963394.

ADDITIONAL REFERENCE BOOKS	
1	Wasserman S. & Faust K., "Social Network Analysis: Methods and Applications", Cambridge University Press, 1/E, 1994, ISBN: 9780521387071.

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B. Tech. III/IV (CSE) HIGH PERFORMANCE COMPUTING CS357 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Learn concepts, issues and limitations related to parallel computing architecture and software development.
CO2	Apply different parallel models of computation, parallel architectures, interconnections and various memory organization in modern high performance architectures.
CO3	Analyze the algorithms to map them onto parallel architectures for parallelism.
CO4	Evaluate the performance of different architectures and parallel algorithms with different aspects of real time problems.
CO5	Design parallel programs for shared-memory architectures and distributed-memory architectures using modern tools like OpenMP and MPI, respectively for given problems.

2.	**Syllabus**	
	PARALLEL PROCESSING CONCEPTS	**(08 Hours)**
	Levels of Parallelism (Instruction, Transaction, Task, Thread, Memory, Function), Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc.), Architectures: N-wide Superscalar Architectures, Multi-core, Multi-threaded.	
	FUNDAMENTAL DESIGN ISSUES IN PARALLEL COMPUTING	**(06 Hours)**
	Synchronization, Scheduling, Job Allocation, Job Partitioning, Dependency Analysis, Mapping Parallel Algorithms onto Parallel Architectures, Performance Analysis of Parallel Algorithms.	
	FUNDAMENTAL LIMITATIONS FACING PARALLEL COMPUTING	**(06 Hours)**
	Bandwidth Limitations, Latency Limitations, Latency Hiding/Tolerating Techniques and their Limitations, Power-Aware Computing and Communication, Power-Aware Processing Techniques, Power-Aware Memory Design, Power-Aware Interconnect Design, Software Power Management	
	PARALLEL PROGRAMMING	**(11 Hours)**

	Programming Languages and Programming-Language Extensions for HPC, Inter-Process Communication, Synchronization, Mutual Exclusion, Basics of Parallel Architecture, Parallel Programming Parallel Programming with OpenMP and (Posix) Threads, Message Passing with MPI.	
	PARALLEL PROGRAMMING WITH CUDA	**(10 Hours)**
	Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in High Performance Computing Architectures: (Examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Micro architecture and Intel Nehalem Micro architecture), Memory Hierarchy and Transaction Specific Memory Design, Thread Organization.	
	ADVANCE TOPICS	**(04 Hours)**
	Petascale Computing, Optics in Parallel Computing, Quantum Computers.	
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	John L. Hennessy and David A. Patterson, “Computer Architecture -- A Quantitative Approach”, 4th Edition, Morgan Kaufmann Publishers, 2017, ISBN 13: 978-0-12-370490-0.
2	Barbara Chapman, Gabriele Jost and Ruud van der Pas, “Using OpenMP: portable shared memory parallel programming”, The MIT Press, 2008, ISBN-13: 978-0-262-53302-7.
3	Marc Snir, Jack Dongarra, Janusz S. Kowalik, Steven Huss-Lederman, Steve W. Otto, David W. Walker, “MPI: The Complete Reference, Volume2”, The MIT Press, 1998, ISBN: 9780262571234.
4	Pacheco S. Peter, “Parallel Programming with MPI”, Morgan Kaufman Publishers, 1992, Paperback ISBN: 9781558603394.
5	https://docs.nvidia.com/cuda/cuda-c-programming-guide/index.html

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B. Tech. III/IV (CSE) UNMANNED AERIAL VEHICLES INFORMATION SYSTEMS CS358 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	acquire a knowledge of contemporary information technologies for processing, analysis, visualization, etc.
CO2	an ability to apply the analytics, skills, and tools necessary for information system practice: for example, visualizing data from drones, etc.
CO3	an ability to analyze the data of UAV systems, for example, sensing, control, and communication data.
CO4	evaluate the usage of data for real time problems w.r.t. global, economic, environmental, and societal context, for example, search and rescue for victims.
CO5	design information management system for using modern tools for given problems.

2.	Syllabus	
	INTRODUCTION	**(08 Hours)**
	UAV Data, Motion Tracking, GIS, and AR 3D Imaging and Reconstruction, Search and Rescue missions Video Analytics (Biometrics and Activity Recognition), Future UAVs, Data Collection – GPS, IMU, Video, Thermal, etc.	
	DATA QUALITY AND ACCURACY	**(04 Hours)**
	Geospatial Data Accuracy and Quality and Mapping Standards, Errors in Measurements, The Ever-confusing Statistical Terms, Standard Deviation and Root Mean Square Error (RMSE), Normal Distribution Curve, Common Error Estimation Terms, Positional Errors and Accuracy.	
	SPATIAL DATABASE	**(08 Hours)**
	Conceptual Data Models for Spatial Databases (e.g. Pictogram Enhanced ERDs), Logical Data Models for Spatial Databases: Raster Model (Map Algebra), Vector Model, Spatial Query Languages, Need for Spatial Operators and Relations, SQL3 and ADT, Spatial Operators, OGIS Queries.	
	GEOSPATIAL MAPPING	**(08 Hours)**

	Aerial photography, Mapping, Datums and coordinate systems, LIDAR, Volumetric surveys, Digital mapping, Contour mapping, Topographic mapping, Digital Terrain Modeling, Aerial Surveys, Photogrammetry, Temporal/Spatial Correlation for Terrain Reconstruction.	
	GEOGRAPHICAL INFORMATION SYSTEM	**(06 Hours)**
	Maps - Classification of Maps - Map Scale - Map Projections - Grouping of Map Projections - Commonly used Map Projections and their Comparison - GIS - Historical Development of GIS - Components of GIS - Data - Types of Data - Spatial and Non-spatial - Vector Data - Point, Line, Polygon - Raster Data - Database Structures - Vector and Raster Data Structures - Files – File Formats, Operations - mapping, tracking, searching, etc.	
	DATA ANALYSIS AND MODELLING	**(11 Hours)**
	Data Retrieval - Query - Spatial Analysis - Overlay - Vector Data Analysis - Raster Data Analysis - Modelling in GIS – Digital Elevation Model - Cost and Path Analysis - Network Analysis – Expert Systems - Artificial Intelligence - AI in data analytics – remote biometric sensing, motion tracking, 3D reconstruction, etc., Integration with GIS.	
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Study of data requirement for different situations.
2	Analysis and Preprocessing of data.
3	Designing spatial database with modeling and UI.
4	Understanding of GIS and data projection in GIS.
5	Implement spatial data and UI for different situations.

4.	**Books Recommended**
1	Richard K. Barnhart, Stephen B. Hottman, Douglas M. Marshall, Eric Shappee, “Introduction to Unmanned Aircraft Systems”, CRC Press, 2012.
2	S. Shekhar and S. Chawla, “Spatial Databases: A Tour”, 1st Edition, Prentice Hall, 2003.
3	Paul Bolstad, “GIS Fundamentals: A First Text on Geographic Information Systems”, 6th ed., XanEdu, 2019.
4	M. Duckham, M. F. Worboys, “GIS: A Computing Perspective”, 2nd Ed., CRC Press, 2004.

5	L. Comber and C. Brunsdon, "Geographical data science and spatial data analysis : an introduction in R", SAGE, 2021.

ADDITIONAL REFERENCE BOOKS	
1	E. Pebesma and R. Bivand, "Spatial Data Science: With Applications in R", Chapman and Hall/CRC, 2023.

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B.Tech. III/IV (CSE) ARTIFICIAL INTELLIGENCE FOR ROBOTICS CS359 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Introduce the concept of the notion of configuration space, Probabilistic Roadmaps in planning for 2D and 3D systems.
CO2	Implement search algorithms to plan the shortest path from one point to another
CO3	Implement filters (including Kalman, and particle filters) in order to localize moving objects whose locations are subject to noise.
CO4	Implement a SLAM algorithm for a robot moving in at least two dimensions

2.	Syllabus	
	INTRODUCTION	**(05 Hours)**
	Introduction to AI and robotics- History, growth; Total Tuning Test Robot applications- Manufacturing industry, defence, rehabilitation, medical etc., Laws of Robotics.	
	SEARCHING TECHNIQUES IN AI	**(06 Hours)**
	Searching Techniques: uninformed search strategies, informed (heuristic) search strategies, local search algorithms, searching in non-deterministic and partially observable environment, adversarial search.	
	ROBOTIC SENSORS AND THEIR INTERFACING	**(05 Hours)**
	Types of sensors , Camera as a sensor , Fundamentals of Computer Vision: Image acquisition and representation, image transformation, filtering, restoration, morphing, Camera Models, Calibration, Single view geometry, Multiple view geometry, Epipolar geometry, RANSAC.	
	POSITION AND ORIENTATION	**(08 Hours)**
	Feature based alignment; Pose estimation; Time varying pose and trajectories, Structure from motion, dense Motion Estimation, Visual Odometry (Semi-direct VO, direct sparse odometry), Bundle Assignment.	
	MOTION PLANNING	**(08 Hours)**
	Navigation, Coverage, Localization and Mapping: Initialization, Tracking, Mapping, Simultaneous Localization and Mapping (SLAM).	

	RECOGNITION AND INTERPRETATIONS:	**(06 Hours)**
	Concepts of machine learning and deep learning, sequence modeling, Learning for robotic vision: Active learning, incremental and class incremental learning identify unknowns, uncertainty estimation, Embodiment for robotic vision: active vision, spatial and temporal embodiment, reasoning for object, scene and scene semantics.	
	RECENT ADVANCEMENT IN THE MOTION PLANNING	**(07 Hours)**
	Planning using Fuzzy Logic and Neural Networks, Reinforcement learning for the planning in robots.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Python Frameworks Tutorial (with Jupyter and Colab) and it's Data Structures
2	Searching in graph based problem space
3	Search techniques in Real Time Applications
4	Introduction to Robot path planning, framework tutorial (ROS and Gazebo)
5	Robot path planning, framework tutorial (MATLAB based Navigation toolbox)
6	Motion Planning using PRM
7	Motion Planning using RRT
8	Introduction to sensor and implementation
9	Reasoning Under Uncertainty using Bayesian Learning
10	Reinforcement Learning using Q-Learning

4.	**Books Recommended**
1	H.R Everett, Sensors for Mobile Robots: Theory and Application, CRC Press.
2	S.R Deb, Sankha Deb Robotics Technology and Flexible Automation.
3	Milan Sonka Vaclav Hlavac and Rger Boyle Image Processing, Analysis and Machine Vision.

B. Tech. III/IV (CSE) **BLOCKCHAIN TECHNOLOGY** **CS360** **(Elective)**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Understand the need, functions and challenges of blockchain technology.
CO2	Deploy smart contracts for given use cases.
CO3	Analyse blockchain based system structure and security offered therein.
CO4	Asses functions, benefits and limitations of various blockchain platforms.
CO5	Design and develop solution using blockchain technology in various application domains.

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Introduction to Blockchain Technology, Concept of Blocks, Transactions, Distributed Consensus, the Chain and the Longest Chain, Cryptocurrency, Blockchain 2.0, Permissioned Model of Blockchain, Permission less Blockchain.	
	DECENTRALIZATION USING BLOCKCHAIN	**(07 Hours)**
	Methods of Decentralization, Disintermediation, Contest-Driven Decentralization, Routes to Decentralization, the Decentralization Framework Example, Blockchain and Full Ecosystem Decentralization, Storage, Communication, Computing Power and Decentralization, Smart Contracts, Decentralized Autonomous Organizations, Decentralized Applications (DApps), Requirements and Operations of DApps, DApps Examples, Platforms for Decentralizations.	
	CRYPTO PRIMITIVES FOR BLOCKCHAIN	**(04 Hours)**
	Symmetric and Public Key Cryptography, Cryptographic Hard Problems, Key Generation, Secure Hash Algorithms, Hash Pointers, Digital Signatures, Merkle Trees, Patricia trees, Distributed Hash Tables.	
	BITCOINS AND CRYPTOCURRENCY	**(08 Hours)**
	Introduction, Digital Keys and Addresses, Private and Public Keys in Bitcoins, Base58Check Encoding, Vanity Addresses, Multi Signature Addresses, Transaction Lifecycle, Data Structure for Transaction, Types of Transactions, Transaction Verification, The Structure of Block in Blockchain, Mining, Proof of Work, Bitcoin Network and Payments, Bitcoin Clients and APIs,	

	Wallets, Alternative Coins, Proof of Stake, Proof of Storage, Various Stake Types, Difficulty Adjustment and Retargeting Algorithms, Bitcoin Limitations.	
	SMART CONTRACTS	**(02 Hours)**
	Smart Contract Templates, Oracle, Smart Oracle, Deploying Smart Contract on Blockchain.	
	PERMISSIONED BLOCKCHAIN	**(05 Hours)**
	Models and Use-cases, Design Issues, Consensus, Paxos, RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance.	
	DEVELOPMENT TOOLS AND FRAMEWORKS	**(05 Hours)**
	Solidity Compilers, IDEs, Ganache, Metamask, Truffle, Contract Development and Deployment, Solidity Language, Types, Value Types, Literals, Enums, Function Types, Reference Types, Global Variables, Control Structures, Layout of Solidity Source Code File.	
	HYPERLEDGER	**(05 Hours)**
	The Reference Architecture, Requirements and Design Goals of Hyperledger Fabric, The Modular Approach, Privacy and Confidentiality, Scalability, Deterministic Transactions, Identity, Auditability, Interoperability, Portability, Membership Services in Fabric, Blockchain Services, Consensus Services, Distributed Ledger, Sawtooth Lake, Corda.	
	BLOCKCHAIN USE-CASES AND CHALLENGES	**(05 Hours)**
	Finances, Government, Supply Chain, Security, Internet of Things, Scalability and Challenges, Network Plane, Consensus Plane, Storage Plane, View Plane, Block Size Increase, Block Interval Reduction, Invertible Bloom Lookup Tables, Private Chains, Sidechains, Privacy Issues, Indistinguishability Obfuscation, Homomorphic Encryption, Zero Knowledge Proofs, State Channels, Secure Multiparty Computation, Confidential Transactions.	
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	Imran Bashir, “Mastering Blockchain”, 2/E, Packt publishing, Mumbai, 2018.
2	Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, 2/E, O’Reilly, 2014.
3	Melanie Swan, “Blockchain Blueprint for a New Economy”, 1/E, O'Reilly Media, 2015.
4	Don and Alex Tapscott, “Blockchain Revolution”, 1/E, Penguin Books Ltd, 2018.
5	Alan T. Norman, “Blockchain Technology Explained”,1/E, CreateSpace Independent Publishing Platform, 2017.

B. Tech. III/IV (CSE) DATA SCIENCE CS361 (Elective)	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Understand types of data and various data science approaches.
CO2	Apply various data pre-processing and manipulation techniques including various distributed analysis paradigm using hadoop and other tools and perform advance statistical analysis to solve complex and large dataset problems.
CO3	Analyze different large data like text data, stream data, graph data.
CO4	Interpret and evaluate various large datasets by applying Data Mining techniques like clustering, filtering, factorization.
CO5	Design the solution for the real life applications.

2.	Syllabus	
	INTRODUCTION	**(03 Hours)**
	Examples, Applications and Results Obtained Using Data Science Techniques, Overview of the Data Science Process.	
	MANAGING LARGESCALE DATA	**(04 Hours)**
	Types of Data and Data Representations, Acquire Data (E.G., Crawling), Process and Parse Data, Data Manipulation, Data Wrangling and Data Cleaning.	
	PARADIGMS FOR DATA MANIPULATION, LARGE SCALE DATA SET	**(08 Hours)**
	Map reduce (Hadoop), Query Large Data Sets in Near Real Time with Pig and Hive, Moving from Traditional Warehouses to Map Reduce, Distributed Databases, Distributed Hash Tables.	
	TEXT ANALYSIS	**(10 Hours)**
	Data Flattening, Filtering and Chunking, Feature Scaling, Dimensionality Reduction, Nonlinear Factorization, Shingling of Documents, Locality Sensitive Hashing for Documents, Distance Measures, LSH Families for Other Distance Measures, Collaborative Filtering.	
	MINING DATA STREAM	**(08 Hours)**

	Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Moments, Windows, Clustering for Streams.	
	ADVANCED DATA ANALYSIS	**(12 Hours)**
	Graph Visualization, Data Summaries, Hypothesis Testing, ML Model-Checking and Comparison, Link Analysis, Mining of Graph, Frequent Item Sets Analysis, High Dimensional Clustering, Hierarchical Clustering, Recommendation Systems.	
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O’reilly Media, 2015, ISBN: 9781491901687.
2	Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, 2nd Edition, Cambridge University Press, 2014, ISBN: 9781107077232.
3	Peter Bruce, Andrew Bruce, “Practical Statistics for Data Scientists: 50” by , 1st Edition, O’reilly publishing house, 2017, ISBN: 9781491952962.
4	Joel Grus, J. “Data science from scratch”, 1st Edition, O'Reilly Media, 2015, ISBN: 9781491901410.
5	Montgomery, Douglas C., and George C. Runger. “Applied statistics and probability for engineers”, John Wiley & Sons, 7th Edition, 2018, ISBN: 9781119400363.

B.Tech. III/IV (CSE) **BIG DATA ANALYTICS** **CS452** **(Elective)**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Understand the key requirements and issues in big data management and its associated applications in intelligent business and scientific computing.
CO2	Use state of the art big data analytics techniques and algorithms.
CO3	Analyze large sets of data to discover patterns and other useful information.
CO4	Compare and evaluate the impact of big data analytics tools and techniques.
CO5	Develop big data solutions using state of the art analytics tools/techniques.

2.	**Syllabus**	
	INTRODUCTION – DATA WAREHOUSING, DATA MINING	**(09 Hours)**
	Define Data Warehousing and Data Mining - The Building Blocks, Defining Features – Data Warehouses and Data Marts, Overview of the Components, Metadata in the Data Warehouse, Need for Data Warehousing, Basic Elements of Data Warehousing, Trends in Data Warehousing.	
	CONCEPTS AND TECHNIQUES IN DATA WAREHOUSING	**(08 Hours)**
	OLAP (Online analytical processing) Definitions, Difference Between OLAP and OLTP, Dimensional Analysis, Define Cubes, Drill-down and Roll-up - Slice and Dice or Rotation, OLAP Models, ROLAP versus MOLAP, Defining Schemas: Stars, Snowflakes and Fact Constellations.	
	CONCEPT DESCRIPTION AND ASSOCIATION RULE MINING	**(08 Hours)**
	Introduction to Concept Description, Data Generalization and Summarization-based Characterization, Analytical Characterization, Class Comparisons, Descriptive Statistical Measures, Market Basket Analysis- Basic Concepts, Association Rule Mining, The Apriori Algorithm, Mining Multilevel Association Rule Mining, Mining Multidimensional Association Rule Mining.	
	INTRODUCTION TO CLASSIFICATION AND PREDICTION	**(10 Hours)**
	Introduction to Classification and Prediction, Issues Regarding Classification, Classification using Decision Trees, Bayesian Classification, Classification by Back Propagation, Prediction Classification Accuracy.	

	ADVANCED TOPICS	**(10 Hours)**
	Clustering, Spatial Mining, Web Mining, Text Mining, Map-Reduce and Hadoop Ecosystem.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	J. Han, M. Kamber, “Data Mining Concepts and Techniques”, 3rd Edition, Morgan Kaufmann, Jun 22, 2011.
2	Paulraj Ponnian, “Data Warehousing Fundamentals”, 1st Edition, John Willey, May 24, 2010.
3	Robert D. Schneider, Hadoop for Dummies, 1st Edition, Wiley India, Apr 14, 2014.
4	M. Kantardzic, “Data mining: Concepts, models, methods and algorithms”, 3rd Edition, John Wiley & Sons Inc., Nov 12, 2019.
5	M. Dunham, “Data Mining: Introductory and Advanced Topics”, 1st Edition, Pearson, Sep 1, 2002.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. III/IV (CSE) DRONE FORENSICS CS453 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Understand data recovered from Unmanned Aircraft Vehicle (UAV) including the associated control devices and the Open-source and commercial tools, technologies and methodologies used in UAV/drone forensic investigations along with the legal and regulatory aspects.
CO2	Apply appropriate software tool for the scenario to identify and perform analysis.
CO3	Analyze the principles and procedure involved in and implementation steps required used Drone forensics.
CO4	Evaluate the model for quality and risk factors of various drone forensics.
CO5	Design and develop software/tool/ for the extraction of data for different risk and preserve extracted evidence.

2.	Syllabus	
	INTRODUCTION TO UAV FORENSICS	**(06 Hours)**
	Introduction to UAS, Criminal Use of UAV's, Drone adaptation, Capacity and Capability of drones, Components of Unmanned Aircraft Systems (UAS): Hardware and Software Components for Flight Control System and Ground Control System, Data Storage; Introduction to controller options: Mobile and Tablet Devices, flight controllers, Integrated displays, FPV controllers, Linked devices – controller considerations, Drones cyberattacks: Hijacking, GPS Spoofing, malware, data stealing, MITM, downlink intercept, DoS and more, Drone seizure and handling at crime scene, Case studies.	
	DATA EXTRACTION AND INTERPRETATION	**(12 Hours)**
	Data extraction from the aircraft, mobile/tablet device, Controller Data, Disassembling techniques, Techniques in using opensource and commercial forensic tools to review the evidence: Interpretation of data contained on the UAV: File System considerations, Extracting registered user information, Identifying UAV details, Flight log analysis techniques; Interpretation of data from portable devices: Default folder structures of the controlling app from an Android and iOS device, Synchronized logs vs. local logs: Error log analysis, Media file examination (geolocations and dates & times), Workflows in combining offline files for further analysis; Interpretation Techniques of additional data on other devices, Corroboration of evidence and Report writing.	

	FUNDAMENTALS OF DRONE FORENSICS	**(10 Hours)**
	Introduction to digital forensics, its principles, digital forensic fields/subfields applicable to Drone forensics, Evidence integrity and standard forensic practices; Evidence continuity, Identifying makes and models, Initial examination and case review, identifying damage or customized Drone, Drone adaptability and modifications, Evidence data locations, Extraction techniques and tools, Extracting removable storage mediums, Preservation of evidence.	
	FORENSIC TOOLS FOR DRONES	**(11 Hours)**
	ANTI-FORENSIC TECHNIQUES	**(06 Hours)**
	Artifact Wiping (Tools-Eraser & BC Wipe), Data Hiding (Relocation of Data, Altering File Extensions), Signature Analysis of Files, Steganography, Trial Obfuscation (Modification of Data, Timestamps altering), Attack on Computer Forensic Tools & Processes (DoS attacks)	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours=75 Hours)	

3.	**Books Recommended**
1	Jay Gundlach, Designing Unmanned Aircraft Systems: A Comprehensive Approach, AIAA Education Series, 2012.
2	Joakim Kävrestad, Fundamentals of Digital Forensics: Theory, Methods, and Real-Life Applications, Springer, 2020.
3	Greg Gogolin, Digital Forensics Explained, CRC Press, 2021.
4	Ministry of Civil Aviation, The Drone Rules, 2021.
5	Information Technology Act 2000 (amendment 2008).

ADDITIONAL REFERENCE BOOKS	
1	Randal W. Beard and Timothy W. McLain: Small Unmanned Aircraft: Theory and Practice, Princeton University Press, 2012.
2	Interpol Framework for Responding to a Drone Incident for First Responders and Digital Forensics Practitioners.
3	Atkinson, Carr, Shaw and Zargari, Drone Forensics: The Impact and Challenges, 2020.

4	Sachi Nandan Mohanty, J.V.R. Ravindra, G. Surya Narayana, Chinmaya Ranjan Pattnaik, Y. Mohamed Sirajudeen, Drone Technology: Future Trends and Practical Applications, Scrivener Publishing, 2023.
5	Sowmya Viswanathan Zubair Baig Digital Forensics for Drones: A Study of Tools and Techniques, Springer International Conference on Applications and Techniques in Information Security. Available: https://link.springer.com/conference/atis
6	S. N. Mohanty, J.V.R. Ravindra, G. Surya Narayana, C.R. Pattnaik and Y. Mohamed Sirajudeen, Drone Technology https://doi.org/10.1002/9781394168002.fmatter

B.Tech. III/IV (CSE) **SOFTWARE SECURITY** **CS454** **(Elective)**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Have a knowledge of the basic concepts and problems of memory unsafe and memory safelanguages
CO2	Be able to use the concepts to detect security vulnerabilities and prevent them.
CO3	Be able to analyze/interpret program code for doing Static and Dynamic Security Testing.
CO4	Be able to design the new software with the security features builtin rather than reliance on thesecurity software.
CO5	Be able to use the concepts of information security to prevent security design faults.

2.	**Syllabus**	
	INTRODUCTION	**(03 Hours)**
	Introduction to the course. Review of Software Engineering Concepts. SDLC. Software Qualities i.e. NFRs. Security as a Software Quality. Review of Information Security concepts. Security in SDLC. Information Security vs. Application Security. The concept of Software Security vs Security Software. Terminologies: Bug, Defect, Vulnerability, Exploit. The trinity of troubles to ensure Software Security viz. Connectivity, Extensibility and Complexity. Studies of various catastrophes due to Insecure software. Model Based Security Engineering, Three Pillars of Software Security. Security in Software Development Lifecycle (SSDLC).	
	SECURITY ATTACKS AND TAXONOMY OF SECURITY ATTACKS	**(03 Hours)**
	Self-study: Review of basic Information Security concepts. The CIA triade. Difference between Security & Privacy. ITU-T's X.800 document: Security architecture for Open Systems.Security Attributes, Mechanisms and Attacks. Cryptography: SKE and PKC. Block ciphers. Design paradigms: Feistel and the Substitution PErmutation Networks. The AES Encryption Decryption & the associated mathematics. The RSA PKC cipher. Attacks and Types of Attackers: Attacks – Types, Methods. Attacks in each phase of software life cycle. Motivation for attackers, Methods for attacks: Malicious code, Hidden software mechanisms, Social Engineering attacks, Physical attacks. Non-malicious dangers to software.	
	OVERVIEW OF CODE ANALYSIS TECHNIQUES:	**(05 Hours)**
	Overview of Code Analysis Techniques: Software Verification and Validation. Approaches to analyze software code. Non-execution based testing. Static analysis. Static Analysis as a	

	verification technique. The errors corrected by Static Analysis. Review of the Synopsis report on Static Analysis. Static Analysis using the tools Splint, FlawFinder, Clang and SonarLint/Qube. Introduction to Stack Analysis. Using GNU debugger to analyze the stack understanding stack semantics.	
	SECURE PROGRAMMING-I:	**(10 Hours)**
	Secure Programming-I: Fundamentals. Risk Management & Threat Modeling Basics. Threat Modeling using STRIDE. Trust Boundaries. Applying Threat Modeling in Use-cases. Developing secure software: The concept of OWASP Top 10 Proactive Controls. OWASP Top 10 Project i.e. OWASP top 10 vulnerabilities. OWASP Application Security Verification Standard (ASVS). OWASP Software Assurances Maturity Model (SAMM), Building Security and Maturity Model (BSMM). Introduction to Security Vulnerabilities. Taxonomy of Security Vulnerabilities. (@Fortiy, @OWASP etc.)	
	SECURE PROGRAMMING-II	**(10 Hours)**
	Secure Programming-II: OWASP Top 10 Proactive Controls: C1: Define Security Requirements. C2: Leverage Security Frameworks and Libraries. C3: Secure Database Access: SQL injection vulnerabilities, The Cross site Scripting vulnerabilities: establishing secure configurations, secure authentication, secure communication. C4: Encode and Escape Data, C5: Validate All Inputs, C6: Implement Digital Identity, C7: Enforce Access Controls, C8: Protect Data Everywhere, C9: Implement Security Logging and Monitoring, C10: Handle All Errors and Exceptions.	
	THREAT MODELLING & SECURE SOFTWARE DESIGN-I	**(08 Hours)**
	Integrating Security into SDLC. Secure development cycle activities and practices. Review of UML, Usecase modelling - Usecases, Sequence Diagram, Collaboration Diagram. Illustrations of Kerberos and SET through Sequence Diagram. Secure Design: Risk Management & Threat Modeling. Attacks in each phase of software life cycle. Attack Taxonomy in Internet of Things and Cyber Physical Systems. Attack Trees. Attack Trees for BGP, PGP. PGP. Review of Design Patterns in SE and Multi-tier architecture. The Attack Patterns, Illustrations, Attack Profiles. Attack Profiles from Attack Patterns. Usage of Attack Profiles. Using Attack Patterns in Attack Profiles. Generating Attack Patterns. Case Studies.	
	THREAT MODELLING & SECURE SOFTWARE DESIGN-II	**(06 Hours)**
	Abuse Cases. The UML Misuse Cases. Using Attack Patterns to generate a UML Abuse Case Model and Anti-requirements. Finite State Machines for Security Requirements. Case Studies. Security Patterns. Architectural Risk Analysis Using UMLSec and/OR SecureUML. OR Using Z for Secure Specifications. Introduction to Penetration Testing.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	Michael Howard, David LeBlanc. Writing Secure Code. Microsoft Press, 2nd Edition. 2004.
2	McConnell Steve. Code Complete (Developer Best Practices), Kindle Edition. Microsoft Press, 2nd Edition. 2004.
3	Counter Hack Reloaded:A Step-byStep Guide to Computer Attacks and Effective Defenses, Edward Skoudis, Tom Liston, Prentice Hall
4	Secure Coding: Principles and Practices, Mark G. Graff, Kenneth R.Van Wyk, O'Reilly Media
5	Software Security: Building Security In, Gary McGraw, Addison-Wesley.

ADDITIONAL REFERENCE BOOKS	
1	Hacking Exposed 7: Network SecuritySecrets & Solutions, Stuart McClure, Joel Scambray, George Kurtz , McGraw-Hill Osborne Media.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. III/IV (CSE) SYSTEM ANALYSIS AND SIMULATION CS455 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Acquire knowledge about the important elements of discrete event simulation and modellingparadigm.
CO2	Interpret the model and apply the results to resolve critical issues in a real world environment.
CO3	Identify and analyse the system requirements using various system analysis techniques.
CO4	Use computer simulation software to solve and interpret the results.
CO5	Develop skills to apply simulation software to construct and execute goal-driven system models.

2.	Syllabus	
	INTRODUCTION	**(09 Hours)**
	Introduction, Organizational and Business Context of System Development.	
	APPROACHES TO SYSTEMS DEVELOPMENT AND PROJECT MANAGEMENT	**(10 Hours)**
	System Development Methodologies, Models, Tools and Techniques for Developing Quality Software.	
	SYSTEM ANALYSIS ACTIVITIES	**(10 Hours)**
	Define, Prioritise, and Evaluate Requirements of an Information System as well as Build Generaland Detailed Models that Specify the System Requirements.	
	ESSENTIALS OF SYSTEM DESIGN	**(09 Hours)**
	Describe, Organize and Structure the Components of a System, Including Decisions About the System's Hardware, Software, and Network Environment, Designing Effective User and System Interfaces Considering Human-Computer Interaction Principles.	
	ADVANCE SYSTEM DESIGN CONCEPTS	**(07 Hours)**

	Apply Object-Oriented Design in Order to Build Detailed Models that Assist Programmers in Implementing the System, Store and Exchange Data in the System by Considering Database Management and Security Issues, and Creating Database Models and Controls, Making the System Operational.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	J. W. Satzinger, R. B. Jackson and S. D. Burd, "Systems Analysis and Design in a Changing World", 6th ed. Boston, USA: Thomson Course Technology, 2012.
2	Averill M. Law, "Simulation modelling and analysis (SIE)", 4th Edition, Tata McGraw Hill India, 2007.
3	David Cloud, Larry Rainey, "Applied Modelling and Simulation", Tata McGraw Hill, India.
4	Gabriel A. Wainer, "Discrete-event modelling and simulation: a practitioner's approach", 1st Edition, CRC Press, 2009.
5	Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, "Theory of modelling and simulation: integrating discrete event and continuous complex dynamic systems", 2nd Edition, Academic Press, 2000.

ADDITIONAL REFERENCE BOOKS	
1	Walter J. Karplus, George A. Bekey, Boris Yakob Kogan, "Modelling and simulation: theory and practice", 1st Edition, Springer, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. Computer Science and Engineering

B.Tech. III/IV (CSE) SECURITY IN CYBER PHYSICAL SYSTEMS CS456 (Elective)	Scheme	L	T	P	Credit
		3	0	0	03

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	To UNDERSTAND the concept of resource constrained devices, their characteristics, their applications and the constraints under which they operate.
CO2	To ANALYZE the security vulnerabilities with respect to various Denial of Service attacks at the Network Layer in CPSs as well as that in the Routing protocols for the MANETs.
CO3	to ANALYZE the design of a typical link layer security architecture for CPSs and the design of the light weight ciphers for the WSNs.
CO4	to DESIGN the security mechanisms suitable for resource constrained devices viz. those for data and entity authentication, confidentiality, protection against replays, key deployment algorithm for the hop-by-hop as well as end-to-end Secure Data Aggregation protocols.
CO5	To ANALYZE & EVALUATE the advanced key management techniques viz. Attribute Based Encryption, Identity Based Encryption, Function Encryption and their applications.
CO6	To analyze the security of the end-to-end classical symmetric and asymmetric homomorphic encryption algorithms – partially additive and multiplicative algorithms viz. Castellucia, Doming- Ferrer, Stepheen Peter, RSA, El Gammal, Paillier, Okamoto-Uchiyama algorithms.
CO7	To be able to UNDERSTAND the applications of the advanced key management techniques viz. Attribute Based Encryption, Identity Based Encryption, Function Encryption and their applications.

2.	Syllabus	
	INTRODUCTION	**(02 Hours)**
	Review of the Network Security Concerns. Fundamental Network Security Threats. Types of Network Security Threats. Network Security Vulnerabilities, their types: Technological Vulnerabilities, Configuration Vulnerabilities, Security policy Vulnerabilities. Types of Network Security Attacks.	
	UBIQUITOUS & PERVASIVE COMPUTING PARADIGM FOR EMBEDDED SECURITY	**(06 Hours)**
	Introduction to ubiquitous and pervasive computing paradigm. Motivation for the Cyber Physical Systems (CPS), the actors of a typical CPS viz. the wireless sensor nodes & the RFID devices, the Wireless Sensor Networks (WSNs). Typical configurations, Typical Applications of the WSNs/RFIDs. Case studies of real-world applications. Deployment models, Characteristics,	

	Security Issues in the Cyber Physical Systems, Typical Attacks including the Denial of Service Attacks and the Countermeasures.	
	SECURE DATA AGGREGATION	**(12 Hours)**
	The Concept of In-network processing and Data Aggregation. Motivation for the Link Layer Security architecture in Cyber Physical Systems. Design Issues for Link Layer Security in Wireless Sensor Networks.Case studies of the hop-by-hop security architectures viz. TinySec, MiniSec, FlexiSec. Use of any appropriate simulator. End-to-end security architecture for Wireless Sensor Networks.	
	END-TO-END SECURE DATA AGGREGATION & ALGORITHMS	**(12 Hours)**
	Use of Partial Homomorphic Encryption Algorithms – Case studies. Additive and Multiplicative Homomorphic Encryption algorithms. Robustness and Resilient Concealed Data Aggregation: Different approaches to offer data integrity viz. using conventional MAC - Aggregate MAC, Homomorphic MAC, Hybrid Secure Data Aggregation. Malleability Resilient Concealed Data Aggregation	
	SECURITY OF THE ROUTING PROTOCOLS IN MANETS	**(02 Hours)**
	Routing Protocols for MANETS, Their Security vulnerabilities, Typical Solutions. Security of the AODV protocol – typical mitigation to counter Black-hole attacks ON AODV.	
	THE KEY MANAGEMENT IN THE EMBEDDED SYSTEMS	**(04 Hours)**
	Public Key Infrastructure in Wireless Sensor Networks, The TinyPK protocol as a case study. Public Key Infrastructure in Wireless Sensor Networks, The Merkle-Hellman tree based approach for key validation. Attribute Based Encryption and its motivation for Embedded Systems. Identity-based encryption and Functional encryption, motivation and case studies.	
	THE TINY CIPHERS	**(02 Hours)**
	Understanding and analyzing the design of the STATE OF THE ART tiny ciphers for the tiny devices and the RFID devices.	
	THE INTERNET OF THINGS SECURITY	**(05 Hours)**
	The Security and Privacy Issues in IoT Systems. Overview of the IoT Protocols. Security of the RPL protocol. The IoT Security Protocols viz. ZigBee, Bluetooth, 6LowPAN, RPL. The CoAP.	
	(Total Contact Time: 45 Hours = 45 Hours)	

3.	**Books Recommended**
1	The research papers prescribed in the class.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. III/IV (CSE) DEEP LEARNING CS457 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Understand fundamental principles, theory and approaches for learning with deep neural networks.
CO2	Learn different types of Neural Network and Deep Neural Networks.
CO3	Apply NN and DNN for various learning tasks in different domains.
CO4	Evaluate various NN and DNN by performing complex statistical analysis for DL techniques.
CO5	Design DL algorithms for real-world problems.

2.	**Syllabus**	
	INTRODUCTION TO DEEP LEARNING	**(02 Hours)**
	Basics of Human learning, Attributes of learning algorithms, Applications, Learning techniques,Types of Learning algorithms, Basics of Deep learning.	
	NEURAL NETWORKS BASICS	**(08 Hours)**
	Biological Neuron, Idea of Computational Units, Output vs Hidden Layers; Linear vs Nonlinear Networks, McCulloch–Pitts Model, Thresholding Logic, Linear Perceptron, Perception Learning Algorithm, Linear Separability. Convergence Theorem for Perception Learning Algorithm, Learning via Gradient Descent, Logistic Regression, Back Propagation Models, Feed Forward Model Empirical Risk Minimization, Regularization, Auto Encoders, Continuous and Discrete Distributions; MaximumLikelihood, Cost Functions, Hypotheses and Tasks; Training Data; Cross Entropy, Bias-variance Trade Off, Regularization, Activation Function : Sigmoid, Tanh, RELU, Softmax; Types of Neural Network : Feed Forward Neural Network , Radial Basis Function Neural Network, Convolution Neural Network, Recurrent Neural Network(RNN) Long Short Term Memory, Modular Neural Network; Simple Word Vector Representations: Word2vec, GloVe.	
	DEEP NEURAL NETWORKS	**(12 Hours)**
	Deep Learning Models : Restricted Boltzmann Machines, Deep Belief Nets, Convolutional Model; Deep Neural Networks: Difficulty of Training Deep Neural Networks, Greedy Layerwise Training; Better Training of Neural Networks: Newer Optimization Methods for Neural Networks (Adagrad, Adadelta, Rmsprop, Adam, NAG), Second Order Methods for Training, Saddle Point Problem in Neural Networks, Regularization Methods	

	(Dropout, Drop Connect, Batch Normalization);Recurrent Neural Networks: Back Propagation Through Time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs ;Convolution Neural Networks: LeNet, AlexNet; Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, Gradient Computations in RBMs, Deep Boltzmann Machines.	
	RECENT TRENDS	**(12 Hours)**
	Auto Encoders (Standard, Denoising, Contractive, etc), Variational Auto Encoders, Adversarial Generative Networks, Maximum Entropy Distributions, Guest Lecture, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning.	
	APPLICATIONS	**(08 Hours)**
	Vision, NLP, Speech; Deep Learning Platforms and Software Libraries:-H2O.ai, DatoGraphLab, Theano, Caffe, TensorFlow etc.	
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning (Adaptive Computation and Machine Learning series)”, MIT Press, 2016.
2	Russell, S. and Norvig, N. “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hall Series in Artificial Intelligence Pearson, 2015.
3	Christopher M. Bishop, “Pattern Recognition and Machine Learning (Information Science and Statistics)”, 3rd Edition, Springer, 2016.
4	Raúl Rojas, “Neural Networks - A Systematic Introduction”, 2nd Edition, Springer-Verlag, Berlin, New-York, 2013.
5	Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, 1st Edition, O’reily, 2017.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. III/IV (CSE) MACHINE LEARNING FOR SECURITY CS458 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Have a knowledge of the limitations of the conventional security software in the wake ofmachine learning based attacks on the security software
CO2	Be able to apply the concepts machine learning based intrusion detection to analyze the IDSs.
CO3	Be able to analyze the malware analysis and mitigation based solutions for the probable threatstherein.
CO4	Be able to design the threat models based on machine learning approaches for network analysis.

2.	**Syllabus**	
	INTRODUCTION & REVIEW OF THE MACHINE LEARNING BASICS	**(01 Hour)**
	Review of the basic concepts in Linear Algebra, Probability and Statistics. Introduction to the ML techniques. Machine Learning problems viz. Classification, Regression, Clustering, Association rule learning, Structured output, Ranking. The Supervised and Unsupervised learning algorithms. Linear Regression, Gradient descent for convex functions, Logistics Regression and Bayesian Classification Support Vector Machines, Decision Tree and Random Forest, Neural Networks, DNNs, Ensemble learning. Principal Components Analysis. Un-supervised learning algorithms: K-means for clustering problems, K-NN (k nearest neighbors). A-priori algorithm for association rule learning problems. Generative vs Discriminative learning. Empirical Risk Minimization, loss functions, VC dimension. Data partitioning (Train/test/Validation), cross-validation, Biases and Variances, Regularization.	
	OVERVIEW OF THE ML APPLICATIONS IN SECURITY	**(01 Hour)**
	Introduction to Internet architecture. Applications of machine learning to network security. Overview of real-world case studies viz. Intrusion Detection System Approaches (Signature-Based Approach, Anomaly-Based Approach), Intrusion Prevention, Phishing Detection, Privacy Preservation, Spam Detection, Risk Assessment, Malware Detection. Adversarial Machine Learning. Supervised learning examples: Spam filtering, phishing. Unsupervised learning examples: Anomaly detection.	
	PRIVACY PRESERVATION IN MACHINE LEARNING APPLICATIONS	**(08 Hours)**

	Privacy Preservation, What is Privacy? Data Privacy. Machine Learning in Privacy Preservation: Four Main stakes to Privacy preservation in ML. Two principle approaches: (a) Augmenting the ML techniques with the conventional approaches in the domain of privacy preservation to achieve privacy viz. Homomorphic Encryption, Secret Multiparty Computations, Zero Knowledge Proofs, Perturbation techniques (e.g. differential privacy), Anonymization techniques (e.g.)k-Anonymity, l-Diversity) (b) ML-specific approaches like Federated Learning OR Ensemble Learning. Homomorphic Encryption Algorithms and the associated mathematics. Ethical issues and Law for data / process privacy : GDPR, Alexa, other relevant applications	
	MACHINE LEARNING IN NETWORK PROTECTION-I	**(06 Hours)**
	ML in Network Protection-II: Misuse Detection & Supervised Machine Learning for Intrusion Detection: Background & Review, Intrusion Detection taxonomies Machine Learning and Intrusion Detection, Review of the metrics to evaluate intrusion detectors. ML methods for MisUse/Signature Detection: Rule-based and Fuzzy Rule-based classifiers, ANN based classifiers, SVM based classifiers, Genetic Programming based classifiers. ML methods for Feature Selection in IDSs: Decision tree, Classification and Regression tree (CART), Bayesian & Naive Bayes classifier.	
	MACHINE LEARNING IN NETWORK PROTECTION-II	**(06 Hours)**
	ML: Machine Learning for the Internet of Things and Advanced Persistent Threats (APT): Motivation for Security and the Privacy Issues in the Internet of Things (IoT) and the Industrial Internet of Things (IIoT). IoT Security Challenges in each layer of the IoT Protocol stack. Common Attacks, APT attacks and Threat Model Analysis in the IoT. Supervised ML methods for Network Intrusion Detection in the IoT. Unsupervised Machine Learning For Network Intrusion Detection.	
	MACHINE LEARNING IN NETWORK PROTECTION-III	**(08 Hours)**
	Machine learning for Anomaly Detection: Types of Anomalies or outliers in machine learning. Motivation for machine learning for anomaly detection. Data Visualization. Supervised, Unsupervised and Semi-supervised Learning methods for Anomaly Detection. Applications of Anomaly Detection: Intrusion detection, Fraud detection, Health monitoring, Defect detection. Intrusion Detection with Heuristics. Goodness-of-fit. Host Intrusion Detection. Network Intrusion Detection. Web Application Intrusion Detection. Machine learning Algorithms for Anomaly Detection: Local outlier factor (LOF), K-nearest Neighbors, Support vector machines, DBSCAN, Autoencoders, Bayesian networks. Feature Engineering for Anomaly Detection. Anomaly Detection with Data and Algorithms. Overview of applications of Anomaly Detection: Intrusion detection, Fraud detection, Health monitoring, Defect detection. Deep Learning for Anomaly Detection.	
	MACHINE LEARNING IN ENDPOINT PROTECTION	**(06 Hours)**

	ML in Endpoint Protection: Malware Analysis: Understanding malware. Static and Dynamic Analyses. Machine Learning–Based Analysis. Motivation for ML-based Analyses. Malware Phases. Feature generation, Features to Classification. Support Vector Machine, Clustering for Malware Detection. Generalized architecture of Command & Control Malware detection systems. Anomaly-based and Signature-based Malware detection. Communication Pattern Detection. DNS Traffic Analysis. Malicious Server Detection. Classifier-Based Methods: Communication Pattern Detection, DNS Traffic Analysis, Malicious Server Detection. Clustering-Based Methods: DNS Traffic Analysis, Fast Flux Detection. Hybrid Detection Systems. Attacks against the ML algorithms for Malware Detection.	
	MACHINE LEARNING BASED ATTACKS & ADVERSARIAL MACHINE LEARNING.	**(06 Hours)**
	Adversarial Machine Learning. Machine Learning Vulnerability Analysis and Threat Model: Categorizing of Attack Properties, Category of Attackers. Attacks on Machine Learning by its Security Property: Causative Attacks, Exploratory Attacks, Evasion Attacks, Data poisoning, Perturbation. Adversarial Defense Techniques. Machine Learning Based Attacks. Machine Learning Based Stealing Attack (MLBSA) methodology: Seven stages viz. Reconnaissance, Weaponization, Delivery, Exploitation, Installation, Command & Control, and Actions on Objectives. ML-based Stealing Attacks and Protections. Evasion Attacks on Classifiers: Mimicry Attack, Gradient Descent Attacks, Genetic programming-based approach for attack, Tree ensemble evasion. Evasion Attacks on Clustering: Mimicry Attack, Gradient Descent Attacks. Poisoning Attacks on Classifiers: LabelFlipping Attacks, Gradient Descent Attacks, Dictionary Attacks. Poisoning Attacks on Clustering: Bridging Attacks, Gradient Descent Attacks. Other Attacks: Attacks on ASG, Attacks on IDSs. Host-Based Evasion Techniques: Evading signatures, Evading dynamic analysis systems, Evading reputation systems. Difficulty of Applying Attacks in Malware systems. Limitations of Current Detection Approaches. Approaches for mitigating/defending against attacks.	
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	Clarence Chio, David Freeman. Machine Learning and Security. Protecting Systems with Data and Algorithms, O'Reilly Media Publications. 2018
2	Marcus A. Maloof (Ed.) , Machine Learning and Data Mining for Computer Security: Methods and Applications, Springer-Verlag London Limited, 2006
3	Sumeet Dua and Xian Du. Data Mining and Machine Learning in Cybersecurity. CRC Press, Taylor and Francis Group, LLC. 2011
4	Research Papers Prescribed in the class.

B.Tech. III/IV (CSE) **NATURAL LANGUAGE PROCESSING** **CS459** **(Elective)**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Understand basics principles of natural language processing.
CO2	Apply machine learning techniques for NLP based different tasks.
CO3	Perform statically analysis and classification, recognition using NLP knowledge acquired.
CO4	Evaluate the performance of machine translation solutions through statistical parameters.
CO5	Design efficient solution for parser, translator and different applications based on NLP for day to day usage.

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Human Languages, Language Models, Computational Linguistics , Ambiguity and Uncertainty in Language, Processing Paradigms, Phases in Natural Language Processing, Basic Terminology, Overview of Different Applications, Regular Expressions and Automata, Finite State Transducers and Morphology, Automata, Word Recognition, Lexicon, Morphology, Acquisition Models, Linguistics Resources, Introduction to Corpus, Elements in Balanced Corpus.	
	SYNTAX AND SEMANTICS	**(08 Hours)**
	Natural Language Grammars, Lexeme, Phonemes, Phrases and Idioms, Word Order, Tense, Probabilistic Models of Spelling, N-grams, Word Classes and Part of Speech Tagging using Maximum Entropy Models, Transformation Based Tagging (TBL), Context Free Grammars for English, Features and Unification, Lexicalized and Parsing, Treebanks, Language and Complexity, Representing Meaning, Semantic Analysis, Lexical Semantics, Word Sense Disambiguation.	
	PROBBILISTIC LANUAGE MODELING	**(10 Hours)**
	Statistical Inference, Hidden Markov Models, Probabilistic (weighted) Finite State Automata, Estimating the Probability of a Word, and Smoothing, Probabilistic Parsing, Generative Models ofLanguage, Probabilistic Context Free Grammars, Probabilistic Parsing, Statistical Alignment and Machine Translation, Clustering, Text Categorization, Viterbi Algorithm for Finding Most	

	Likely HMM Path.	
	PRAGMATICS	**(06 Hours)**
	Discourse, Dialogue and Conversational Agents, Natural Language Generation, Machine Translation, Dictionary Based Approaches, Reference Resolution, Algorithm for Pronoun Resolution, Text Coherence, Discourse Structure, Applications of NLP- Spell-Checking.	
	MACHINE TRANSLATION	**(09 Hours)**
	Probabilistic Models for Translating One to Another Language, Alignment, Translation, Language Generation, Expectation Maximization, Automatically Discovering Verb Subcategorization, Language Modelling Integrated into Social Network Analysis, Automatic Summarization, Question-Answering, Interactive Dialogue Systems.	
	ADVANCED TOPICS	**(08 Hours)**
	Summarization, Information Retrieval, Vector Space Model, Term Weighting, Homonymy, Polysemy, Synonymy, Improving User Queries, Document Classification, Sentence Segmentation, and Other Language Tasks, Automatically-Trained Email Spam Filter, Automatically Determining the Language, Speech Recognition.	
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Books Recommended**
1	Daniel Jurafsky, James H. Martin: "Speech and Language Processing", 2/E, Pearson Education, 2009.
2	James Allen, "Natural Language Understanding", 2/E, Addison-Wesley, 1994.
3	Christopher D. Manning, Hinrich Schutze: "Foundations of Statistical Natural Language Processing", 1/E, MIT Press, 1999.
4	Steven Bird, “Natural Language Processing with Python”, 1st Edition, O'Reilly, 2009.
5	Jacob Perkins, “Python Text Processing with NLTK 2.0 Cookbook”, 2nd Edition, Packt Publishing, 2010.

ADDITIONAL REFERENCE BOOKS	
1	Bharati A., Sangal R., Chaitanya V., “Natural language processing: A Paninian perspective”, PHI, 2000.
2	Siddiqui T., Tiwary U. S., “Natural language processing and Information retrieval”, 1st Edition, OUP, 2008.

B.Tech. III/IV (CSE) NETWORK RECONNAISSANCE CS460 (Elective)	Scheme	L	T	P	Credit
		3	0	0	03

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Have a knowledge of the basic concepts of network, host, services and vulnerability gathering techniques employed by an attacker.
CO2	Be able to use the tools for doing network footprinting including stealth scanning.
CO3	Be able to analyze the installations for the vulnerabilities that could be exploited by an adversary.
CO4	Be able to design the secure system installations that can withstand the adversarial attacks.
CO5	Be able to extend the existing tools for network and systems protection.

2.	Syllabus	
	INTRODUCTION	**(05 Hours)**
	Review of the Network Fundamentals, Network Topologies, Network Components, TCP/IP Networking Basics, TCP/IP Protocol Stack: DNS, SNMP, TCP, UDP, IP, ARP, RARP, ICMP protocols. Ethernet, Subnet Masking, Subnetting, Supernetting. Review of the Security Basics: Attributes, Mechanisms and Attacks Taxonomy. The CIA Traid. Threats, Vulnerabilities, Attacks	
	NETWORK SECURITY CONCERNS	**(04 Hours)**
	Network Security Concerns. Fundamental Network Security Threats. Types of Network Security Threats. Network Security Vulnerabilities, their types: Technological Vulnerabilities, Configuration Vulnerabilities, Security policy Vulnerabilities. Types of Network Security Attacks	
	INTELLIGENCE (INT) GATHERING	**(08 Hours)**
	Learning about the target, its business, its organizational structure, and its business partners. To output the list of company names, partner organization names, and DNS names, and the servers. The concepts of Search engines, Financial databases, Business reports. The use of WHOIS, RWHOIS, Domain name registries and registrars, Web archives and the corresponding open source tools for mining these data. Cloud reconnaissance.	
	NETWORK FOOTPRINTING	**(09 Hours)**

	Active & Passive Footprinting. Network and system footprinting. Tools for network footprinting. Using Search engines to find the tools. Mining the DNS host names, corresponding IP addresses, IP address ranges, Firewalls, Network maps. Use of search engines, social media, social engineering, the websites of the target organization. Using archive.org. Using Neo trace, DNS Footprinting and who is databases. Use of the contemporary tools (e.g. png, port scanners) for finding these information. Email footprinting. Email Tracking. Footprinting through Google tools. Using traceroute. Verification to confirm the validity of information collected in the prior phases. The countermeasures to prevent successful network footprinting.	
	SCANNING & ENUMERATION	**(09 Hours)**
	Scanning: goals and type, overall scanning tips, sniffing with tcpdump, network tracing, port scanning. OS fingerprinting, version scanning. Identify open ports. Web Service Review Tools: Identify web-based vulnerabilities. Network Vulnerability Scanning Tools: Identify infrastructure- related security issues. The illustrative tools are Nmap, ping, AngryIP, Nikto, OpenVAS, udp-proto-scanner, Netsparker, Nessus, Masscan, SQLMap, Nexpose, Burpsuite, Qualys, HCL AppScan, Amass, wpscan, Eyewitness, WebInspect, ZAP. Stealth Scannning: Scanning Beyond an IDS. Network diagram generation using typical tools viz. Network Topology Mapper, OpManager, LANState, Friendly Pinger. Proxy Servers, The Onion Routing. http tunneling. ssh tunneling. Anonymizers.	
	EXPLOITATION	**(10 Hours)**
	Network based exploitation: using tools a such as Metasploit to compromise vulnerable systems, basics of pivoting, and pilfering. Detection of IP Spoofing. Common web vulnerabilities: Cross-site scripting, OS and Command injections, Buffer overflows, SQL injection, race conditions, and such other vulnerabilities scanning and exploitation techniques, including those in OWASP Top 25. Extracting information about the user names using email IDs, the list of default passwords used by the products used at the target, user names using the SNMP protocol, user groups from Windows and the DNS zone transfer information. SuperScan. Route Analysis Tools. SNMP Enumeration. Reconnaissance Attacks and how to mitigate reconnaissance attacks.	
	(Total Contact Time: 45 Hours = 45 Hours)	

3.	**Books Recommended**
1	John Slavio Hacking, ”A Beginners’ Guide to Computer Hacking, Basic Security, And Penetration Testing.”

2	Yuri Diogenes, Dr. Erdal Ozkaya, "Cybersecurity – Attack and Defense Strategies: Counter modern threats and employ state-of-the-art tools and techniques to protect your organization against cybercriminals", 2nd Edition Kindle Edition, Packt Publishing; 2nd edition, 2019.
3	Hidaia Mahmood Alassouli, "Footprinting, Reconnaissance, Scanning and Enumeration Techniques of Computer Networks", Blurb Publishers.
4	Robert Shimonski, "Cyber Reconnaissance, Surveillance and Defense" 1st Edition, Kindle Edition, Syngress; 2014.
5	Michael Sikorski, Andrew Honig, "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software", Kindle Edition.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. III/IV (CSE) MOTION ANALYTICS CS461 (Elective)	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Acquire knowledge about bio-mechanics.
CO2	Design the solutions of motion analysis .
CO3	comprehensive overview of clinical gait analysis to those who are relatively new to the field
CO4	Analyse the motion modelling for human and robots
CO5	To understand and implement Model of Human Pose and Motion

2.	**Syllabus**	
	INTRODUCTION TO MATHEMATICS AND MECHANICS	**(05 Hours)**
	Introduction to Mathematics and Bio- Mechanics: Trigonometry and Vector, Mechanics, Signal Processing	
	BIO-MOTION	**(05 Hours)**
	Introduction to Bio-Motion: Anatomy of Human Body, Motion Physiology, Bio-Mechanics, Human Gait	
	HUMAN GAIT	**(06 Hours)**
	Anthropometry in Bio-Motion, Walking and Gait Terminologies, Movement Analysis Methods (Vision Based , Marker Based Motion Capture, Marker Less Motion Capture) , Sensor Based, Other Techniques	
	GAIT PARAMETERS EXTRACTION METHODS	**(08 Hours)**
	Kinematic: Conventions, Direct Measurement Techniques Goniometer, Imaging Measurement Techniques, Processing of Raw Kinematic, Other Kinematic Variables. Kinetic: Forces and Momentum of Force, Biomechanical Models, Free body Diagram, Force Transducers and force Plates, EMG based motion analysis.	
	MODEL OF HUMAN POSE AND MOTION	**(08 Hours)**

	Object Detection, Semantic Segmentation, Instance Segmentation, Traditional Object Detectors methods, SIFT, HOG, BOW, Advance Object detectors, Landmark detection, Sliding windows detection –Bounding box predictions, YOLO, Anchor boxes, Evaluating object localization, Human Body Representation, Traditional Methods: Latent Variable Models- PCA, FA, etc., Discriminative Model: Regression, Generative Model: Kalman Filter, Partial Filter.	
	MOTION MODELLING AND SYNTHESIS USING ML APPROACHES	**(06 Hours)**
	Motion Graph Inverse Kinematics Latent Variable, Supervised Techniques, Unsupervised Techniques, Reinforcement Techniques, Human Motion Classification Methods.	
	GAIT ANALYSIS APPLICATIONS	**(07 Hours)**
	Clinical Analysis, Sports Analysis, Biometric Gait, Gait Rehabilitation, Control Applications, Bipedal Robotics: introduction and methods.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Python Frameworks Tutorial (with Jupyter and Colab) and it’s Data Structures
2	Introduction to Python libraries for Data Analysis (Pandas, NumPy, Matplotlib)
3	Data Collection & Creation Using Web Scraping- Static and Dynamic Webpages
4	Exploratory Data Analytics and Feature Engineering
5	Vision based gait analysis system using passive markers; Identifying the markers positions (in an image)
6	Feature Engineering using video; Marker Detection and Classification [M1-M5]; Gap filtering the occluded frames.
7	Kinematic Parameters Estimation: Knee Angle (Passive Markers)
8	Human Detection and Marker based system occlusions: Regression
9	Marker less Gait Analysis (Kinematic Parameters Extraction) using OpenPose
10	Application of Traditional Computational Techniques in Kinetic Analysis, Biometric Gait, Sports Analysis, Bipedal gait

4.	**Books Recommended**
1	Michael W. Whittle, Gait Analysis: An Introduction
2	Biomechanics in Clinic and Research. Author: Jim Richards. Churchill Livingstone.
3	David A. Winter , Biomechanics and Motor Control of Human Movement

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

Five Years Integrated M.Sc. Physics M.Sc. II Semester – IV DATA STRUCTURES CS102	Scheme	L	T	P	Credit
		3	1	2	05

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Recognize the need of different data structures and understand its characteristics.
CO2	Apply different data structures for given problems.
CO3	Design and analyze different data structures, sorting and searching techniques.
CO4	Evaluate data structure operations theoretically and experimentally.
CO5	Solve for complex engineering problems.

2.	**Syllabus**	
	BASICS OF DATA STRUCTURES	**(02 Hours)**
	Review of Concepts: Information and Meaning, Abstract Data Types, Internal Representation of Primitive Data Structures, Arrays, Strings, Structures, Pointers.	
	LINEAR LISTS	**(06 Hours)**
	Sequential and Linked Representations of Linear Lists, Comparison of Insertion, Deletion and Search Operations for Sequential and Linked Lists, Doubly Linked Lists, Circular Lists, Lists in Standard Template Library (STL), Applications of Lists.	
	STACKS	**(06 Hours)**
	Sequential and Linked Implementations, Representative Applications such as Recursion, Expression Evaluation Viz., Infix, Prefix and Postfix, Parenthesis Matching, Towers of Hanoi, Wire Routing in a Circuit, Finding Path in a Maze.	
	QUEUES	**(06 Hours)**
	Operations of Queues, Circular Queue, Priority Queue, Dequeue, Applications of Queues, Simulation of Time Sharing Operating Systems, Continuous Network Monitoring System Etc.	
	SORTING AND SEARCHING	**(04 Hours)**

	Sorting Methods, Bubble Sort, Selection Sort, Quick Sort, Radix Sort, Bucket Sort, Dictionaries, Hashing, Analysis of Collision Resolution Techniques, Searching Methods, Linear Search, Binary Search, Character Strings and Different String Operations.	
	TREES	**(08 Hours)**
	Binary Trees and Their Properties, Terminology, Sequential and Linked Implementations, Tree Traversal Methods and Algorithms, Complete Binary Trees, General Trees, AVL Trees, Threaded Trees, Arithmetic Expression Evaluation, Infix-Prefix-Postfix Notation Conversion, Heaps as Priority Queues, Heap Implementation, Insertion and Deletion Operations, Heapsort, Heaps in Huffman Coding, Tournament Trees, Bin Packing.	
	MULTIWAY TREES	**(04 Hours)**
	Issues in Large Dictionaries, M-Way Search Trees, B Trees, Search, Insert and Delete Operations, Height of B-Tree, 2-3 Trees, Sets and Multisets in STL.	
	GRAPHS	**(06 Hours)**
	Definition, Terminology, Directed and Undirected Graphs, Properties, Connectivity in Graphs, Applications, Adjacency Matrix and Linked Adjacency Chains, Graph Traversal, Breadth First and Depth First Traversal, Spanning Trees, Shortest Path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 14 Hours + 30 Hours = 89 Hours)	

3.	**Tutorials**
1	Problems on Array
2	Problems on Stack and Queue
3	Problems on Linked List
4	Problems on Trees
5	Problems on Graph

4.	Practicals
1	Implementation of Array and its applications
2	Implementation of Stack and its applications
3	Implementation of Queue and its applications
4	Implementation of Link List and its applications
5	Implementation of Trees and its applications
6	Implementation of Graph and its applications
7	Implementation of Hashing function and collision resolution techniques
8	Mini Project (Implementation using above Data Structure

5.	Books Recommended
1	Trembley and Sorenson, An Introduction to Data Structures with Applications, 2nd Edition, Tata McGraw Hill, 1991.
2	Tanenbaum and Augenstein, Data Structures using C and C++, 2nd Edition, Pearson, 2007.
3	Horowitz and Sahani, Fundamentals of Data Structures in C, 2nd Edition, Silicon Press, 2007.
4	T. H. Cormen, C. E. Leiserson, and R. L. Rivest, Introduction to Algorithms, 3rd Edition, MIT Press, 2009.
5	Robert L. Kruse, C. L. Tondo and Brence Leung, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2001.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	First Semester (1st year of UG)				
1	Introduction to Computer Science	AI101	3-1-0	4	70
2	Introduction to Programming	AI103	3-0-2	4	85
3	English and Professional Communication	HS110	3-1-0	4	70
4	Electrical Network Analysis	EE103	3-0-2	4	85
5	Fundamentals of Engineering Mathematics	MA105	3-1-0	4	70
			Total	**20**	**380**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	AIV01 / AIP01	0-0-10	5	200 (20 x 10)
	Second Semester (1st year of UG)				
1	Data Structures	AI102	3-1-2	5	100
2	Web Programming and Python	AI104	3-0-2	4	85
3	Energy and Environmental Engineering	EG110	3-0-2	4	85
4	Linear Algebra and Statistics	MA106	3-1-0	4	70
5	Digital Electronics and Logic Design	EC106	3-0-2	4	85
6	Indian Value System and Social Consciousness	HS120	2-0-0	2	35
			Total	**23**	**460**
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	AIV02 / AIP02	0-0-10	5	200 (20 x 10)
	Third Semester (2nd year of UG)				
1	Computer Organization	AI201	3-1-0	4	70
2	Database Management Systems	AI203	3-0-2	4	85
3	Design and Analysis of Algorithms	AI205	3-1-0	4	70
4	Discrete Mathematics	AI207	3-1-0	4	70
5	Object Oriented Programming	AI231	3-0-2	4	85
			Total	**20**	**380**
	Fourth Semester (2nd year of UG)				
1	Artificial Intelligence	AI202	3-0-2	4	85
2	Operating Systems	AI204	3-0-2	4	85
3	Automata and Formal Languages	AI206	3-1-0	4	70
4	Computer Networks	AI208	3-0-2	4	85
5	Microprocessor and Interfacing Techniques	AI232	3-0-2	4	85
			Total	**20**	**410**
6	Minor / Honor (M/H#1)	AI2AA	3-X-X	3/4	55/70/85
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	AIV04 / AIP04	0-0-10	5	200 (20 x 10)
	Fifth Semester (3rd year of UG)				
1	Machine Learning	AI301	3-0-2	4	85

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

B. Tech. II (AI) Semester – III COMPUTER ORGANIZATION AI201		L	T	P	Credit
	Scheme	3	1	0	04

1.	**Course Outcomes (COs):** At the end of the course, students will be able to
CO1	acquire knowledge of basics of computer architecture, its components with peripheral devices, instruction set architecture, instruction execution using data path and control unit interface.
CO2	apply knowledge of combinational and sequential logic circuits to mimic simple computer architecture to solve the given problem.
CO3	analyze performance of various instruction set architecture, control unit, memories, various processor architectures.
CO4	evaluate programming solutions to implement fast methods of ALU, FP unit implementations, processor architectures and instruction set architectures.
CO5	implement fast methods of ALU, FP unit implementations and to design and develop hardware solution for given instruction coding scheme of an Instruction Set Architecture or vice versa using available technology tools.

2.	**Syllabus**	
	PROCESSOR BASICS	(05 Hours)
	Basics CPU Organization - Functional Units, Data Paths, Registers, Stored Program Concept, Data Representation - Basic Formats, Fixed and Floating Point Representation, Instruction Sets, Instruction Types, Instruction Formats, Addressing Modes, Designing of an Instruction Set, Data path Design, Concepts of Machine Level Programmig, Assembly Level Programming and High Level Programming.	
	ARITHMETIC AND LOGIC UNIT	(08 Hours)
	Arithmetic and Logical Operation and Hardware Implementation, Implementation of some Complex Operation: Fixed-Point Arithmetic Multiplication Algorithms-Hardware Algorithm, Booth Multiplication Algorithm, Division Algorithm, Divide Overflow Algorithm, Combinational ALU and Sequential ALU, Floating Point Arithmetic Operations.	
	CONTROL UNIT	(07 Hours)
	Basic Concepts, Instruction Interpretation and Execution, Hardwired Control, Microprogrammed Control, CPU Control Unit Design, Performance.	

	SUBROUTINE MANAGEMENT	(03 Hours)
	Concepts of Subroutine, Subroutine Call and Return.	
	MEMORY ORGANIZATION	(06 Hours)
	Concepts of Semiconductor Memory, Cpu-Memory Interaction, Organization of Memory Modules, Cache Memory and Related Mapping and Replacement Policies, Virtual Memory.	
	SYSTEM ORGANIZATION	(05 Hours)
	Introduction to InputAnd Output Processing, Working with Video Display Unit and Keyboard and Routine to Control them, Programmed Controlled I/O Transfer, Interrupt Controlled I/O Transfer, DMA Controller, Secondary Storage and Type Of Storage Devices, Introduction to Buses and Connecting I/O Devices to CPU and Memory.	
	PIPELINE CONTROL AND PARALLEL PROCESSING	(08 Hours)
	Instruction Pipelines, Pipeline Hazards, Pipeline Performance, Superscalar Processing, Introduction to Parallel Processing, Processor-Level Parallelism, Multiprocessor.	
	Tutorials will be based on the coverage of the above topics separately.	(14 Hours)
	(Total Contact Time: 42 Hours + 14 Hours = 56 Hours)	

3. Tutorials:
1. Problems on data conversion in various formats and floating-point representation
2. Solving computations involving complex arithmetic operations and hardware implementation of the same
3. Interpretation of basic instruction execution and various addressing modes possible
4. Learning instruction set architecture level instructions for the high level language programming
5. Problems on memory management, mapping and replacement policies

4. Books Recommended:

1. John L. Hannessy, David A. Patterson, "Computer organization and Design", 3/E, Morgan Kaufmaan, reprint - 2003.
2. Andrew S. Tanenbaum, "Structured Computer Organization", 6/E, PHI EEE, reprint 1995.
3. William Stallings, "Computer Organization & Architecture: Designing For Performance", 6/E, PHI, 2002.
4. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5/E, McGraw-Hill, 2002.
5. Morris Mano, "Computer Systems Architecture", 3/E, PHI, reprint 1997.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – III DATABASE MANAGEMENT SYSTEMS AI203		L	T	P	Credit
	Scheme	3	0	2	04

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	understand different database models and query languages to manage the data for given real life application scenario.
CO2	apply the concept of database model, relational tables, normalization to solve different problems.
CO3	analyze the problems for designing the effective solution using procedural and nonprocedural languages and/or index.
CO4	evaluate the solution using transaction management, concurrency management, query performance and optimization, or recovery.
CO5	implement an efficient solution using industry standards for real life problems.

2.	Syllabus	
	INTRODUCTORY CONCEPTS OF DBMS	(02 Hours)
	Introduction, Applications of DBMS, Purpose of Database, Data Independence, Database System Architecture, Data Abstraction, Database users and DBA.	
	ENTITY RELATIONSHIP MODEL	(06 Hours)
	Basic Concepts, Design Process, Constraints, Keys, Design Issues, E-R Diagrams, Attribute Types, Mapping Cardinality, Types of Relationship, Weak/Strong Entity Sets, Extended E-R Features – Generalization, Specialization, Aggregation.	
	RELATIONAL MODELS	(04 Hours)
	Structure of Relational Databases, Domains, Relations, Mapping of ER Model to Relational Model, Relational Algebra – Fundamentals, Operators and Syntax, Relational Algebra Queries, Tuple Relational Calculus.	
	RELATIONAL DATABASE DESIGN	(08 Hours)
	Functional Dependency – Definition, Trivial and Non-trivial FD, Closure of FD Set, Closure of Attributes, Irreducible Set of FD, Normalization – 1Nf, 2NF, 3NF, Decomposition using FD- Dependency	

	Preservation, BCNF, Multi- Valued Dependency, 4NF, Join Dependency and 5NF.	
	QUERY PROCESSING AND OPTIMIZATION	(04 Hours)
	Overview of Query Processing, Measures of Query Cost, Select Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Overview of Query Optimization, Transformation of Relational, Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views, Advanced Topics in Query Optimization.	
	TRANSACTION MANAGEMENT	(06 Hours)
	Transaction Concepts, Properties of Transactions, Serializability of Transactions, Testing for Serializability, Concurrent Executions of Transactions and Related Problems, Locking Mechanism, Solution to Concurrency Related Problems, Two-phase Locking Protocol, Deadlock, Isolation, Intent Locking, System Recovery, Recovery and Atomicity, Log-based Recovery.	
	SQL CONCEPT	(04 Hours)
	Basics of SQL, DDL,DML,DCL, Structure – Creation/Alteration, Defining Constraints – Primary Key, Foreign Key, Unique, Not Null, Check, IN Operator.	
	PL-SQL CONCEPT	(04 Hours)
	Cursors, Stored Procedures, Stored Function, Database Triggers.	
	ADVANCED TOPICS	(04 Hours)
	Data Security: Introduction, Discretionary Access Control, Mandatory Access Control, Data Encryption, Semi Structured Data and XML, Object Oriented and Object Relational DBMS, Distributed DBMS, NOSQL DBMS.	
	Tutorials will be based on the coverage of the above topics separately	(14 Hours)
	Practicals will be based on the coverage of the above topics separately	(28 Hours)
	(Total Contact Time: 42 Hours + 28 Hours = 70 Hours)	

3.	**Tutorials:**
1	Introduction and application of DBMS
2	Designing Relational Models, ER Models and Relational databases
3	Query solving using SQL and PL/SQL
4	Optimum query designing

5	Managing Locks for the management of Transactions and concurrent access of the database

4.	Practicals:
1	Implementation for Physical data storage (Sequential, Index Sequential..)
2	Practicing DDL and DML Queries for database creation and managing the data
3	Develop a Database system for the real life application scenario by managing the storage constrains
4	Practicing PL/SQL with the designed databases
5	Design considering Transaction management and concurrency control
6	Design of ER model based example
7	Design of Relational model based example
8	Design of Normalized form of database

5. Books Recommended:

1. A Silberschatz, H. F. Korth, and S Sudarshan, "Database System Concepts", 6/E, TMH, 2010.
2. McFadden, F.Hoffer, Prescott : M. B "Modern database management", 8/E, Benjamin/Cummings Inc,2006.
3. C.J Date, "An Introduction to Database Systems", Publisher: Addison, Wesley, 8/E, 2003.
4. Raghu Ramakrishnan and Gehrke: "Database Management System", 3/E, WCB/McGraw-Hill, 2003.
5. Margaret H. Dunham, "Data Mining: Introductory and advanced topics", Pearson Education, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – III DESIGN AND ANALYSIS OF ALGORITHMS AI205		L	T	P	Credit
	Scheme	3	1	0	04

1. Course Outcomes (COs): At the end of course, students will be able to	
CO1	Acquire knowledge about the application of mathematical formula and technique to solve the problem and computational complexity analysis.
CO2	Apply the different algorithm design techniques for designing a solution of different applications.
CO3	Analyse the performance of algorithms using different algorithmic design techniques based on asymptotic or amortized or probabilistic methods.
CO4	Evaluate the correctness and implementation of algorithms using different methods of performance evaluation.
CO5	Design and innovate efficient algorithms in the field of computer science & engineering and industry related applications using the different algorithm design techniques.

2.	Syllabus	
	INTRODUCTION	(04 Hours)
	Introduction to Algorithms, Analysis and Design Techniques, Analysis Techniques: Mathematical, Empirical and Asymptotic Analysis. Recurrence Relations and Solving Recurrences, Mathematical Proof Techniques, Amortized Analysis, Probabilistic Analysis.	
	DIVIDE AND CONQUER APPROACH	(06 Hours)
	Sorting & Order Statistics, Divide and Conquer Technique, Various Comparison based Sorts, Analysis of the Worst-Case and the Best-Cases, Randomized Sorting Algorithms, Lower Bound on Sorting, Non-comparison based Sorts, Medians and Order Statistics, Min-Max Problem, Polynomial Multiplication, Fast Fourier Transform.	
	GREEDY DESIGN TECHNIQUES	(08 Hours)
	Basic Greedy Control Abstraction, Motivation, Thirsty Baby Problem, Formalization, Activity Selection and its Variants, Huffman Coding, Horn Formulas, Tape Storage Problem, Container Loading Problem, Knapsack Problem, Graph Algorithms, Graph algorithms: All-pairs Shortest Paths, Topological Ordering of DAG, DFS in Directed Graphs, Strongly Connected Components, Minimum Spanning Trees, Single Source Shortest Paths, Maximum Bipartite Cover Problem, Network Flows: Ford Fulkerson Algorithm, Max-flow Min-cut Theorem, Polynomial Time Algorithms for Max-flow.	
	DYNAMIC PROGRAMMING	(08 Hours)

	Motivation, Matrix Multiplication Problem, Assembly Line Problem, Coin Changing Problem, Longest Common Subsequence, 0/1 Knapsack problem, All-pairs Shortest Path Problems, Dynamic Programming Control Abstraction, Optimal Binary Search Tree.	
	SEARCHING ALGORITHMS	(04 Hours)
	Backtracking, N-Queens Problem, Sum of Subset Problem, Complexity Analysis, Branch & Bound, Least Cost Branch & Bound (LCBB), LCBB Complexity Analysis, 15-Puzzle Problem, Traveling Sales Person Problem.	
	NUMBER THEORETIC ALGORITHMS	(06 Hours)
	Number Theoretic Notions, GCD, Modular Arithmetic, Chinese Remainder Theorem, Generators, Cyclic Groups, Galois Fields, Applications in Cryptography, Primality Testing.	
	NP-COMPLETE PROBLEMS	(06 Hours)
	Polynomial Time, Verification, NP-completeness, Search Problems, Reductions, Dealing with NP-Completeness, Approximation Algorithms, Local Search Heuristics.	
	Tutorials will be based on the coverage of the above topics.	(14 Hours)
	Practicals will be based on the coverage of the above topics.	(28 Hours)
	(Total Contact Time: 42 Hours + 28 Hours = 70 Hours)	

3. Practicals:

1. Practical based on time analysis of sorting algorithms.
2. Practical based on divide and conquer technique.
3. Practical based on greedy design technique.
4. Practical based on dynamic programming.
5. Practical based on searching algorithms.
6. Practical based on back tracking technique.
7. Practical based on Graph based algorithms.
8. Practical based on branch and bound technique.

4. Books Recommended:

1. Cormen, Leiserson, Rivest, Stein," Introduction to Algorithms", 3/E, MIT Press, 2009.
2. J. Kleinberg, E. Tardos, "Algorithm Design", 1/E, Pearson Education, Reprint 2006.
3. SartajSahni, "Data Structures, Algorithms and Applications in C++", 2/E, Universities Press/Orient Longman, 2005

4. Sara Baase, Allen van Gelder," Computer Algorithms: Introduction to Design & Analysis, 3/E, Pearson Education, 2000.
5. Knuth, Donald E., "The Art of Computer Programming, Vol I &III", 3/E, Pearson Education, 1997.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – III DISCRETE MATHEMATICS AI207		L	T	P	Credit
	Scheme	3	1	0	04

1. **Course Outcomes (COs):**

At the end of the course, students will be able to

CO1	acquire knowledge of sets, group and functions, graphs.
CO2	apply group theory, relations and lattice.
CO3	analyse functions, counting and based on mathematical logic.
CO4	evaluate formal verification of computer programmes.
CO5	design solutions for various types of problems in different disciplines like information security, optimization, mathematical analysis.

2.	**Syllabus**	
	Introduction	(04 Hours)
	Introduction to set theory, Basics of functions, Application of Functions in Computer Science Areas.	
	GROUP THEORY	(08 Hours)
	Basic Properties of Group, Groupoid, Semigroup & Monoid, Abelian Group, Subgroup, Cosets, Normal Subgroup, Lagrange's Theorem, Cyclic Group, Permutation Group, Homomorphism & Isomorphism of Groups, Basic Properties, Error Correction & Detection Code.	
	RELATION & LATTICES	(05 Hours)
	Definition & Basic Properties, Graphs Of Relation, Matrices Of Relation, Equivalence Relation, Equivalence Classes, Partition, Partial Ordered Relation, Posets, Hasse Diagram, Upper Bounds, Lower Bound, GLB & LUB Of Sets, Definition & Properties Of Lattice, Sub Lattice, Distributive & Modular Lattices, Complemented & Bounded Lattices, Complete Lattices & Boolean Algebra.	
	MATHEMATICAL LOGIC AND PROGRAM VERIFICATION	(05 Hours)
	Induction, Propositions, Combination Of Propositions, Logical Operators & Propositional Algebra, Equivalence, Predicates & Quantifiers, Interaction of Quantifiers with Logical Operators, Logical Interference & Proof Techniques, Formal Verification of Computer Programs (Elements of Hoare Logic).	
	COUNTING AND RECURRENCE RELATION	(05 Hours)
	First Counting Principle, Second Counting Principle, Permutation, Circular Permutations, Combination, Pigeonhole Principle, Recurrence Relations, Linear Recurrence Relations, Inclusion And Exclusion,	

	Generating Functions.	
	BASICS OF GRAPHS	(05 Hours)
	Graph Definition, Graph Representation, Basic Concepts Of Finite & Infinite Graph, Incidence & Degree, Isomorphism, Subgraph, Walk, Path & Circuits, Cliques, Cycles and Loops, Operations On Graphs, Connected Graph, Disconnected Graph & Components, Complete Graph, Regular Graph, Bipartite Graph, Planar Graphs, Weighted Graphs, Directed & Undirected Graphs, Connectivity Of Graphs.	
	GRAPHS ALGORITHMS	(10 Hours)
	Flows, Combinatorics, Euler's Graph, Hamiltonian Paths & Circuits, Activity Planning and Critical Path, Planar Graphs: Properties, Graph Coloring, Vertex Coloring, Chromatic Polynomials, Edge Coloring, Planar Graph Coloring, Matching and Factorizations: Maximum Matching In Bipartite Graphs, Maximum Matching In General Graphs, Hall's Marriage Theorem, Factorization; Networks: Max-Flow Min-Cut Theorem, Menger's Theorem, Graph and Matrices; Probabilistic Graphical Models:Graphical models, Directed models: Bayesian network, Undirected model: Markov Random Fields, Dynamic model: Hidden Markov Model, Learning in Graphical models: Parameter estimation, Expectation Maximization.	
	Tutorials will be based on the coverage of the above topics separately	(14 Hours)
		(Total Contact Time: 42 Hours + 14 Hours = 56 Hours)

3. Books Recommended:

1. Rosen K.H., "Discrete Mathematics and Its Applications", 6/E, MGH, 2006.
2. Liu C.L., "Elements of Discrete Mathematics", MGH, 2000.
3. Deo Narsingh., "Graph theory with applications to Engineering & Computer Science", PHI, 2000.
4. J. A.Bondy and U. S. R.Murty, "Graph Theory", Springer, 2008.
5. V. K. Balakrishnan, "Theory and Problems of Graph Theory", Tata McGraw-Hill, 2007.

ADDITIONAL REFERENCE BOOKS

1. Kolman B., Busby R.C. & Ross S., "Discrete Mathematical Structure", 5/E, PHI, 2003.
2. Tremblay J. P. & Manohar R., "Discrete Mathematical structure with applications to computer science", MGH, 1999.
3. D. B. West, "Introduction to Graph Theory", 2nd Edition, PHI 2002.
4. G. Chatrand and O.R. Ollermann, "Applied and Algorithmic Graph Theory", McGraw Hill, 1993.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – III OBJECT ORIENTED PROGRAMMING AI231		L	T	P	Credit
	Scheme	3	0	2	04

1. Co..se Outcomes(COs): At the end of the course, students will be able to	
CO1	acquire knowledge of object oriented programming.
CO2	apply the knowledge of object oriented concepts to solve the real world problems.
CO3	analyse object oriented concepts to solve the problem efficiently.
CO4	evaluate the object oriented features' suitability for the implementation of the problem.
CO5	design and implement the efficient object oriented program using various object oriented concepts.

	Syllabus:	
	Introduction	(06 Hours)
	Review of High Level Language, Difference between Procedure Oriented and Object Oriented Approach; Characteristics of Object-Oriented Languages Object Oriented Concepts: Objects, Classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism; Dynamic Binding, Message Passing; , Types of Operators, Operator precedence and associativity, Data type conversions; Selection and Loops	
	Classes and Objects	(08 Hours)
	Abstract data types, Object and classes, attributes, methods, Class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.	
	Inheritance	(06 Hours)
	Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs. classification hierarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.	
	Polymorphism	(06 Hours)
	Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions, Late Binding, Abstract Classes.	

	Strings, Files and Exception Handling	(04 Hours)
	Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration, unexpected exceptions, exception when handling exceptions, resource capture and release.	
	Dynamic memory management	(04 Hours)
	Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.	
	Standard Template Library	(08 Hours)
	Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors, Usage of Template Library for the Implementation of Data Structure.	
	Practicals will be based on the coverage of the above topics separately.	(28 Hours)
	(Total Contact Time: 42 Hours + 28 Hours = 70 Hours)	

3. Practicals using C++/JAVA:

1. Creation of objects in programs.
2. Experiments with private, public member variables and functions and friend functions.
3. Experiments for the usage of constructors and destructors.
4. Experiments for the working of operator overloading.
5. Experiments with abstract classes, interfaces and inheritance to access objects.
6. Experiments with polymorphism and virtual functions.
7. Experiments for strings manipulation.
8. Experiments on file handling.
9. Implementing common data structures, such as trees, lists and hash tables.
10. To deal with runtime errors using exception handling mechanism.
11. Implementation of mini project using object oriented concepts.

4. Books Recommended:

1. E. Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Education (India).
2. E. Balagurusamy, "Programming with JAVA", McGraw Hill.
3. Yashwant Kanetkar, "Object Oriented Programming using C++", BPB, 2004.
4. R. Lafore, "Object Oriented Programming using C++", BPB Publications, 2004.

5. Naughton P. and Schildt H., "Java2 Complete Reference", Eighth Edition, Tata McGraw Hill, 2011.

ADDITIONAL REFERENCE BOOKS

1. Parasons, "Object Oriented Programming with C++", BPB Publication, 1999.
2. Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication, 2002.
3. Jaime Nino, Fredrick A. Hosch, "An Introduction to Programming and Object Oriented Design using Java", Wiley India Private Limited, 2010.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – IV ARTIFICIAL INTELLIGENCE AI202		L	T	P	Credit
	Scheme	3	0	2	04

1.	Course Outcomes (COs): At end of the program, students will be able to
CO1	understand the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
CO2	apply various knowledge representation technique, searching techniques, constraint satisfaction problem and example problems- game playing techniques.
CO3	analyse the current scope, potential, limitations, and implications of intelligent systems.
CO4	evaluate the AI techniques suitable for recent areas of applications like expert systems, neural networks, fuzzy logic, robotics, natural language processing, and computer vision.
CO5	design a real world problem for implementation and understand the dynamic behaviour of a system.

2.	Syllabus	
	INTRODUCTION TO AI	(03 Hours)
	Intelligent Agents, AI Techniques, AI-Problem formulation, AI Applications, Production Systems, Control Strategies.	
	KNOWLEDGE REPRESENTATION	(06 Hours)
	Knowledge Representation Using Predicate Logic, Introduction to Predicate Calculus, Resolution, Use of Predicate Calculus, Knowledge Representation Using other Logic-Structured Representation of Knowledge.	
	PRODUCTION SYSTEM	(06 Hours)
	Defining the Problems as a State Space Search, Production Systems, Production Characteristics, Production System Characteristics, Forward and Backward, State-Space Search, Problem Solving Methods – Problem Graphs, Matching, Indexing.	
	PROBLEM-SOLVING THROUGH SEARCH	(06 Hours)
	Generate and Test, BFS, DFS, Blind, Heuristic, Problem-Reduction, A, A*, AO*, Minimax, Constraint Propagation, Neural, Stochastic, and Evolutionary Search Algorithms, Sample Applications, Measure of Performance and Analysis of Search Algorithms, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis, Issues in the Design of Search Programs.	

	KNOWLEDGE INFERENCE	(06 Hours)
	Knowledge Representation -Production Based System, Frame Based System; Inference – Backward Chaining, Forward Chaining, Rule Value Approach; Fuzzy Reasoning – Certainty Factors, Bayesian Theory-Bayesian Network-Dempster – Shafer Theory; Symbolic Logic Under Uncertainty: Non-Monotonic Reasoning, Logics for Non-Monotonic Reasoning; Statistical Reasoning : Probability and Bayes Theorem, Certainty Factors, Probabilistic Graphical Models, Bayesian Networks, Markov Networks, Fuzzy Logic.	
	GAME PLAYING AND PLANNING	(06 HOURS)
	Overview and Example Domain: Overview, Minimax, Alpha-Beta Cut-Off, Refinements, Iterative Deepening, The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques.	
	NATURAL LANGUAGE PROCESSING	(04 Hours)
	Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Spell Checking.	
	EXPERT SYSTEMS	(05 Hours)
	Expert Systems, Architecture of Expert Systems, Roles of Expert Systems, Knowledge Acquisition, Meta Knowledge, Heuristics, Typical Expert Systems – MYCIN, DART, XOON, Expert Systems Shells.	
	Practicals will be based on the coverage of the above topics using prolog.	**(28 Hours)**
	(Total Contact Time: 42 Hours + 28 Hours = 70 Hours)	

3.	**Practicals:**
1	Practical assignment to understanding basic concepts of prolog.
2	Practical assignment to implement various search strategies.
3	Practical assignment to implement various algorithm based on game theory.
4	Implementation of heuristic based search techniques.
5	Implementation of neural network based application.
6	Implementation of fuzzy logic based application.
7	Implementation of fuzzy inference engine for an application.
8	Implementation of neuro-fuzzy based system.

4. Books Recommended:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003.
2. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009.

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3. Nils Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann, 1998,
4. W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', Prentice Hall of India, 2010.
5. I. Bratko, "Prolog Programming for Artificial Intelligence", 3/E, Addison-Wesley, 2001, 0-201-40375-7.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – IV OPERATING SYSTEMS AI204		L	T	P	Credit
	Scheme	3	0	2	04

1. Course Outcomes (COs): At the end of course, students will be able to	
CO1	understand the significance of operating system in computing devices, exemplify the communication between application programs and hardware devices through system calls.
CO2	compare and illustrate various process scheduling algorithms.
CO3	apply appropriate memory and file management schemes.
CO4	illustrate various disk scheduling algorithms.
CO5	design access control and protection based modules for an operating system.

2.	Syllabus	
	OPERATING SYSTEM OVERVIEW	(03 Hours)
	Operating System (OS) Objectives, Evolution, Types, Major Achievements, Modern Operating Systems, Virtual Machines, OS Design Considerations for Multiprocessor and Multicore.	
	PROCESSES AND THREADS	(05 Hours)
	Process Concept, Process States, Process Description, Process Control Block, PCB as a Data Structure in Contemporary Operating Systems, Process Hierarchy, Processes vs Threads, Types of Threads, Multicore and Multithreading, Case Study: Linux & Windows Process and Thread Management and its Related System Calls.	
	CONCURRENCY: MUTUAL EXCLUSION AND SYNCHRONIZATION	(04 Hours)
	Principles of Concurrency, Mutual Exclusion, Semaphores, Monitors, Message Passing, Readers/Writers Problem.	
	CONCURRENCY: DEADLOCK AND STARVATION	(04 Hours)
	Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Dining Philosopher's Problem, Case Study: Linux & Windows Concurrency Mechanism.	
	SCHEDULING	(08 Hours)

Uniprocessor Scheduling: Long Term Scheduling, Medium Term Scheduling, Short Term Scheduling, Scheduling Algorithms: Short Term Scheduling Criteria, Use of Priorities, Alternative Scheduling Policies, Performance Comparison, Fair-Share Scheduling. Multiprocessor Scheduling: Granularity, Design Issue, Process Scheduling, Thread Scheduling, Real-Time Scheduling: Characteristics of RTOS, Real-Time Scheduling, Deadline Scheduling, Rate Monotonic Scheduling, Priority Inversion. Case Study: Linux & Windows Scheduling.	
MEMORY MANAGEMENT	**(05 Hours)**
Memory Hierarchy, Static and Dynamic Memory Allocation, Overview of Swapping, Multiple Partitions, Contiguous and Non-Contiguous Memory Allocation, Concepts of Simple Paging, Simple Segmentation.	
VIRTUAL MEMORY	**(05 Hours)**
Virtual Memory Concepts, Paging and Segmentation using Virtual Memory, Protection and Sharing, Fetch Policy, Placement Policy, Replacement Policy, Resident Set Management, Cleaning Policy, Load Control, Case Study: Linux & Windows Memory Management.	
I/O MANAGEMENT AND DISK SCHEDULING	**(04 Hours)**
I/O Device, Organisation of the I/O Function, Operating System Design Issue, I/O Buffering, Disk Scheduling, RAID, Disk Cache, Case Study: Linux & Windows I/O.	
FILE MANAGEMENT	**(04 Hours)**
Overview of : Files & File Systems, File Structure, File Management Systems, File Organisation and Access, B-tree, File Directories, File Sharing, Record Blocking, Secondary Storage Management, File System Security, Case Study: Linux & Windows File System.	
Practicals will be based on the coverage of the above topics separately	**(30 Hours)**
(Total Contact Time: 45 Hours + 30 Hours= 75 Hours)	

3.	**Practicals:**
1	Introduction to Basic and Advance commands of Linux.
2	Introduction to Shell Script and programs based on it.
3	Practical based on different Memory management scheme.
4	Practical based on different Process scheduling algorithm.
5	Practical based on different Disk scheduling algorithm.
6	Process synchronization and deadlock.
7	Practical based on file management system.
8	Practical based on input output device management.

5. **Books Recommended:**

1. Silberschatz, Galvin and Gagne, "Operating System Concepts", 10/E, John Wiley & Sons, 2018.
2. W. Stallings, "Operating Systems: Internals and Design Principles", 9/E, Pearson Pub., 2017.
3. W Richard Stevens, Stephen A Rago, "Advanced Programming in the UNIX Environment"; 3/E, Addison Wesley Professional, 2013.
4. Kernighan & Pike, "UNIX programming Environment", 2/E, PHI-EEE, 2001.
5. A Tanenbaum, A Woodhull, "Operating Systems - Design and Implementation", 3/E, PHI EEE, 2006.

ADDITIONAL REFERENCE BOOKS

1. Crawley, "Operating Systems - A Design Oriented Approach", 1/E, McGraw Hill, 1998.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. Artificial Intelligence

		L	T	P	Credit
B. Tech. II (AI) Semester – IV AUTOMATA AND FORMAL LANGUAGES AI206	Scheme	3	1	0	04

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	acquire knowledge of the basis of theory of computation, different computational problems and the importance of automata as a modelling tool of computational problems.
CO2	to apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO3	analyse the solutions for different problems and argue formally about correctness on different restricted machine models of computation.
CO4	evaluate and Identify limitations of computational models and possible methods of proving them.
CO5	design the solution in the forms of different types of machine with correctness proof and able to develop different system software.

2.	Syllabus	
	INTRODUCTION	(05 Hours)
	Basic Mathematical Objects: Sets, Logic, Functions, Relations, Strings, Alphabets, Languages; Mathematical Induction: Inductive Proofs, Principles, Recursive Definitions, Set Notation.	
	FINITE AUTOMATA AND REGULAR EXPRESSIONS	(12 Hours)
	Finite State Systems, Deterministic Finite Automata; Nondeterministic Finite Automata, Nondeterministic Finite Automata with Epsilon, Applications, Kleene' Theorem; Two-way Finite Automata, Finite Automata with Output, Regular Languages & Regular Expressions, Properties of Regular Sets: The Pumping Lemma for Regular Sets, Closure Properties, Decision Properties of Regular Languages, Equivalence and Minimization of Automata, Moore and Mealy Machines.	
	CONTEXT FREE GRAMMARS	(14 Hours)
	Definition, Derivation Trees & Ambiguity, Inherent Ambiguity, Parse Tree, Application of CFG, Simplification of CFG, Normal Form of CFG, Chomsky Normal Form and Chomsky Hierarchy, Unrestricted Grammars, Context-Sensitive Languages, Relations between Classes of Languages, Properties of Context Free Languages: The Pumping Lemma, Closure Properties, Decision Properties of CFL.	
	PUSHDOWN AUTOMATA	(05 Hours)
	Definitions, Languages of PDA, Equivalence of PDA and CFG , Deterministic PDA.	
	TURING MACHINES	(06 Hours)

	Turing Machine Model, Language of a Turing Machine (TM), Programming Techniques of the TM, Variations of TM, Multiple TM, One-Tape and Multi-Tape TM, Deterministic and Non deterministic TM, Universal TM, Churche Thesis, Recursively Enumerable Languages, Decidability, Reducibility, Intractable Problem Classes of Problems NP Hard, NP Complete.	
	Tutorials will be based on the coverage of the above topics.	**(14 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 56 Hours)	

3.	**Tutorials:**
1	Problem statements based on Regular Language and Finite Automata.
2	Questions based on Context Free Grammar.
3	Problems regarding Push Down Automata.
4	Solving Problems for Turing Machine.
5	Decidable and Undecidable Problems.

4. Books Recommended:

1. Michael Sipser, "Introduction to the Theory of Computation",Cengage Learning, 3/E, 2013.
2. John C Martin, "Introduction to Languages & the Theory of Computation", 3/E, Tata McGraw-Hill, 2011.
3. John E. Hopcroft, Rajeev Motwani, Jeffrey Ullman, "Introduction to Automata theory, languages computation, 3/E, Pearson India, 2008.
4. Daniel I A Cohen, "Introduction to Computer Theory", John Wiley & Sons, 2/E, Reprint 2008.
5. Andrew Ilachinski, "Cellular Automata", 1st Ed., World Scientific, 2001.

ADDITIONAL REFERENCE BOOKS

1. Sushil Kumar Azad, "Theory of Computation, An introduction to /automata, Formal Languages And Computability", Dhanpat Ray & Co., New Delhi, 2005.
2. A.M. Natarajan, A.Tamilarasi, "Theory of computation", New Age Publication, 1/E, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – IV COMPUTER NETWORKS AI208		L	T	P	Credit
Sany, TP, Mfms	Scheme	3	0	2	04

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	understand computer network models and services offered at different layers of network protocol stack.
CO2	apply knowledge of data communication, data transmission techniques using various transmission media to deliver error free data and communicate with multiple nodes.
CO3	analyse various routing methods to identify effective routing protocols.
CO4	evaluate network performance by means of transport and flow control protocols, Congestion Control protocols and Quality of services.
CO5	create a computer network application using modern network tools and simulation softwares.

2.	Syllabus	
	INTRODUCTION	(06 Hours)
	Overview of Computer Networks and Data Communication, Computer Networking Protocols and Standards, Types of Computer Networks, Network Topology, Protocol Hierarchies and Design Issues, Interfaces and Services, Networking Devices, OSI and TCP/IP Reference Models.	
	PHYSICAL LAYER	(06 Hours)
	Physical Layer Design Issues, Data Transmission Techniques, Multiplexing, Transmission Media, Asynchronous Communication, Wireless Transmission, ISDN, ATM, Cellular Radio, Switching Techniques and Issues.	
	LOGICAL LINK CONTROL LAYER	(06 Hours)
	LLC Design Issues, Framing, Error and Flow Control, Framing Techniques, Error Control Methods, Flow Control Methods, PPP and HDLC.	
	MEDIUM ACCESS CONTROL LAYER	(06 Hours)
	MAC Layer Design Issues, Channel Allocation Methods, Multiple Access Protocols - ALOHA, CSMA, CSMA/CD Protocols, Collision Free Protocols, Limited Contention Protocols, LAN Architectures, IEEE -802 Standards, Ethernet(CSMA/CD), Token Bus, Token Ring, DQDB, FDDI, Bridges and Recent Developments.	
	NETWORK LAYER	(06 Hours)

	Network Layer Design Issues, Routing Algorithms and Protocols, Congestion Control Algorithms and QoS, Internetworking, Addressing, N/W Layer Protocols and Recent Developments.	
	TRANSPORT LAYER	**(06 Hours)**
	Transport Layer Design Issues, Transport Services, Sockets, Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, Multiplexing, Transport Layer Protocols, Real Time Transport Protocol (RTP), Stream Control Transmission Protocol (SCTP), Congestion Control, QoS and Recent Developments, Virtualization, Network Functions Virtualization(NFV), Software Defined Networks.	
	APPLICATION LAYER	**(06 Hours)**
	Client Server Model, Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP) and Recent Developments.	
	Practicals will be based on the coverage of the above topics separately	**(28 Hours)**
	(Total Contact Time: 42 Hours + 28 Hours= 84 Hours)	

3.	**Practicals:**
1	Study network configuration commands and computer network setup.
2	Implementation of different Data Link and MAC Layer protocols.
3	Implementationof different Network Layer protocols.
4	Implementation of different Transport and Application Layer protocols.
5	Design and configure a network systems using modern network simulator softwares.
6	Implementation of Secured Socket Layer protocol.
7	Implementation of ICMP based message transmission over network.
8	Implementation of SMTP protocol for mail transfer.

4. Books Recommended:

1. William Stalling, "Data and Computer Communication", 10/E, Pearson India, 2017.
2. B. Forouzan, "Data Communication and Networking", 5/E, McGraw Hill, 2017.
3. Douglas E. Comer, "Internetworking with TCP/IP Volume – I", 6/E Pearson India, 2015.
4. Andrew S. Tanenbaum, "Computer Network", 5/E, Pearson India, 2013.
5. W. Richard Stevens, "TCP/IP Illustrated Volume - I", 2/E, Addison Wesley, 2011.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – IV MICROPROCESSOR AND INTERFACING TECHNIQUES AI232		L	T	P	Credit
	Scheme	3	0	2	04

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	Acquire knowledge of diff erent architectures, addressing modes and instructi ons of 8085/86.
CO2	Interface memory, I/O devices and interrupt controller with 8085/86 microprocessors
CO3	Analyse and compare the features of microprocessors and microcontrollers.
CO4	Describe the internal architecture and diff erent modes of operati ons of a typical peripheral device.
CO5	Design and develop assembly language programs using 8085/86 instructi ons, soft ware interrupts, subrouti nes, macros.

2.	Syllabus	
	INTRODUCTION TO MICROPROCESSOR EVOLUTION	(02 Hours)
	Introduction to Microprocessor and Development and its Operation.	
	ARCHITECTURE FEATURES OF 8085	(03 Hours)
	8085 Architecture and Pin out diagram, 8085 Operations.	
	INTRODUCTION SET AND PROGRAMMING OF 8085	(06 Hours)
	Data Transfer instructi ons, Arithmeti c instructi ons and its examples, Logical Instructi ons and its examples, Branch, Stack, and I/O related instructi ons, How to write, assemble and execute assembly language programmes, Assembly language programming Practi ce Based on above instructi ons for 8085, Design Counters in 8085, Design Time delays in 8085, Stack & Subrouti nes: Restart, Conditi onal and Unconditi onal Call and Return Instructi ons, Advanced Subroutine Concepts, Code Conversion, 16-bit Data Operation.	
	PERIPHERAL & MEMORY INTERFACING WITH 8085	(08 Hours)
	Basic I/O Interfacing Concepts: Interfacing Display devices, Interfacing Input devices, Memory Interfacing: Absolute decoding, Parti al Decoding, Shadow Memory, Interfacing Peripherals: 8255A Programmable Peripheral Interface, Examples of Interfacing Keyboard and seven-segment Display, Examples of Bidirecti onal Data transfer Between Two Microcomputer, The 8254 (8253) Programmable Interval Timer, The 8259A Programmable Interrupt Controller, Direct Memory Access and 8237 DMA Controller, The 8279 Programmable Keyboard/Display Interface, Interfacing Scanned Multi plexed Displays and Liquid Crystal Displays, Interfacing a Matrix Keyboard, Serial I/O and Data Communicati on: Basic concepts in Serial I/O,	

	Software Controlled Asynchronous Serial I/O, The 8085-Serial I/O lines: SOD and SID, Hardware Controlled Serial I/O Using Programmable Chips.	
	8085 INTERRUPT MANAGEMENT	(04 Hours)
	Interrupts and its Types in 8085, Interrupt Vector Table, Priority of Interrupts, Programming using Interrupts.	
	8086 ARCHITECTURE	(03 Hours)
	8086 Architecture, Pin Out Diagram and its Features, Registers of 8086.	
	INSTRUCTION SET OF 8086	(06 Hour)
	Data Transfer Instructi ons and Examples based on it, Arithmeti c Instructi ons and Examples based on it, Logical Instructi ons, Comparison Instructi ons, Jump Instructi ons, Examples based on Logical, Comparison, Jump Instructi ons, Various 8086 Assembler Directives, Examples based on Various Assembler Directi ves, What are Procedures in 8086?, Procedure-based Examples in 8086, What are Macros in 8086? Macros-based Examples in 8086.	
	PERIPHERAL & MEMORY INTERFACING WITH 8086	(04 Hour)
	Interfacing Peripherals:- 8255A: Examples of Interfacing Keyboard and Seven-segment Display, Interfacing with Alphanumeric Displays, Examples of Bidirecti onal Data Transfer Between Two Microcomputer, 8254, 8259A, and 8279 Interfacing with 8086.	
	8086 INTERRUPTS MANAGEMENT AND APPLICATIONS	(03 Hour)
	8086 Interrupts and Interrupts Responses, Interrupt Pointer Table, Hardware Interrupt, Software Interrupts, Interrupt Applications.	
	RECENT TRENDS IN MICROPROCESSORS	(03 Hour)
	Practicals will be based on the coverage of the above topics.	(30 Hours)
		(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3.	**Practicals:**
1	Introduction of 8085 kit and Installati on Of 8085 simulator
2	Assembly Language Programming based on Data transfer and Arithmetic and Logic instructions
3	Assembly Language Programming based on Branch operations
4	Assembly Language Programming based on stack and subroutines
5	Assembly Language Programming based on Code conversions

6	Assembly Language Programming based on counter and time delays
7	Introduction of 8086 Microprocessor and Installati on of TASM, TLINK, TD, and DEBUG
8	Assembly Language Programming based on 8086 instructi on and assembler directi ves
9	Practical based on 8085 interfacing

4. Books Recommended:

1. Senti lkumar N, Saravanan M and Jeevananthan S, "Microprocessors and Microcontrollers" 2/E, Oxford University Press, 2018..
2. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applicati ons with 8085", 6/E, Penram Internati onal Publishing (India) Pvt. Ltd., 2013.
3. Douglas V Hall, "Microprocessors and Interfacing: Programming & Hardware", 3/E, TMH, 2013
4. Brey, "The Intel Microprocessors", 8/E, Pearson Educati on, 2009.Andrew Ilachinski, "Cellular Automata", 1st Ed., World Scientific, 2001.
5. A K Ray and K M Bhurchandi, "Advanced Microprocessors & Peripherals: Architecture Programming & Interfacing", 2/E, TMH, 2006.

ADDITIONAL REFERENCE BOOKS

1. Abel Peter and Nizamuddin, "IBM PC Assembly Language and Programming", 5/E, Pearson Education, 2001.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Department of Artificial Intelligence

B.Tech. Artificial Intelligence

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Annexure 66.32
of the 66th meeting of the IAAC

Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat.

Department of Electrical Engineering

B. Tech. Electrical Engineering (2nd Year Scheme)

S. No.	Subjects	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	Third Semester (2nd year of UG)				
1.	Electrical Machines I	EE201	3-1-2	5	100
2.	Signals & Systems	EE202	3-1-0	4	70
3.	Electromagnetic theory	EE231	3-1-0	4	70
4.	Digital Circuits	EC209	3-0-2	4	85
5.	Elective	EE2AA	3-X-X	3/4	55/70/85
			Total	**20-21**	**380-410**
	Fourth Semester (2nd year of UG)				
1.	Electrical Machines – II	EE202	3-1-2	5	100
2.	Elements of Power Systems	EE204	3-1-2	5	100
3.	Numerical Methods and Applications to Electrical Engineering	EE232	3-1-2	5	100
4.	Professional Ethics, Economics and Business Management	MG210	3-1-0	4	70
5.	Elective	EE2BB	3-X-X	3/4	55/70/85
			Total	**22-23**	**425-455**
6.	Minor/Honor/ (M/H#1)	EE2CC	3-X-X	4	70/85
7.	Vocational Training/ Professional Experience (optional) (Mandatory for Exit)	EEV04/ EEP04	0-0-10	5	200 (20x10)

Sr. No.	**Optional Core**	Code	Scheme L-T-P
1.	Electromagnetic Theory	EE231	3-1-0
2.	Numerical Methods and Applications to Electrical Engineering	EE232	3-1-2

Sr. No.	**Electives**	Code	Scheme L-T-P
	B. Tech. II year (EE2AA, EE2BB)		
	III Semester (EE2AA)		
1.	Renewable Energy Sources	EE251	3-0-0
2.	Modern Material for Electrical Engineering	EE252	3-0-0
3.	Object oriented programming and Data structure	EE253	3-0-0
4.	Principles and applications of electrochemistry	CY251	3-0-0
	IV Semester (EE2BB)		
5.	Special Electrical Machines	EE254	3-0-0
6.	Digital Signal Processing	EE255	3-0-0
7.	Power Plant Engineering	EE256	3-0-0
8.	Energy Audit and Management	EE257	3-0-0

Sr. No.	**for B.Tech. (CE, ME, ChE) students (Minor in Electrical Engineering)**	Code	Scheme L-T-P
1.	Electrical Circuits (IV semester)	EE281	3-1-0

Sr. No.	**for B.Tech. (AI, CSE, ECE) students (Minor in Electrical Engineering)**	Code	Scheme L-T-P
1.	Electrical Machines (IV semester)	EE282	3-0-2

Sr. No.	**B.Tech. in Electrical Engineering with Honours in Power Electronics & Electrical Drives (PEED)**	Code	Scheme L-T-P
1.	Modeling of Electrical Machines (IV semester)	EE291	3-1-0

Sr. No.	**B.Tech. in Electrical Engineering with Honours in Power Systems (PS)**	Code	Scheme L-T-P
1.	Computer Methods for Power Systems (IV semester)	EE292	3-1-0

Sr. No.	**B.Tech. in Electrical Engineering with Honours in Instrumentation and Control (IC)**	Code	Scheme L-T-P
1.	State Variable Analysis (IV semester)	EE293	3-1-0

B. Tech. II year, Semester III	L	T	P	Credit
Electrical Machines – I	3	1	2	05

EE201 **Scheme**

1. Course Outcomes (Cos):

At the end of the course the students will be able to:

CO1	explain the construction and principle of operation of the transformers and induction motors.
CO2	perform tests on the transformers and induction motors
CO3	analyze the performance of the transformers and induction motors
CO4	compare the performance of different types of transformers and induction motors
CO5	select the machines for different real world applications
CO6	communicate effectively through laboratory report writing, presentation and perform task as an efficient team member

2. Syllabus

- **Transformers** **(06 Hours)**
  Review of equivalent circuits and vector diagram, circuit parameter determination, per unitimpedance, regulation, losses, efficiency, magnetic inrush and effect of saturation, parallel operation.
- **Polyphase Transformers** **(09 Hours)**
  Standard connections phase angle difference, harmonic analysis, open delta connection, Scott connections, three-phase to six-phase conversion, three winding transforms and parallel operation.
- **Auto Transformers** **(02 Hours)**
  Construction, voltage and current ratios, phasor diagram and equivalent circuit.
- **Tests On Transformers** **(04 Hours)**
  OC- SC tests, Polarity test, Back to back Sumpner's test.
- **Three-Phase Induction Motors** **(07 Hours)**
  Review of equivalent circuit and vector diagram, performance analysis, torque-speed characteristics,no load and blocked rotor tests, circle diagram.
- **Starting, Braking And Speed Control** **(07 Hours)**
  Double cage motors, starting problems, methods of starting, speed control methods, cascade connections, cogging and crawling, regenerative braking, plugging, ac and dc dynamic (rheostatic) braking.
- **Induction Generators And Regulator** **(03 Hours)**
  Principle of operation, performance analysis, application.
- **Single Phase Induction Motors** **(04 Hours)**
  Principle of operation, revolving field theory, cross field theory, equivalent circuit and performance analysis, determination of circuit parameters by no- load and blocked rotor test, starting methods, unbalanced operation of three phase induction motor.

Total Hours:42

Tutorials will be conducted separately for 15 hours

3. List of Experiments:

1. Determination of efficiency & regulation of single- phase transformer from Open circuit andshort circuit test.
2. Determination of efficiency & regulation of single- phase transformer from Sumpner's test.
3. Scott connection of 1-phase transformers.
4. Open delta connection of three single-phase transformers.
5. Standard connections for three-phase transformer.
6. Load test on three-phase Induction Motor.
7. Load test on three-phase Induction Generator.
8. Determination of the equivalent circuit parameters from No-Load and Blocked rotor tests ofthree-phase Induction Motor.
9. Determination of the equivalent circuit parameters from No-Load and Blocked rotor tests of1-phase Induction Motor.
10. Determination of the performance parameters of three-phase induction motor from circlediagram.
11. Induction regulator.
12. Unbalanced operation of three-phase Induction Motor.

4. Books Recommended:

1. I. J. Nagrath and D. P. Kothari, Electric Machines, Tata McGraw Hill, New Delhi, 2005.
2. M. G. Say, The performance and design of alternating current machines, CBS Publishers and Distributors, Delhi, 1983.
3. Fitzgerald, Kingsley and Umans, Electric Machinery, Tata McGraw Hill, New Delhi, 2003
4. S. K. Sen, Electrical Machinery, Khanna Pub., Delhi, 2012.
5. Mukherjee and Chakravorty, Electrical Machines, Dhanpat Rai Pub., New Delhi, 2005.

B. Tech. II year, Semester III	**L**	**T**	**P**	**Credit**
Signals and Systems	**3**	**1**	**0**	**04**

EE202 **Scheme**

1. Course Outcomes (Cos):

At the end of the course students will be able to:

CO1	classify various signals and their mathematical representation
CO2	develop insights into discrete-time systems and their realization
CO3	analyse the characteristics of LTI systems with the help of impulse response and convolution
CO4	design the system properties in frequency domain
CO5	analyse random signals and justify their usefulness in engineering systems

2. Syllabus:

- **Signals And Their Properties** **(08 Hours)**
  Classification of Signals, continuous-time and discrete-time signals, deterministic and random signals, periodic signals, even and odd signals, exponential and sinusoidal signals, unit step and unit impulse signals, systems with and without memory, time-varying, time-invariant, stationarity, causality, homogeneity, linearity, stability of systems
- **Linear Time Invariant Systems** **(08 Hours)**
  Properties of linear time-variant systems, continuous-time LTI systems, relationship between linear differential equations with constant coefficients, transfer function, state space models, convolution integrals from transfer function and state space models, discrete-time LTI systems, relationship between linear difference equations with constant coefficients, pulse transfer function, discrete-time state space models, convolution sum from transfer function and state space models, connections between time-invariance, causality, stationarity.
- **Fourier Series Representation And Fourier Transform** **(05 Hours)**
  Fourier series representation of continuous-time periodic signals, Parseval formula for continuous-time periodic signals, continuous time Fourier transform, discrete-time Fourier transforms, connection between the Fourier transform and Laplace transform, connection between the z-transform and discrete-time Fourier transform.
- **The Laplace Transformation Technique** **(06 Hours)**
  Definition of the Laplace transformation, the need of the Laplace transformation, region of the convergence of the Laplace transform of signals, properties of the Laplace transform, the Laplace transforms of test signals and practically useful signals, unilateral Laplace transform and bilateral Laplace transforms.
- **The Z-Transformation Technique** **(06 Hours)**
  Definition of the z- transformation, the need of the z- transformation, region of the convergence of the z-transform of signals, pulse transfer function, stability of systems using the z-transform. The z-transforms of test signals and practically useful signals, unilateral z transform and bilateral z transforms
- **Feedback Concepts** **(09 Hours)**
  Physical representation of network, general restrictions on physical network characteristics Feedback, mathematical definition of feedback, stability and feedback realizability, contour integration and Nyquist criterion for stability, physical representation of network, general restrictions on physical network characteristics

Total Lectures: 42

Tutorials will be conducted separately for 15 hours

3. **Books Recommended**:

1. A. V. Oppenheim, A. S. Wilsky and S. H. Nawab, Signals and Systems, Pearson India Education Services Private limited India, 2nd Edition, 2016.
2. R. A. Gabel and R. A. Robert, Signals and Linear Systems, John Wiley and Sons, 3rd Edition, 1987.
3. B. P. Lathi, Principles of Linear Systems and Signals, Oxford University Press, 2nd Edition, 2009.
4. C. T. Chen, Systems and Signal Analysis - A Fresh Look, Oxford University Press India, 3rd Edition, 2004.
5. S. T. Alan, Introduction to Signals and Systems, Thomson India Edition, 1st Edition, 2007.

B. Tech. II year, Semester III

Electromagnetic Theory

EE231

L	T	P	Credit
3	1	0	04

Scheme

1. Course Outcomes (Cos):

At the end of the course the students will be able to:

CO1	describe various theorems related to vector analysis and their application to determine Maxwell's equations
CO2	differentiate different types of coordinate systems and use them for solving the problems of electromagnetic field theory
CO3	explain concepts, theories and laws of electrostatics, magnetics, electromagnetics, electromagnetic wave propagation and transmission lines
CO4	analyze problems of electrostatics, magnetics, electromagnetics and electromagnetic wave propagation
CO5	apply theories and laws of electrostatics, magnetics and electromagnetics to solve electrical engineering problems
CO6	deduce the electromagnetic wave propagation from Maxwell's equations and apply the wave propagation for transmission line

2. Syllabus

- **Coordinate Systems And Vector Calculus** **(08 Hours)**
  Scalar and Vector Fields, Review of basic vector operations, Overview of Coordinate systems (Rectangular, Cylindrical, Spherical and their transformations), curvilinear systems, Vector Calculus: Integral and Differential Vector Calculus (Gradient, Divergent, Curl, Laplacian, Divergence and Stokes Theorem).

- **Electrostatics** **(12 Hours)**
  Coulomb's law, Electrical filed intensity, electric flux density, electric field due to point, line, sheet, spherical charge distributions, Gauss' law and its applications, Divergence and curl of electrostatic field, electric potential, potential due to point, line, spherical charge distributions, potential gradient, Electric dipole, Dipole moment, potential and electric field due to an electric dipole, Energy in electrostatic field, Electric fields in material space (properties of materials, convection and conduction current, polarization in dielectrics, continuity equation and relaxation time), boundary conditions, Poisson's and Laplace' equations, Uniqueness theorem, resistance, capacitance calculation.

- **Magnetostatics** **(10 Hours)**
  Biot-Savart's law, magnetic flux density, magnetic field intensity, magnetic field due to straight wire, surface, solenoid, toroid carrying steady current Ampere's Law and its applications, Divergence and curl of Magnetic field, Comparison of magnetostatics and electrostatics, Magnetic scalar and vector potentials, Lorentz force, inductance, self and mutual inductance of solenoid, toroidal and other simple configurations, conductors, magnetic materials, energy in magneto static fields, boundary conditions.

- **Maxwells Equations For Time Varying Fields** **(06 Hours)**
  Faraday's law, Lenz's law, transformer emf and motional emf, inconsistency of Ampere's law, displacement current, Maxwell's equations in Final forms (Time Varying and Time Harmonic Fields).

- **Electromagnetic Wave And Transmission Lines** **(06 Hours)**
  Waves in General, Wave equations, wave propagation in lossy dielectrics, plane waves in free space, plane waves in good conductors, Power and Poynting theorem, Transmission line Parameters, Line equations, input impedance, standing wave ratio and power, some applications of Transmission lines.

Total Hours:42

Tutorials will be conducted separately for 15 hours

3. Books Recommended:

1. William H. Hayt Jr., John A. Buck, and M Jaleel Akhtar, Engineering Electromagnetics, McGraw Hill, 2020, 9th Edition.
2. Matthew Sadiku and S.V. Kulkarni, Elements of Electromagnetics, Oxford University Press, 2015, 6th Edition.
3. Nathan Ida, Engineering Electromagnetics, Springer, 2021, 4th Edition.
4. David J. Griffiths, Introduction to Electrodynamics, 4th Edition, PHI, 2013.
5. S. P. Seth, Elements of Electromagnetic Fields, Dhanpat Rai & Co., 4th Edition, 2012.
6. Engineering Electromagnetics, C. L. Wadhwa, New Age International Publishers, 3rd Edition, 2012.
7. Electromagnetic Fields Theory, Rakesh Singh Kshetrimayum, Cengage Learning, First Impression, 2012.

B. Tech. II year, Semester III

DIGITAL CIRCUITS

L	T	P	Credit
3	0	2	04

EC 209 **Scheme**

1. Course Outcomes (COs):

At the end of the course the students will be able to:

CO1	Understand Boolean algebra, Postulates and theorems of binary logic, and logic gates.
CO2	Formulate combinational logic problems and solve using truth table and optimize using K-map and other equivalent techniques.
CO3	Design and analyse various sequential logic circuits using flip-flops
CO4	Explain the operation of counters, registers, and memory
CO5	Describe digital hardware using VHDL statements and simulate logic circuit
CO6	Realize circuits for ALU, Shifter, and Control unit architectures

2. Syllabus:

- **Boolean Algebra And Simplification** **(08 Hours)**

  Basic Logic Operation and Logic Gates, Truth Table, Basic Postulates and Fundamental Theorems of Boolean Algebra, Standard Representations of Logic Functions- SOP and POS Forms, Simplification of Switching Functions-K-Map and Quine-Mccluskey Tabular Methods, Synthesis of Combinational Logic Circuits

- **Combinational Logic Circuits** **(08 Hours)**

  Binary Parallel Adder, BCD Adder, Encoder Priority Encoder, Decoder, Multiplexer and Demultiplexer Circuits, Implementation of Boolean Functions using Decoder and Multiplexer, Arithmetic and Logic Units, BCD-To-Segment Decoder, Common Anode and Common Cathode, Random Access Memory, Read Only Memory and Erasable Programmable ROMs, Programmable Logic Arrays(PLA) and Programmable Array Logic(PAL)

- **Latches And Flip-Flops** **(06 Hours)**

  Cross Coupled SR Flip-Flop Using NAND or NOR Gates, Clocked Flip-flops, D-Types and Toggle Flip-flops, Truth Tables and Excitation Tables for Flip-flop. Master Slave Configuration, Edge Triggered and Level Triggered Flip-flop, Flip-flop with Preset and Clear

- **Sequential Logic Circuit** **(09 Hours)**

  Introduction to State Machine, Mealy and Moore Model, State Machine Notation, State Diagram, State Table, Transition Table, Table Excitation, Table and Equation, Basic Concepts of Counters and Register, , Shift Left and Right Register, Registers with Parallel Load, Serial-in-Parallel-Out(SIPO) and Parallel-In-Serial-Out(PISO), Register Using Different Types of Flip-flop, Binary Counters, BCD Counters, Up Down Counter, Johnson Counter, Module-N Counter, Design of Counter using State Diagrams and Tables, Sequence Generators

- **Processor Logic Design** **(08 Hours)**

  Arithmetic, Logic and Shift Micro-Operation, Arithmetic Shifts, Design of Arithmetic Logic Unit (ALU), Control Unit Organization – Hard-Wired

- **Introduction To Vhdl** **(06 Hours)**
  Introduction, Data Type, Operators and Operands, Signal Assignment Statements (Concurrent, Conditional and Selected), Structural Modeling, Process Statement and Behavioral Modeling, HDL code for Registers, Flip-flop, Multiplexer, Adder/Subtractors.

(Total Contact Hours: 45)

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3. List of Practicals:

(The following practicals are to be performed using discrete components)

1. Introduction to the variety of logic gates and digital ICs
2. Latches using NAND/ NOR Gate.
3. Flip-flops using NAND/ NOR Gate
4. Half-Adder/Half-subtractor Circuits using a serial Input.
5. Full-Adder/Full-subtractor Circuits using a serial Input.
6. Parity checker and parity generator circuit
7. 4-Bit Gray to Binary/ Binary to Gray Code converter using Select input.
8. Boolean function implementation using MUX
9. (a) Mod 5 ripple up counter using JK flip flops (b) Mod 5 ripple down counter using JK flip flops

(The following practicals are to be performed on a CPLD/FPGA kit using VHDL)

10. Adders: (a) 1-bit Full adder (b) 4-bit Ripple carry adder using structural modeling
11. 4x1 MUX implementation using concurrent signal assignment statements
12. D and JK Flip flops with synchronous reset.
13. 4-Bit Shift Left/Right Register.
14. 4-bit Ripple counter with Asynchronous Reset.

4. Books Recommended:

1. Mano Morris, "Digital Logic and Computer Design", Pearson Education, 2019 Edition.
2. Anand Kumar, "Fundamentals of Digital Circuits", 4th Ed., PHI, 2016.
3. Jain R. P. and Anand M. H. S., "Digital Electronics Practices using Integrated Circuits", 1st Ed., TMH, 2004.
4. Lee Samuel, "Digital Circuits and Logic Design", PHI Learning, 2009.
5. Floyed Thomas L. and Jain R. P., "Digital Fundamentals", 8th Ed., Pearson Education, 2006.

5. Reference Books:

1. Brown S. and ZvonkoVranesic, "Fundamental of Logic with Verilog Design", 1st Ed., Tata McGraw Hill, 2003.

B. Tech. II year, Semester III
RENEWABLE ENERGY SOURCES

L	T	P	Credit
3	0	0	03

EE 251 **Scheme**

1. Course Outcomes (COs):

At the end of the course the students will be able to:

CO1	Understand the limits of the conventional energy sources and present scenario of renewable energy conversion.
CO2	Explain the working principle of wind energy conversion and identify the suitable turbine and power electronic interfaces.
CO3	Acquire the knowledge of the solar thermal energy conversion and associated applications.
CO4	Explain the working principle of solar energy conversion, maximum power tracking algorithms and power electronics interface.
CO5	Understand the basic operation of the other renewable energy sources.

2. Syllabus:

- **Present world and Indian energy scenario** **(03 Hours)**
  Conventional sources of energy, their availability and limitations, alternative sources of energy, their advantages and present status.
- **Wind Energy** **(10 Hours)**
  Introduction, types of wind turbines and their characteristics, wind data and energy estimation, site selection, basic components of wind electric conversion system, types of electrical machines suitable for wind energy conversion, maximum power extraction, power electronics interface for wind turbine.
- **Solar Thermal Energy** **(05 Hours)**
  Introduction, Solar energy storage systems, thermal storage, sensible heat storage, latent heat storage, solar pond, non-conductive solar pond, Extraction of Thermal energy, Applications of Solar pond, solar thermal electric conversion.
- **Solar Photovoltaic Energy** **(12 Hours)**
  Basics of p-n junction, p-n junction exposure to light, photovoltaic cell/module characteristics and effects of light intensity and temperature variations, maximum power point tracking algorithms, power electronics interface for solar photovoltaics, PV applications (domestic loads, battery storage, and irrigation), and different thin film PV technologies.
- **Bio Energy** **(06 Hours)**
  Introduction to biomass, Biomass conversion technologies, wet process and dry process, Biogas generation, classification of biogas plants, continuous & batch types, The dome and the drum types, Different variations in the drum type, Types of Biogas plants, Floating gas holder, Fixed dome digester, Biogas from plant wastes, Community biogas plants, Materials used for biogas generation, selection of site for biogas plant, Methods of maintaining Biogas generation, starting a biogas plant, Fuel properties of biogas, utilization of biogas, methods of obtaining energy from Biomass Combustion.
- **Other Sources of Renewable Energy** **(06 Hours)**
  Geothermal energy, classifications and prime movers used for geothermal energy, fuel cell technologies, different types of fuel cells, OTEC energy conversion.

Total Lecture Hours: 42

3. Books Recommended:

1. J. K. Nayak and S. P. Sukhatme, “Solar Energy - Principles of thermal collection and storage”, TMH, 2008.
2. J. Twidell and T. Weir, “Renewable Energy Resources”, E & F N Spon Ltd, London, 1999.
3. Bent SØrensen, “Renewable Energy: physics, engineering, environmental impacts, economics & planning”, 4th Edition, Academic Press, Gurgaon, 2011.
4. Chetan Singh Solanki, “Solar Photovoltaics: Fundamental, Technologies and Applications”, 2nd Edition, PHI Learning Pvt. Limited, New Delhi, 2011.
5. Gary L. Johnson, "Wind Energy Systems", Prentice Hall Inc., 1985.
6. Klouse Jägar, et al., “Solar Energy: Fundamental, Technology and Systems”, Delft University of Technology, Netherlands, 2014.

B. Tech. II year, Semester III

Modern Materials for Electrical Engineering

L	T	P	Credit
3	0	0	03

EE 252 **Scheme**

1. Course Outcomes (COs):

At the end of the course the students will be able to:

CO1	Understand the properties of liquid, gaseous and solid insulating materials.
CO2	Appreciate properties of magnetic materials.
CO3	Explain semiconductor material technology.
CO4	Acquire knowledge on materials used in electrical engineering and applications.
CO5	Evaluate insulating, conducting and magnetic materials used in electrical machines.
CO6	Appreciate usefulness of special purpose materials.

2. Syllabus:

- **Dielectric Materials** **(10 Hours)**

  Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, liquid dielectric, Electric conductivity in solid, liquid and gaseous dielectrics, Properties of ferroelectric materials in static fields, Spontaneous polarization, Curie point, Anti-ferromagnetic materials, Piezoelectric and Pyroelectric materials.

- **Magnetic Materials** **(10 Hours)**

  Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic anisotropy, magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets, factors effecting permeability and hysteresis.

- **Semiconductor Materials** **(8 Hours)**

  Method of semiconductor material preparation, Purification and Doping, Introduction to process of Manufacturing Semiconductor Devices, Transistors, Integrated Circuits. Monolithic Diodes, Integrated Resistors and Integrated Capacitor.

- **Materials for Electrical Applications** **(6 Hours)**

  Materials used for resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, liquid and gaseous insulating materials. Effect of moisture on insulation.

- **Special Purpose Materials** **(8 Hours)**

  Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI.

(Total Lecture Hours: 42)

3. Books Recommended:

1. Dekkar, A.J., ``Electrical Engineering Materials, Reprint Edition", 2009, Prentice Hall Publications Co.
2. Kasap S.O., ``Principle of Electronic Materials and Devices", Second Edition, Tata McGraw- Hill.
3. Indulkar C, ``Introduction to Electrical Engineering Materials'', 2004, S. Chand & Company Ltd-New Delhi.
4. S.P. Seth, P.V. Gupta, `` A course in Electrical Engineering Materials", Dhanpat Rai & Sons.
5. T.K. Basak, ``A course in Electrical Engineering Materials", 2009, New Age Science Publications.

B. Tech. II year, Semester III

Object Oriented Programming and data Structure

L	T	P	Credit
3	0	0	03

EE 253 **Scheme**

1. Course Outcomes (COs):

At the end of the course, the students will be able to

CO1	Explain the fundamentals of object-oriented programming
CO2	Classify various functions and variables used in object-oriented programming
CO3	Develop programs for implementing linear data structures
CO4	Asses various tree and graph traversing techniques
CO5	Compare various sorting techniques by using time and space complexity analysis

2. Syllabus

- **Introduction to object-oriented programming and Overview of C++** **(10 Hours)**
  Basic concepts of object-oriented programming (OOP), Benefits and Applications of OOP.
  Classes and Objects, Defining and Accessing member functions and variables, Static variables and static functions, Friend function, Dynamic memory allocation, Constructors and Destructors, Overloading – Function and operator overloading
- **Inheritance & Polymorphism** **(08 Hours)**
  Base Classes and Derived Classes, Public, Protected and Private Inheritance, Multilevel, Multiple, Hierarchical and Hybrid Inheritances, Constructors and Destructors in derived Classes, Virtual base classes and abstract classes. Pointers in C++, This pointer, Types of polymorphisms: static and run-time polymorphism and Virtual functions.
- **Linear Data Structures** **(10 Hours)**
  Introduction to data structures, Arrays, Linked Lists – Singly linked, doubly linked lists. Implementation of Stack and Queue by using Arrays and linked lists. Analysis of Algorithms, Big – O Notation.
- **Non-Linear Data Structures** **(08 Hours)**
  Trees, Binary Trees, Binary tree representation and traversals, Application of trees, Graph and its representations – Graph Traversals – Representation of Graphs, Breadth-first search, Depth-first search.
- **Sorting and searching** **(09 Hours)**
  Sorting algorithms: Bubble, Insertion, Selection, Quick and Merge sorts Searching: Linear search –Binary Search

(Total Contact Time: 45 Hours)

3. Books Recommended

1 Bjarne Stroustrup, C++ Programming Language, Fourth Edition, Addison-Wiley Publications.
2 Ulla Kirch-Prinz, Peter Prinz, A Complete Guide to Programming in C++, 1st Edition, Jones And Bartlett Publishers
3 E Balaguruswamy, “Object Oriented Programming with C++”, 7th Edition, Tata McGraw Hill publication
4 Trembley & Sorenson: "An Introduction to Data Structures with Applications", 2/E, TMH, 1991.
5 Tanenbaum & Augenstein: "Data Structures using C and C++", 2/E, Pearson, 2007

B. Tech. II year, Semester III
Principles and applications of Electrochemistry

L	T	P	Credit
3	0	0	03

CY 251 **Scheme**

1. Course Outcomes (Cos):

At the end of the course students will be able to:

CO1	Acquire knowledge about basic concepts of electrochemistry in the elementary level such as different type of cells, laws of electrolysis, theory of conduction of electricity in solution, etc.
CO2	Understand about electrochemical kinetics and mechanism
CO3	Develop understanding about electrochemical techniques involved in the area of energy conversion and storage
CO4	Differentiate between electrochemical devices
CO5	Accumulate a deep knowledge about electrochemistry concepts applicable in multidisciplinary areas.

2. Syllabus

- **FUNDAMENTALS OF ELECTROCHEMISTRY** **(07 Hours)**

  Electrochemical cells; Characteristics of electrochemical cells; Importance of electrochemical systems; Scientific units, Constants, Cell conventions; Faraday's law; Faradic efficiencies; Electrochemical cells, Electrochemical series; Electrode types (SHE, Glass, Calomel etc.); Equilibrium cell potentials; Reversibility and Gibb's free energy; Free Energy and Standard cell potentials; Effect of temperature on standard cell potentials; Activity coefficients; EMF and concentration; The Nernst equation; Liquid junction potentials.

- **ELECTROCHEMICAL KINETICS AND CATALYSIS** **(06 Hours)**

  Electrochemical double layer; Dynamic equilibrium; Rate equation; Arrhenius equation and activation energy; Exchange current density; Interfacial potential; Butler–Volmer equation; Current –overpotential characteristics; Tafel equation.

- **ELECTRODE STRUCTURE AND CONFIGURATIONS** **(06 Hours)**

  Structure and characterization of porous electrodes; Electrode material type: silicon, carbon based, transition metal, rare earth metals based etc.; Gas-liquid interface in porous electrode; Three-phase electrodes.

- **ELECTROCHEMICAL METHODS** **(06 Hours)**

  Types of techniques; Detection; current-potential characteristics; A planar microelectrode; Cyclic voltammetry; Electrochemical Impedance; Rotating Disc electrode.

- **ENERGY HARVESTING APPLICATIONS OF ELECTROCHEMISTRY:** **(14 Hours)**

  Batteries: Fundamentals, classification and components of a cell; Cell characteristics and electrochemical performance; Efficiency of cell; Supercapacitors: Introduction, types, advantages and applications; Solar cells: Principle**,** Construction, working and application of solar cells, crystalline silicon-based and thin-film solar cells: silicon based solar cells, Cadmium telluride solar cells, Dye sensitized solar cells, Copper-indium-gallium-selenide (CIGS) solar cells. Introduction and types of fuel cells; EMF of fuel cell; Current-voltage characteristics and overpotentials, direct alcohol fuel cells; molten carbonate fuel cells; solid oxide fuel cells; proton exchange membrane fuel cell (PEMFC).

- **INDUSTRIAL SIGNIFICANCE OF ELECTROCHEMISTRY** **(06 Hours)**

  Electrochemical Corrosion; Electrodeposition; Industrial electrolysis; Redox-flow batteries.

(Total Lecture Hours: 45)

3. **Books Recommended:**

1. S. Glasstone*,* An Introduction to Electrochemistry*,* Maurice Press, 2011.
2. Thomas F. Fuller, John N. Harb., "Electrochemical Engineering" Wiley, 2018.
3. Corrosion Engineering: Principles and Practices, Pierre R. Roberge, McGraw Hill, 2008.Corrosion, Vol. I, Edited by L. L. Shreir
4. Allen J. Bard, Larry R. Faulkner., "Electrochemical Methods-Fundamentals and Applications" John Wiley & Sons.
5. Thomas Engel and Philip Reid, Physical Chemistry, Pearson Publication 2006.

For further reading:

1. The Elements of Physical Chemistry', P.W. Atkins & Julio de Paula, 8th edition, Oxford University Press, Oxford 2006.
2. P. C. Rakshit, Physical Chemistry, 7th Edition, Sarat Book Distributors, Kolkata, 2004.

B. Tech. II year, Semester IV

Electrical Machines – II

L	T	P	Credit
3	1	2	05

EE202 **Scheme**

1. course outcomes (COs):

At the end of the course the students will be able to:

CO1	explain the construction and principle of operation of the DC machines and synchronous machines
CO2	perform tests on the DC machines and synchronous machines
CO3	analyze the performance of the DC machines and synchronous machines
CO4	compare the performance of different types of DC machines and synchronous machines
CO5	select the machines for different real world applications
CO6	communicate effectively through laboratory report writing, presentation and perform task as an efficient team member

2. Syllabus

- **Starting, Speed Control And Braking Of Dc Machines** **(06 Hours)**
  Starting problems, methods of starting, starters, methods of speed control, methods of braking.

- **Direct Current Machines** **(09 Hours)**
  Construction, armature windings, simple lap and wave windings, armature reaction, demagnetizing and cross magnetizing ampere-turns, compensating winding, commutation, commutation time and type, reactance voltage, inter-poles, ampere-turns for inter-poles, self and separate excitations, shunt, series and compound motors and generators, magnetization characteristics, performance characteristics of DC generators and motors.

- **Starting, Speed Control And Braking Of Dc Machines** **(05 Hours)**
  Swinburne's test, Hopkinson's test, separation of core losses, retardation test, series field test.

- **Brushless D.C.Machine** **(03 Hours)**
  Construction, equivalent circuit, performance analysis.

- **Synchronous Machines**

Construction, cylindrical and salient pole type, basic principles, armature windings, distributed winding, full pitched windings, chording, EMF equation, distribution and pitch factors, excitation system **(04 Hours)**

armature reaction, synchronous machine impedance, SCR, equivalent circuit, phasor diagram, voltage regulations, synchronous impedance method, MMFmethod, ZPF method, operating characteristics **(05 Hours)**

'V' and inverted 'V' curves, power angle characteristics, power flow equation forsalient and non-salient pole type synchronous machines, salient pole synchronous machine - two reaction model, phasor diagram, **(05 Hours)**

power angle characteristic, hunting, damper winding, parallel operation of alternators, starting methods of synchronous motors, synchronous condenser, synduction machines **(05 Hours)**

Total 45 Hou

Tutorials will be conducted separately for 14 hours

3. List of experiments:

1. Speed control of dc shunt motor.
2. Swinburne's test
3. Speed torque characteristic of a D. C. Shunt motor.
4. D. C. Series motor, Speed -torque characteristic.
5. External & Internal characteristics of D. C. separately excited and Shunt generator.
6. Regulation of an alternator by synchronous impedance method
7. 'V' and 'inverted V' curves of a synchronous motor.
8. Regulation of an alternator by zero power factor method
9. Regulation of an alternator by MMF method.
10. Synchronization of an alternator with infinite bus bar.
11. Power factor improvement using synchronous motor.
12. Hopkinson's Test on DC machines.
13. Retardation Test on DC Shunt motor.
14. Separation of core losses of DC machines.

4. Books Recommended:

1. Nagrath and Kothari, "Electric Machines", TMH, New Delhi, 2005.
2. M. G. Say, The performance and design of alternating current machines, CBS Publishers and Distributors, Delhi, 1983.
3. A. E. Clayton and N. M. Hancock, The Performance and Design of Direct Current Machines,CBS Publishers, 2004.
4. P. K. Mukherjee and S. Chakravorty, Electrical Machines, Dhanpat Rai Pub., New Delhi, 2005.
5. Fitzgerald, Kingsley and Umans, Electric Machinery, Tata McGraw Hill, New Delhi, 2003.

B. Tech. II year, Semester IV	L	T	P	Credit
Elements of Power Systems	**3**	**1**	**2**	**05**

EE204 **Scheme**

1. Course Outcomes (Cos):

At the end of the course the students will be able to:

CO1	classify and analyze the electrical power transmission and distribution.
CO2	compute the cost of power generation and the cost of electricity.
CO3	design the transmission line and analyze the performance of transmission lines.
CO4	analyze the performance of the underground cable.
CO5	Simulate/model the power system components in MATLAB/ETAP platforms and analyze the numerical results.

2. SYLLABUS:

- **SUPPLY SYSTEMS** **(04 Hours)**

  AC and DC power supply systems, comparison of ac and dc transmission, advantages of high transmission voltage, various systems of power supply, comparison of conductor materials in overhead system and underground cable system, economic choice of conductor size and economic choice of voltage.

- **D.C. AND A. C. DISTRIBUTION** **(06 Hours)**

  Types of dc distributors, dc distribution calculations, ac distributor, fed at one and fed at both the ends with concentrated loads and uniformly distributed loads, ring distributors with inter connectors, current distribution in three wire and four wire ac systems, overview of distribution automation.

- **ECONOMIC ASPECTS OF POWER SYSTEM** **(06 Hours)**

  Power factor improvement, Tariff structure, ABT, Economic aspects of power generation.

- **UNDERGROUND CABLES** **(05 Hours)**

  Underground cables, construction of cables, classification of cables, cables for three phase services, insulation resistance of a single core cable, capacitance of a single core cable, dielectric stresses in a single core cable, most economical conductor size in a cable, grading of cables, capacitance grading and inter-sheath grading, capacitance of three core cable and measurements of capacitances, dielectric loss and tan(δ) measurement.

- **CALCULATION OF LINE PARAMETERS** **(09 Hours)**

  Conductors, types of conductors in use, bundled conductor, spacing of conductors, symmetrical and unsymmetrical spacing, equivalent spacing, transposition, transmission line constants, calculation of resistance, inductance and capacitance for simple arrangements and multi-circuit lines, symmetrical and unsymmetrical spacing, concept of self GMD, mutual GMD and their uses in calculations of parameters of overhead lines, skin and proximity effects.

- **CHARACTERISTICS AND PERFORMANCE OF POWER TRANSMISSION LINES** **(12 Hours)**

  Short and medium transmission lines, Line performance, effect of capacitance, charging currents, short and medium lines, calculation by nominal-T, nominal-π and end-condenser method, regulation and efficiency, Concept of ABCD constants, the long transmission line- rigorous solution, evaluation of ABCD constants, interpretation of long line equation, surge impedance and surge impedance loading, the equivalent circuit of a long transmission line, power flow through a transmission line, circle diagrams, Ferranti effect. Reactive power compensation, transmission line transients, concept of travelling waves, reflection and refraction coefficients.

Total hours: 45

Tutorials will be conducted separately for 14 hours

3. List of Experiments:

The experiments are based on the MATLAB/ETAP simulations of power system components and hardware experiments and a substation/power plant visit.

1. Demonstration visit of 66 kV/22 kV SVNIT sub-station.
2. Study of single line diagram of Power System.
3. Power factor improvement of load.
4. Performance calculation of short and medium transmission lines.
5. Performance calculation of long transmission lines.
6. String efficiency calculation of suspension type insulator.

4. Books Recommended:

1. W. D. Stevenson, Element of Power System Analysis, McGraw Hill, 4th Edition 1982.
2. I. J. Nagrath and D. P. Kothari, Power System Engineering, 4th edition, Tata McGraw Hill publishing Company Ltd, 2014.
3. A. Chakrabarti, M. L. Soni, P. V. Gupta and U. S. Bhatnagar, A Text Book on Power System Engineering, Dhanpat Rai & Co., 2nd Edition 2001.
4. Hadi Saadat, Power System Analysis. 5th reprint, TMH publishing Company Ltd, 2004.
5. Arthur R. Bergen, Vijay Vittal, Power Systems Analysis, Prentice-Hall, Inc., 2nd Edition 2000.

B. Tech. II Year, Smester IV	L	T	P	Credit
Numerical Methods and Applications to Electrical Engineering	3	1	2	05

EE232 **Scheme**

1. Course Outcomes (Cos):

At the end of the course the students will be able to:

CO1	understand the need of numerical methods, learn various system of representation of numbers.
CO2	compare the accuracy, convergence rate and computational complexity of various numerical methods.
CO3	solve algebraic and differential equations using numerical methods apply to Electrical Engineering problems.
CO4	model various electrical systems to interpolate, predict and perform regression analysis.
CO5	implement the algorithms through software like on C/C++/MATLAB.

2. Syllabus:

- **Errors in Numerical Computation and Their Estimation** **(04 Hours)**
- Introduction, Taylor Theorem Revisit, Measuring Errors, Sources of Error, Binary Representation, Floating Point Representation, Propagation of Errors.
  Application: errors in electrical measurements and instrumentation

- **Solution of Transcendental and Polynomial** **(06 Hours)**
  Bisection method, Secant Method, False position method, Newton Raphson method for Polynomial and transcendental equations, Generalized Newton's method system of nonlinear equations, rate of convergence, conditions for convergence

- **Numerical Integration** **(03 Hours)**
  Trapezoidal rule, Simpson's 1/3 and 3/8 rules and Errors
  Applications: average, RMS quantity determination of electrical measuring quantities, load demand calculations.

- **Solution to System of Linear Algebraic Equations** **(08 Hours)**
  Gauss elimination method, Gauss Jordon Method, LU decomposition, Jacobi and Gauss Seidel Iteration methods, conditions for convergence, ill/well-conditioned systems.
  Applications: solution to mesh and nodal analysis of electrical networks, solution to power load flow, operation of different electrical applications

- **Interpolation and Regression** **(12 Hours)**
  Direct method of interpolation, Linear interpolation and higher order interpolation using Lagrange's and Newton's forward, backward and divided difference formulae, linear, quadratic, exponential and logarithmic regression, adequacy of regression models.
  Applications: prediction of the performance of electrical motors and generators from their practical data, application to load forecasting and generation scheduling, prediction of solar intensity and wind velocity.
- **Equations Solution to Ordinary Differential Equations** **(09 Hours)**
  Euler's Method, Modified Euler's Method, Runge-Kutta methods: II and IV order, higher order/coupled differential equations.
  Applications: DC and AC transients of electrical networks, solution for generator oscillations

Total Hours: 45

Tutorials will be conducted separately for 14 hours

3. List of Experiments:

The programmes are to be executed in C++/MATLAB

1. To find the roots of the polynomial using bisection, false position, Newton-Raphson, secant methods
2. To find the solution of set of nonlinear equations using Newton-Raphson method
3. To find the numerical integration suing trapezoidal, Simpson's 1/3 and Simpson's 3/8 method
4. To find the interpolating polynomial using Linear, Lagrangian, Newton's forward, backward and divided difference methods
5. To find the solution to set of linear simultaneous equations using Gauss elimination, Gauss-Jordan, Jacobi and Gauss-Seidel methods
6. To find the solution to ordinary differential equations using Euler's, modified Euler's, Runge-Kutta 2nd order and 4th order methods
7. To regress a given set of data using polynomial, exponential and logarithmic regression formulae

4. Books Recommended:

1. S. S. Shastri, Introductory Methods of Numerical Analysis, Prentice Hall Ltd., 4th Edition, 2005.
2. M. K. Jain, M. K. Iyengar and S.R.K., Jain, Numerical Methods for Scientific and Engineering Computation, 4th Edition, 2003, New Age international Publishers, Pvt. Ltd.
3. S. A. Teukolsky W. T. Vetterling, W. H. Press and B. P. Flannery, Numerical recipes in 'C', 2nd Edition, Foundation Books Pvt. Ltd., 2001.
4. R. S. Salaria, Numerical methods: A computer-oriented approach, BPB Publications, 1996.
5. S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach, 3rd Edition, McGraw-Hill, 1980.

B. Tech. II Year, Smester IV
Professional Ethics, Economics And Business Management

L	T	P	Credit
3	1	0	04

MG210 **Scheme**

1. Course Outcomes (COs):

At the end of the course, the students will be able to

CO1	Develop knowledge regarding Professional ethics
CO2	Develop knowledge of Economics in engineering
CO3	Develop managerial skills to become future engineering managers
CO4	Develop skills related to various functional areas of management (Marketing Management, Financial Management, Operations Management, Personnel Management etc.)
CO5	Build knowledge about modern management concepts
CO6	Develop experiential learning through Assignments, Management games, Case study discussion, Group discussion, Group presentations etc.

2. Syllabus

- **PROFESSIONAL ETHICS** **(6 Hours)**
  Introduction, Meaning of Ethics, Approaches to Ethics, Major attributes of Ethics, Business Ethics, Factors influencing Ethics, Importance of Ethics, Ethics in Management, Organizational Ethics, Ethical aspects in Marketing, Mass communication and Ethics - Television, Whistle blowing, Education – Ethics and New Professional, Intellectual Properties and Ethics, Introduction to Professional Ethics, Engineering Ethics
- **ECONOMICS** **(8 Hours)**
  Introduction To Economics, Applications & Scopes of Economics, Micro & Macro Economics, Demand Analysis, Demand Forecasting, Factors of Production, Types of Cost, Market Structures, Break Even Analysis
- **MANAGEMENT** **(15 Hours)**
  Introduction to Management, Features of Management, Nature of Management, Development of Management Thoughts – Scientific Management by Taylor & Contribution of Henry Fayol, Coordination & Functions Of Management, Centralization & Decentralization, Decision Making; Fundamentals of Planning; Objectives & MBO; Types of Business Organizations: Private Sector, Public Sector & Joint Sector; Organizational Behaviour: Theories of Motivation, Theories of Leadership
- **FUNCTIONAL MANAGEMENT** **(14 Hours)**
  Marketing Management: Core Concepts of Marketing, Marketing Mix (4p), Segmentation – Targeting – Positioning, Marketing Research, Marketing Information System, Concept of International Marketing, Difference Between Domestic Marketing & International Marketing; Operations Management: Introduction to Operations Management, Types of Operation Systems, Types of Layouts, Material Handling, Purchasing & Store System, Inventory Management; Personnel Management: Roles & Functions of Personnel Manager, Recruitment, Selection, Training; Financial Management: Goal of Financial Management, Key Activities In Financial Management, Organization of Financial Management, Financial Institutions, Financial Instruments, Sources of Finance
- **MODERN MANAGEMENT ASPECTS** **(2 Hours)**
  Introduction To ERP, e – CRM, SCM, RE – Engineering, WTO, IPR Etc.

Tutorial: **(15 Hours)**

Case Study Discussion, Group Discussion, Management games and Assignments / Mini projects & presentation on related Topics

(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)

3. Tutorials

1 Case Study Discussion

2 Group Discussion

3 Management games

4 Assignments / Mini projects & presentation on related Topics

4. Books Recommended:

1 Balachandran V. and Chandrasekaran, Corporate Governance, Ethics and Social Responsibility, PHI, 2nd Edition, 2011

2 Prasad L.M., Principles & Practice of Management, Sultan Chand & Sons, 8th Edition,2015

3 Banga T. R. & Sharma S.C., Industrial Organisation & Engineering Economics, Khanna Publishers, 25th Edition, 2015

4 Everett E. Adam, Ronald J. Ebert, Production and Operations Management, Prentice Hall of India, 5th edition, 2012

5 Kotler P., Keller K. L, Koshi A.& Jha M., Marketing Management – A South Asian Perspective, Pearson, 14th Edition, 2014

6 Tripathi P.C., Personnel Management & Industrial Relations, Sultan Chand & sons, 21st Edition, 2013

7 Chandra P., Financial Management, Tata McGraw Hill, 9th Edition, 2015

ADDITIONAL REFERENCE BOOKS / FURTHER READING:

1 Crane A. & Matten D., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Oxford University, 2010

2 Fritzsche D. J., Business Ethics: a Global and Managerial Perspectives, McGraw Hill Irwin, Singapore, 2004

3 Mandal S. K., Ethics in Business and Corporate Governance, Tata McGraw Hill, 2011

B. Tech. II (Electrical), Semester IV

Special Electrical Machines

L	T	P	Credit
3	0	0	03

EE254 **Scheme**

1. Course Outcomes (Cos):

At the end of the course students will be able to:

CO1	list different types of special electrical machines
CO2	describe the basic principles of special Electrical machines
CO3	compare the performance of various special electric machines
CO4	analyze the steady state performance of special Electrical machines
CO5	identify the special constructional and operating features of special electrical machines
CO6	select appropriate special electric machine for given application

2. Syllabus:

- **Servo Motors** **(05 Hours)**
  Symmetrical components applied to two - phase servo motors - equivalent circuit and performance based on symmetrical components - servo motor torque - speed curves.
- **Variable Reluctance Motors** **(08 Hours)**
  Construction of VRM, Concepts of co-energy and expression of torque, inductance, current and torque calculation and waveforms, Drive circuit for VRM.
- **Stepper Motors** **(07 Hours)**
  Construction features, half stepping and the required switching sequence, stepper motor ratings, static and dynamic characteristics, application and selection of stepper motor.
- **Reluctance Motors** **(02 Hours)**
  Construction – poly-phase and split phase reluctance motors - capacitor type reluctance motors.
- **Hysterisis Motors** **(02 Hours)**
  Construction – poly-phase: capacitor type and shaded pole hysteresis motors.
- **Universal Motors** **(03 Hours)**
  Essential parts of universal motor, performance characteristics and application.
- **Linear Machines** **(08 Hours)**
  Basic difference between LEMS and rotating - machine - classification of LEMS, linear motors and levitation machines - linear induction motors - linear synchronous motors - DC linear motors - linear levitation machines.
- **PMDC Motors** **(01 Hour)**
  Construction, principle of operation, performance analysis.
- **Brushless DC Motors** **(06Hours)**
  Construction, principle of operation, phasor diagram, characteristics, performance analysis.

Total Hours: 45

3. Books Recommended:

1. V. D. Toro, Electric machines and power systems, Prentice Hall of India, 1985.
2. Veinott, Fractional horse power electric motors, McGraw Hill, 4th Edition, 1987.
3. S. A. Nasar, Boldeal, Linear Motion Electric machine, John Wiley,1976.
4. V. V. Athani, Stepper Motors, New Age International Pvt. Ltd., 1997.
5. I. J. Nagrath and D. P. Kothari, Electric Machines, Tata McGraw Hill Publishing Company, New Delhi,4th Edition, 2010.

B. Tech. II (Electrical), Semester IV

Digital Signal Processing

L	T	P	C
3	0	0	3

EE255 **Scheme**

1. COURSE OUTCOMES (COs):

Upon completion of the course, the students will be able to:

CO1	classify the discrete time signals, systems
CO2	design optimum structures for realizing IIR and FIR systems
CO3	apply signal processing techniques to real situation problems
CO4	design and implement different types of FIR/IIR filters
CO5	develop various DSP FFT algorithms through software like MATLAB

2. SYLLABUS:

- **INTRODUCTION** **(04 Hours)**
  Review of continuous-time signals and systems, convolution of continuous-time signals, Laplace transform, the Fourier series and Fourier transform.

- **DISCRETE-TIME SIGNALS AND SYSTEMS** **(08 Hours)**
  Sequences, discrete-time systems, linear time-invariant systems, convolution representation of linear time-invariant discrete-time systems, convolution of discrete-time signals, linear difference equations with constant coefficients, realizations, frequency-domain representation of discrete-time signals and systems.

- **SAMPLING OF CONTINUOUS-TIME SIGNALS** **(08 Hours)**
  Periodic sampling, frequency-domain representation of sampling, reconstruction of a band-limited signal, discrete-time processing of continuous-time signals, continuous-time processing of discrete-time signals, changing the sampling rate using discrete-time processing.

- **THE Z-TRANSFORM** **(08Hours)**
  The Z-transform, properties of the Z-transform, transfer function representation, Inverse Z-transform, Z-transform applied to difference equations, the complex convolution theorem, stability of discrete-time systems, frequency response of discrete-time systems.

- **THE DISCRETE FOURIER TRANSFORM** **(09 Hours)**
  Discrete-time Fourier transform (DTFT), the discrete Fourier series, the Fourier transform of periodic signals, discrete Fourier transform (DFT), properties of the DFT, system analysis via the DTFT and DFT, circular convolution, linear convolution using the DFT. The Fast Fourier Transform (FFT) Algorithms: Decimation in time FFT, introduction to radix-2 FFTs, some properties of radix-2 decimation in time FFT, decimation in frequency algorithm, computing the inverse DFT by doing a direct DFT.

- **INTRODUCTION TO DIGITAL FILTERS** **(09 Hours)**
  Recursive digital filters-infinite impulse response (IIR) Filters: Analog approximations, impulse invariant method, bilinear transformation method, matched Z-transform method, realizations, non-recursive digital filters – finite impulse response (FIR).

Total Hours: 45

B. Tech. II year, Semester IV

L	T	P	Credit
3	0	0	3

Power Plant Engineering

EE256 **Scheme**

1. Course Outcomes (Cos):

At the end of the course the students will be able to:

CO1	understand the economics of power generation
CO2	explain the basics of various components of the power station
CO3	describe the working of steam and hydro power stations
CO4	describe the working of nuclear, diesel and gas power stations.
CO5	explain the working of the power stations based on non-conventional resources.
CO6	design the controllers for various power stations.

2. Syllabus

- **Steam Power Station** **(04 Hours)**
  Main flow circuits of thermal power station, thermodynamic cycles of steam flow, general layout of power stations, power station auxiliaries, cooling system of alternators, flue-gas flow arrangement, circulating water system, cooling tower.
- **Hydroelectric Power Plant** **(06 Hours)**
  Selection of site, water power equations, types of dams, arrangement and layouts of hydro-electric station, classification of plants, water turbines, properties of water wheels, specific speed on the basis of discharge, combined steam and hydro-plants, pumped storage hydro station.
- **Nuclear Power Station** **(07 Hours)**
  Atomic structure, isotopes, energy release by fission, chain reaction, atomic reactor, fuels, moderators and coolants, types of reactors, fast breeder reactor, radio activity and hazards.
- **Diesel And Gasturbine Station** **(06 Hours)**
  Field of use, general layout and principle of operation.
- **Non Conventional Method Of Power Generation** **(06 Hours)**
  MHD generation, wind power, tidal power, solar power, solar cell and fuel cell.
- **Combinations Of Different Types Of Power Plants** **(10 Hours)**
  Types of power station, advantages of combined working of different types of power station, need for coordination of different types of power station, run-off river plant in combination with steam plant, hydro- electric plants with ample storage in combination with steam plants, pumped storage plant in combination with ordinary hydro-electric plant, co-ordination of hydro-electric and gas turbine plant, co-ordination of hydro-electric and nuclear power station, co-ordination of different types of power plants in power station.
- **Power Station Control** **(03 Hours)**
  Excitation systems, excitation control, field protection, commissioning of alternators, power supply for station auxiliaries, power station control.

Total Hours:42

3. Books Recommended:

1. Nag, P. K. (2008). *Power plant engineering*. New Delhi, India: Tata McGraw-Hill.
2. Arogya swamy, Power Station Practice, Oxford & IBM Publication Co., New Delhi, 1976.
3. Baptidanov L., Power Station & Substation, Moscow Peace Publication.
4. Leznov S. & Taits, Power Station & Substation Maintenance, Moscow Mir Publication, 1983.
5. Leznov S. & Taits, Power Station Electrification, Moscow Mir Publication, 1983.
6. Bruce, John, London, Power Station Efficiency Control, Sir Issac Pitman & Sons Ltd., 1926.

B. Tech. II year, Semester IV

Energy Audit and Management

L	T	P	Credit
3	0	0	03

EE257 **Scheme**

1. Course Outcomes (Cos):

After completion of the course, the students will be able to:

CO1	recognize the significance of energy management and its role in industries
CO2	analysis of Energy conservation and needs of energy audit and management.
CO3	evaluate the energy economics.
CO4	plan and design energy efficient systems
CO5	estimate the economy and judge the environmental concerns.

2. Syllabus:

- **ENERGY MANAGEMENT** **(12 Hours)**
  Energy Scenario – Energy Demand and Ecological Balance –Resource availability and management, Strategies, Tools available, Energy Monitoring and Targeting, Energy Norms, Energy Policy, Demand Side Management–Role of Energy Managers in Industries - maximizing system efficiencies, Optimizing input energy requirements - Principles and Imperatives of Energy Conservation - Energy Consumption pattern, Energy Conservation acts, Energy Conservation Implementation Programme (ECIP), Energy Audit concepts, needs, energy management (audit) approach, energy audit instruments, Energy action planning and Project management.
- **ELECTRICAL ENERGY AUDITING** **(10 Hours)**
  Potential areas of Electrical Energy Conservation in various industries–Energy Management opportunities in Cable selection, Electricity Act, Electric Heating and Lighting systems –Six basic rules of Energy, Efficient Lighting, Energy losses in electric motors and drives, Energy Efficient Motors and Drives, Soft starters with energy saver, Power factor improvement, Energy conservation in domestic gadgets and transport, DG system- factors affecting selection & performance.
- **ENERGY ECONOMICS** **(10 Hours)**
  Economic analysis of investments, Present value criterion, Discount rate, simple payback period, return on investment, net present value(NPV), internal rate of return, life cycle costing, energy performance contracts and role of ESCOs, Energy Management Information Systems.
- **ECONOMICS OF POWER GENERATION** **(10 Hours)**
  Factors affecting the cost of generation – Load factor, Diversity factor, Plant capacity factor, Plant use factor, Load curves, Load duration curves, Reduction of costs by Interconnection of Stations, Choice of size & number of generator units, Tariffs : types and significance.

Total Hours:45

3. Books Recommended:

1. Albert Thumann, Handbook of Energy Engineering, The Fairmont Press Inc., 6th Edition, 2003.
2. Wayne C. Turner, Energy management Handbook, John Wiley and sons, 9th Edition, 2019.
3. Prasanna Chandra, Financial management, Tata McGraw Hill, 10th Edition, 2019.
4. S. Choudhury, Projects: Planning, Analysis, Selection, Implementation and Review, Tata McGraw Hill Publishing Company, New Delhi, 1995.
5. Cleaner Production, Energy Efficiency Manual for GERIAP, UNEP, prepared by National Productivity Council, Bangkock.

B. Tech. II year, Semester IV

Electrical Circuits (For Minor Degree)

(For B. Tech. CE, ME, ChE students)

L	T	P	Credit
3	1	0	04

EE281 **Scheme**

1. Course Outcomes (COs):

At the end of the course, the students will be able to

CO1	able to apply various techniques like mesh and nodal analysis and network theorems for circuit problems
CO2	explain the principles of magnetic circuits and solve the series and parallel ac circuits
CO3	analyze poly-phase circuits
CO4	calculate various parameters of two port network and inter relationship between them.
CO5	develop a mathematical model (differential equations) of a given electric circuit and solve it

2. Syllabus

- **Electrical Networks Analysis** **(10 Hours)**

Kirchhoff's Voltage Law, Kirchhoff's Current Law, independent and dependent sources, Mesh current and Nodal Voltage analysis, Super position theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Maximum power transfer theorem

- **Magnetism And Analysis Of Ac Circuits** **(12 Hours)**

Faradays law, Lenz law, self-inductance, mutual inductance, coefficient of mutual inductance, coefficient of coupling, inductance in series, parallel, series-parallel, Analysis of coupled coils, dot rule, conductively coupled equivalent circuit. Complex algebra and its application to circuit analysis, R-L, R-C, R-L-C series and parallel circuits, series and parallel resonance.

- **Polyphase Circuits** **(08 Hours)**

Balanced three phase systems, star and mesh connections, calculations for balanced and unbalanced three phase networks, poly-phase vector diagram, and measurement of power in three phase circuits.

- **Two Port Networks** **(06 Hours)**

Introduction two port networks, Impedance Parameters, Admittance Parameters, Hybrid Parameters, inverse hybrid parameters, Transmission Parameters, Relationships Between Parameters, Interconnection of Networks.

- **AC AND DC Transients** **(06 Hours)**

Transient response of R-L, R-C and R-L-C circuits, complete response of RL, RC and RLC circuits to step, sinusoidal, exponential, ramp, impulse and the combinations of these excitations.

- **Tutorials will be based on the coverage of the above topics separately** **(15 Hours)**

Tutorials will be based on the coverage of the topics given in the detailed syllabus separately for 15 hours

(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)

3. Books Recommended

1 W. H. Hayt, J. E. Kemmerly, and Durbin S. M., Engineering Circuit Analysis, Tata McGraw Hill, 6th Edition, 2006.

2 M.E. Van Valkenburg, Network Analysis, Prentice Hall, India, 3rd Edition, 2002.

3 A. Chakrabarti, Circuit Theory, Dhanpat Rai & Co., 6th Edition, 2012.

4 A. Edminister Joseph, Electrical circuits, Schaum's outline series, McGraw hill, 2nd Edition, 1983.

5 Charles K. Alaxander and Matthew N.O. Sadiku, Fundamentals of electric circuits, Tata McGraw Hill, 5th Edition, 2013.

B. Tech. II year, Semester IV

Electrical Machines (For Minor Degree)

(For B. Tech. AI,CSE,ECE students)

L	T	P	Credit
3	0	2	04

EE282 **Scheme**

1. Course Outcomes (COs):

At the end of the course, the students will be able to

CO1	Explain the construction and principle of operation of the DC motors, transformers, induction motors, Synchronous generator and Fractional horse power motors.
CO2	Perform tests on the DC motors, transformers, induction motors and Synchronous generator.
CO3	Compute performance parameters of the DC motors, transformers, induction motors and Synchronous generator.
CO4	Analyze the performance of the DC motors, transformers, induction motors and Synchronous generator.
CO5	Select the machines for different real world applications
CO6	Communicate effectively through laboratory report writing, presentation and perform task as an efficient team member

2. Syllabus

- **DC Motors** **(08 Hours)**
  Construction and working principle, EMF equation, Torque equation, Classification of DC motors and their characteristics, Speed control, Braking, Applications.
- **Transformers** **(08 Hours)**
  Construction and working principle, Equivalent circuit, Open circuit and Short Circuit tests, Regulation and efficiency, Autotransformers, Different connections of three phase transformers.
- **Three-phase Induction Motor** **(09 Hours)**
  Construction and working principle, Equivalent Circuit, No load and Blocked rotor tests, Torque equation, Torque–slip characteristics, Speed control, Industrial applications.
- **Synchronous Generator** **(08 Hours)**
  Construction, Principle of operation and types, Various types of excitation systems, Equivalent circuit, Determination of voltage regulation by synchronous impedance method.
- **Fractional Horse Power Motors** **(09 Hours)**
  Single phase induction motors – Construction and principle of operation, Classification based on starting method, Applications in home appliances. Construction and application of Stepper motors, Servomotors and Universal motors.
- **Practical**

1. Determination of efficiency & regulation of single- phase transformer from Open circuit and short circuit test
2. Load test on single phase transformer
3. Determination of the equivalent circuit parameters from No-Load and Blocked rotor tests of three-phase Induction Motor.
4. Load test on three-phase Induction Motor.
5. Speed control of dc shunt motor.
6. Speed torque characteristic of a D. C. Shunt motor.
7. D. C. Series motor, Speed -torque characteristic.
8. Swinburne's test
9. Regulation of an alternator by synchronous impedance method
10. To study the construction and starting method of a single phase induction motor

3. Books Recommended

1 D.P.Kothari and I.J.Nagrath, 'Electric Machines', McGraw Hill Education Private Limited, latest Edition.

2 A Fitzgerald, Charles Kingsley, Stephen Umans, 'Electric Machinery', McGraw Hill Education, latest edition.

3 Mukherjee and Chakravorty, Electrical Machines, Dhanpat Rai Pub., New Delhi, latest edition

4 M. G. Say, The performance and design of alternating current machines, CBS Publishers and Distributors, Delhi, latest edition

5 A. E. Clayton and N. M. Hancock, The Performance and Design of Direct Current Machines, CBS Publishers

B. Tech. II year, Semester IV	**L**	**T**	**P**	**Credit**
Modeling of Electrical Machines (For B.Tech in Electrical Engineering with honours in Power Electronics & Electrical Drives)	**3**	**1**	**0**	**04**

EE291 **Scheme**

1. course outcomes (COs):

Upon completion of the course, the students will be able to:

CO1	explain the basic principle of electrical machines based on principle of electromagnetic energy conversion
CO2	develop the mathematical model of DC machine
CO3	explain various reference frame theories for modeling electric machines
CO4	deduce the mathematical model of induction, synchronous and permanent magnet synchronous machines based on reference frame theory
CO5	analyze the performance of electric machines based on the derived mathematical machines
CO6	simulate various electric machines based on mathematical models

2. SYLLABUS:

- **Basic Principle Of Electric Machine** **(03 hours)**
  Review of Magnetic circuit and electromagnetics (Faraday's law, Ampere's law, Bio Savart's law, Kirchhoff law and Maxwell's equation (integral form and point form)), Principle of transformer action, Principle of Electromagnetic Energy Conversion, Elementary electric machine
- **DC Machine Modelling** **(06 hours)**
  Modeling of D.C. Machine (Separately Excited, shunt and series type), Linearization of machine equations, State-Space Modeling of the machine.
- **Induction Machine Modeling** **(12 hours)**
  Distributed Winding in AC Machinery, winding function, air gap mmf, rotating mmf, Flux linkage and Inductance, Stator and rotor voltage equation and torque equation in stator reference frame, Reference frame theory: Space phasor description, Derivation of induction motor modelling in rotor flux and stator flux reference frame, Derivation of steady state model.
- **Permanent Magnet Machine Modeling** **(11hours)**
  Voltage and torque equation of surface mount permanent magnet machine in stator reference frame, Voltage and torque equation of surface mount permanent magnet machine in rotor reference frame, Derivation of steady state model.
- **Synchronous Machine Modeling** **(10 hours)**
  Voltage and torque equation of salient pole synchronous machine including damper winding in stator reference frame, Voltage and torque equation of salient pole synchronous machine including damper winding in rotor reference frame.

Total Hours: 42

3. Books recommended:

1. P. C. Krause, Oreg Wasynczuk, Scott D. Sudhoff, "Analysis of Electric Machinery and drive systems", Wiley Interscience, 2nd Edition, 2010.
2. P. S. Bimbhra, "Generalized theory of Electrical M/C", Khanna Publication, 2000.
3. S. K. Sen, "Electrical Machinery", Khanna Pub., Delhi, 2012.
4. Mrittunjay Bhattacharya, "Electrical Machines: Modelling and Analysis", PHI, 2016.
5. R. Ramanujam, "Modelling and Analysis of Electrical Machines", Wiley, 2019.

B. Tech. II year, Semester IV	**L**	**T**	**P**	**Credit**
Computer Methods for Power System **(For B.Tech In Electrical Engineering with honours in Power System)**	**3**	**1**	**0**	**04**

EE292 **Scheme**

1. COURSE OUTCOMES (COs):

At the end of the course the students will be able to:

CO1	illustrate various methods of solving linear system
CO2	apply various methods of solving non- linear system to power system problems.
CO3	apply various methods of solving sparse matrices to power system problems.
CO4	use various methods of numerical integration to solve differential equation pertaining to power system.
CO5	use modal analysis for small signal stability study of power systems.
CO6	Estimate states of the system using optimization techniques

2. SYLLABUS:

- **SOLUTION OF LINEAR SYSTEMS** **(06 Hours)**
  Gaussian elimination, LU factorization with partial and complete pivoting, condition numbers and error propagation, relaxation methods, conjugate gradient methods.

- **SOLUTION OF NONLINEAR SYSTEMS** **(07 Hours)**
  Method to solve nonlinear system: Newton's method, Broyden's method, Finite difference method, Power system applications: Power flow, regulating transformers, Decoupled power flow, Fast Decoupled power flow, PV curves and continuation power flow, Three phase power flow.

- **SPARSE MATRIX SOLUTION TECHNIQUES** **(06 Hours)**
  Storage methods, sparse matrix representation, Ordering schemes: Scheme O, Scheme I, Scheme II, Other scheme, Power system applications.

- **NUMERICAL INTEGRATION** **(07 Hours)**
  explicit methods, implicit methods, One step methods, Multistep methods, fixed step methods, variable step methods, Stability and accuracy-analysis of numerical methods, stiff systems, step size selection, differential algebraic systems, Power system application: Transient stability analysis.

- **EIGENVALUE PROBLEMS** **(08 Hours)**
  Eigen value computations methods: QR algorithm, Power method, Arnoldi methods, Prony method. Power system applications: Modal analysis, participation factors, SSR analysis.

- **OPTIMIZATION** **(08 Hours)**
  Least squares optimization, Weighted Least square optimization, Steepest Descent algorithm, Newton's method. Power system applications: Optimal power flow, Linear and Nonlinear least square state estimation.

Total Hours:42

3. Books recommended:

1. Mariesa Crow, Computational Methods for Electric Power Systems, 2nd edition, Electric power engineering series, CRC Press, 2009.
2. S. A. Soman, S. A. Khaparde, and Shubha Pandit, Computational Methods for Large Sparse Power System Analysis, Kluwer Academic Publishers, 2012.
3. Stagg and El-Abiad, Computer Methods in Power System Analysis, McGraw Hill Series, International student Edition, 1968.
4. Reijer Idema and Domenico J. P. Lahaye, Computational Methods in Power System Analysis, Volume 1, Atlantis Press, Atlantis Studies in Scientific Computing in Electromagnetics. 2014.
5. J. Arrillaga and C. P. Arnold, Computer Analysis of Power Systems, John Wiley & Sons Ltd, 1990

B. Tech. II year, Semester IV	**L**	**T**	**P**	**Credit**
State Variable Analysis (For B.Tech In Electrical Engineering with honours in Instrumentation and Control)	**3**	**1**	**0**	**04**

EE293 **Scheme**

1. Course Outcomes (CoS):

At the end of the course students will be able to:

CO1	construct state-space models for the systems from the ubiquitous domains (electrical/mechanical).
CO2	correlate differential equations, transfer function model with the state space models.
CO3	recast linear, nonlinear, multi input multi output, continuous and discrete systems in state space form.
CO4	design control systems using the state space techniques and analyze the properties of state space models which are essential for developing controllers and observers.
CO5	adopt state space technique for the models of real world problems.

2. Syllabus:

- **Mathematical background-matrices:** **(03 Hours)**
  Definition of Matrices; Matrix Algebra; Matrix Multiplication and Inversion; Rank of a Matrix; Differentiation and Integration of Matrix.

- **State space analysis methods and techniques:** **(16 Hours)**
  State Variables; State-Space Representation of Electrical and Mechanical and Electromechanical Systems; State Space Representation of Nth Order, Linear Differential Equation; Transformation to Phase Variable Canonical Form; Relationship Between Transfer Functions and State Equations; Characteristic Equation; Eigen Values and Eigen Vectors; Transformation to Diagonal Canonical Form; Jordan Canonical Form.

- **Solution of the time-invariant systems:** **(06 Hours)**
  Solution of the Time-Invariant State Equation; State Transition Matrix and its Properties; Transfer Matrix; Transfer Matrix of Closed Loop Systems, Methods of calculations of the matrix exponentials using algebraic and algorithmic methods.

- **Controllabilty and observability:** **(08 Hours)**
  Concept of Controllability and Observability; Kalman’s Theorems on Controllability; and Observability, Alternative Tests (Gilbert’s Method) of Controllability and Observability; Principle of Duality; Relationship among Controllability, Observability and Transfer Function, Decomposition of Transfer Function-Direct, Cascade and Parallel Decomposition; State Diagram.

- **Lyapunov stability analysis:** **(09 HOURS)**
  Stability of Equilibrium State in the Sense of Lyapunov; Graphical Representation of Stability; Asymptotic Stability and Instability; Sign-Definiteness of Scalar Function; Second Method of Lyapunov; Stability Analysis of Linear Systems; Krasovskii’s Theorem; Lyapunov Function Based on Variable Gradient Method.

Total Hours: 42

3. Books recommended:

1. I. J. Nagrath & M. Gopal, “Control System Engineering”, New Age International Publishers, 3rd Edition, 2001.
2. K. Ogata, “Modern Control System Engineering”, Pearson Education Asia, 4th Edition, 2002.
3. B. C. Kuo, “Automatic Control Systems”, Prentice Hall of India, 7th Edition, 1995.
4. Nise N. S., “Control System Engineering”, John Wiley & sons, 4th Edition, 2004.
5. P. F. Blackman, “Introduction to State Variable Analysis”, the McMillan Press, 1st Edition, 1977.

Department of Electronics Engineering

Proposed Revised Curriculum Structure for Multiple Entry Multiple Exit Scheme

(with effect from AY-2023-24) **Annexure 66.32 of 66th meeting of the IAAC**

B. Tech. Electronics and Communication Engineering

Year	Subject	Subject Type	Code	Schemes	Credits	Notional hours
2nd of UG (III & IV Sem)	**Third Semester**					
	CBCS-1	**Mandatory Core** Analog Circuits	EC201	3-0-2	04	85
	CBCS-2	**Mandatory Core** Signals and Systems	EC203	3-1-0	04	70
	CBCS-3	**Mandatory Core** Microprocessors and Microcontrollers	EC205	3-0-2	04	85
	CBCS-4	**Mandatory Core** Principles of Communication Systems	EC207	3-0-2	04	85
	CBCS-5	**Management** Professional Ethics, Economics, and Business Management	MG210	3-1-0	04	70
	Vocational/ Professional	**(Optional)** **(Mandatory for Exit)** Vocational Training	VS2XX	0-0-8	04	160 (20x8)
				Total	**24**	**555**
				Minimum Credit Requirement	**20**	**395**
	Fourth Semester					
	CBCS-1	**Mandatory Core** Statistical Signal Analysis	EC202	3-1-0	04	70
	CBCS-2	**Mandatory Core** Linear IC Applications	EC204	3-0-2	04	85
	CBCS-3	**Mandatory Core** Electromagnetic Waves	EC206	3-0-2	04	85
	CBCS-4	**Mandatory Core** Digital Integrated Circuits	EC208	3-0-2	04	85
	CBCS-5	**Other Engineering** Control Systems	EE258	3-0-2	04	85
	Vocational/ Professional	**(Optional)** **(Mandatory for Exit)** Vocational Training	VS2XX	0-0-8	04	160 (20x8)
				Total	**24**	**570**
				Minimum Credit Requirement	**20**	**410**
				Minimum Credit Requirement (2nd year)	**40**	**805**

Vocational Training/ Professional Experience (For B. Tech I & II year)				
Sr. No.	**Subject**	**Code**	**Scheme**	**Credits**
	Institute Based			
1	Matlab & Simulink	VS101/ VS102/ VS201/ VS202	0-0-10	05
2	Arduino and MicroPython Programming for the Development of IoT Systems		0-0-10	05
	Industry Based			
1	Python Programming	VS101/ VS102/ VS201/ VS202	0-0-10	05
2	C++ Programming		0-0-10	05

ANALOG CIRCUITS

L	T	P	Credit
3	0	2	04

EC 201 **Scheme**

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Describe single-stage / multistage amplifiers and their frequency response characteristics.
CO2	Apply the concept of current sources/sinks in the differential amplifiers.
CO3	Analyze different amplifier configurations by deploying negative feedback therein.
CO4	Evaluate the criterion for the stability of analog circuits.
CO5	Design ssolid-statepower amplifiers.

2. **Syllabus:**

- **HIGH FREQUENCY AMPLIFIERS** **(12 Hours)**
Classification of Amplifiers, Distortion in Amplifiers, Frequency Response of An Amplifier, Bode Plots, Step Response of Amplifiers, CE Short Circuit Current Gain, High-Frequency Response of a CE Stage, Gain Bandwidth Product, Emitter Follower at High Frequencies, Common Source and Common Drain Amplifier at High Frequencies. Analysis of Multistage Amplifier, Design of Two-Stage Amplifier, Frequency Response of Multistage Amplifier, Two Pole Analysis.
- **FEEDBACK AMPLIFIERS** **(12 Hours)**
Representation of Amplifiers, Feedback Concept, Transfer Gain with Feedback, Characteristics of Negative Feedback Amplifiers. I/O Impedance in Feedback Amplifiers, Analysis of Amplifiers having Voltage Series, Current Series, Current Shunt and Voltage Shunt Feedback, General Analysis of Multistage Feedback Amplifiers, Effect of Negative Feedback on Bandwidth, Frequency Response of Feedback Amplifiers, frequency compensation.

- **POWER AMPLIFIERS** **(09 Hours)**
Class A, B, AB, and C Power Amplifiers, Transformer Coupled Push–Pull and Complementary Symmetry Push-Pull Amplifier, Heat Sinks, Power Output, Efficiency, Crossover Distortion and Harmonic Distortion, Tuned Amplifiers, High Fidelity Design, Tuned Amplifiers

- **DIFFERENTIAL AMPLIFIERS** **(12 Hours)**
Differential amplifiers, AC/DC Analysis of Various Differential Amplifiers using BJT/MOSFET, CMRR and I/O Resistances, Output Offset Voltages, Active Load Differential Amplifiers, Current Mirrors using MOSFET, Widlar Current Source, Cascaded Differential Amplifier Stages and Level Translator, Operational Amplifier Design.

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. **List of Practicals:**

Practicals are to be performed using breadboard and SPICE Simulators.

1. Study and design a single-stage RC coupled amplifier and obtain its high-frequency response curve.
2. Study and design a double-stage RC coupled amplifier and obtain its high-frequency response curve.
3. Study and design a differential amplifier and measure its differential and common mode output voltages.

4. Study and design a Voltage Series Feedback amplifier and obtain its frequency response characteristics with and without feedback.
5. Study and design a Current Series Feedback amplifier and obtain its frequency response characteristics with and without feedback.
6. Study and design a Voltage Shunt Feedback amplifier and obtain its frequency response characteristics with and without feedback.
7. Study & Design a Class Power Amplifier and obtain its efficiency.
8. Study and design a Push-Pull Amplifier and obtain its efficiency.
9. Design a Current Mirror Circuit using BJT/MOSFET
10. Design of Differential Amplifier
11. SPICE Simulation for Analog Circuits
12. Mini Project.

4. <u>Books Recommended:</u>

1. Millman Jacob, Halkias Christos C., and Parikh C., "Integrated Electronics", 2nd Edition, McGraw-Hill, 2017.
2. A. Sedra and K. C. Smith, "Microelectronic Circuits", 5th Edition, Oxford University Press, 2005.
3. Donald Neamen, "Electronic Circuits: Analysis & Design", 3rd Edition, McGraw Hill, 2006.
4. B. Razavi, "Fundamental of Microelectronics", 3rd Edition, Wiley India, 2021.
5. Robert Boylestad and Louis Nashlesky, "Electronics Device & Circuits and Theory", PHI, 10th Edition, 2009.

SIGNALS AND SYSTEMS

L	T	P	Credit
3	1	0	04

EC 203 **Scheme**

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Describe Signals and Systems with their classifications
CO2	Describe Z-transform and its properties
CO3	Analyse discrete-time system with Z-transform
CO4	Understand the process of sampling and aliasing error.
CO5	Analyze Discrete Time Fourier Transform and Discrete Fourier Transform for LTI systems

2. **Syllabus:**

- **INTRODUCTION** **(05 Hours)**
  Introduction to Signal and its Classification, Concept of Frequency in Continuous-Time and Discrete-Time Signal.

- **DISCRETE TIME SIGNAL AND SYSTEM** **(08 Hours)**
  Discrete-Time Signals and basic operations, Discrete Time Systems, Linear Time-Invariant Systems, Properties of LTI Systems, Causal LTI Systems Described by Difference equations.

- **Z-TRANSFORM** **(08 Hours)**
  Z-transform, Properties of Region of convergence, Inverse Z-transform, properties of Z-transform. Z-transform for LTI systems with pole-zero patterns

- **SAMPLING** **(08 Hours)**
  Sampling theorem, Periodic Sampling, Frequency-Domain Representation of Sampling, Reconstruction of sampled signals, Aliasing error, sampling theorem, Sampling of Bandlimited Signals

- **DISCRETE TIME FOURIER TRANSFORM (DTFT) and DISCRETE FOURIER TRANSFORM (DFT)** **(08 Hours)**
  DTFT and it's convergence, Properties of DTFT, Sampling the Fourier Transform, The Discrete Fourier Transform, Properties of the Discrete Fourier Transform.

- **FREQUENCY DOMAIN ANALYSIS OF LINEAR TIME-INVARIANT SYSTEMS** **(08 Hours)**
  Frequency Domain Representation of Discrete-Time Systems, Frequency Response for Rational systems Functions, Frequency Response of LTI Systems, System analysis with frequency domain representation. Time domain and Frequency domain aspects of ideal and non-ideal filters

- **TUTORIALS** **(15 Hours)**

(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)

3. **Books Recommended:**

1. Barry Van Veen Simon Haykin, "Signals and Systems", 2nd Ed., Wiley, 2007
2. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, "Signals and Systems Prentice Hall India", 2nd Ed., Pearson, 2009.
3. B.P. Lathi, "Principles of Linear Systems and Signals", 2nd Ed., oxford, 22 Jul 2009

4. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing, Principles, Algorithms, and Applications”, 4th Ed., PHI, 2007.
5. Robert A. Gable, Richard A. Roberts, “Signals & Linear Systems”, 3rd Ed., John Wiley, 1995.

MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	Credit
3	0	2	04

EC 205 **Scheme**

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Classify microprocessor and microcontroller with RISC & CISC architectures. Overview of 8/16/32 microcontrollers
CO2	Describe 8-bit microprocessor 8085 architecture, bus system, Memory and I/O interfacing
CO3	Analyze the merits of ARM controllers along with architectural features and instructions
CO4	Elevate the knowledge gained for Programming ARM Cortex M0+ for different applications
CO5	Design an embedded system with various peripheral interfacing using Embedded C and Assembly language

2. **Syllabus:**

- **INTRODUCTION TO MICROPROCESSORS AND MICROCONTROLLER (06 Hours)**
  Microprocessor architectures basics, 8085 as Von Neumann CISC CPU. Bus system and its operation. 8085 Memory and peripheral interfacing. Advanced Microprocessors, Von Neumann vs Harvard, CISC vs RISC architecture, Overview and features of 8051 microcontrollers, Overview of the various commercially available 8-bit/16-bit Microcontrollers

- **ARM 32-BIT MICROCONTROLLER (12 Hours)**
  The architecture of ARM Cortex M0+, Various Units in the architecture, Thumb-2 technology, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence. Other Cortex series processors

- **ARM CORTEX M0+ INSTRUCTION SETS AND PROGRAMMING (13 Hours)**
  Arm & Thumb Instruction Set: Data Processing Instruction, Branch Instruction, Load Store Instruction, Special instructions, Bit-band operations and CMSIS, Assembly and C Language Programming

- **EMBEDDED SYSTEM COMPONENTS (14 Hours)**
  Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. The core of an Embedded System includes all types of processors/controllers, Peripheral interfacing such as timers, ADC, DAC, Sensors, Actuators, LED/LCD display, Push button switches, Communication Interface standards (onboard and external), Embedded firmware, Other system components, RTOS based embedded system

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. **List of Practicals:**

(The practical set is based on ARM Cortex-M Kit)

1. Introduce Keil ARM – MDK development flow
2. Assembly language programming set 1: (a) 2’s complement of 64-bit number (b) add data items of an array
3. Assembly language programming set 2: (a) packed BCD to binary conversion (b) sorting of an array in ascending/ descending order
4. Assembly language programming set 3: (a) multiplication with shift and add method (b) compute square root of a 32-bit number
5. Write an program to flash simple LEDs (D0, D1, ..., D7) connected to Ports in various patterns

6. Write code to show up/down BCD count on Multiplexed 7-segment LED display updated every second. Use two keys (up & down) to change the direction of counting.
7. Write a program to display “Welcome to SVNIT” as a welcome message on the LCD interface.
8. Interface the 4x4 keypad and pressed the display key on the LCD
9. Establish full duplex ASCII communication between kit and PC using UART
10. Generate Sine wave/Triangle/Square wave using SPI-based DAC and observe on CRO. Increase or Decrease frequency using Keys in decades.
11. Using the internal PWM module of the ARM controller generate PWM and vary its duty cycle
12. Interface DC and stepper motor and demonstrate its operation
13. Demonstrate the use of an external interrupt to toggle an LED ON/OFF
14. Display digital output for given analog input using internal ADC

4. <u>Books Recommended:</u>

1. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M0/M0+ processors, 2nd Ed., Newnes, (Elsevier), 2015.
2. A.N.Sloss, D.Symes and C. Wright, “ARM System Developer’s Guide: Designing and Optimizing System Software”, Elsevier, 2008
3. ARM Cortex M0 Technical Reference Manual. Available at:http://infocenter.arm.com/help/topic/com.arm.doc.ddi0432c/DDI0432C_cortex_m0_r0p0_trm.pdf
4. Gaonkar R. S., "Microprocessor Architecture, Programming and Applications with 8085", 6th Ed., Penram International, Indian, 2013
5. Ram B., "Fundamental of Microprocessor & Microcomputers", 9th Ed., Dhanpat Rai Publications, 2022

5. <u>Reference Book:</u>

1. Shibu K V, “Introduction to Embedded Systems”, 2nd Ed., Tata McGraw Hill, 200

PRINCIPLES OF COMMUNICATION SYSTEMS

L	T	P	Credit
3	0	2	04

EC 207 **Scheme**

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Describe the basic principles of communication techniques including important terminology
CO2	Explain about signal processing and statistical aspects involved in communication with time and frequency domain fundamentals.
CO3	Implement analog communication systems and digital baseband preparation stages.
CO4	Analyze the performance parameter for analog communication link and digital baseband.
CO5	Evaluate the various stages of analog communication link, baseband digital and point to point link performance parameters by experimentation using modern tools/simulators and hardware.
CO6	Design various stages of analog communication system and digital database preparation with optimum parameter selection criteria satisfying given parameters.

2. **Syllabus:**

- **ANALYSIS AND TRANSMISSION OF SIGNALS** **(06 Hours)**
  Aperiodic signal representation by Fourier Integral, Signal Transmission Through a Linear System, Ideal versus Practical Filter, Signal Distortion over a Communication Channel, Signal Energy and Energy Spectral Density, Signal Power and Power spectral Density.

- **AMPLITUDE MODULATION AND DEMODULATION** **(09 Hours)**
  Baseband Vs Carrier Communications, DSB-C And DSB- SC Amplitude Modulation, QAM, SSB, Vestigial Sideband (VSB) Transmission, Carrier Acquisition, AM transmitter design, AM receiver.

- **ANGLE MODULATION AND DEMODULATION** **(09 Hours)**
  Concept of instantaneous frequency, Bandwidth of Angle Modulated Waves, NBFM and WBFM, Generating FM Waves, Demodulation of FM, Phase Modulation Concepts, Effects of Nonlinear Distortion and Interferences in angle modulated systems, FM Receiver

- **NOISE** **(05 Hours)**
  Various Types of Noises: Internal and External Noise, White Noise and Filtered Noise, AWGN Properties, Noise Equivalent Bandwidth Concept, Noise Sampling, Signal to Noise ratio, AM & FM in the presence of noise

- **PULSE MODULATION TECHNIQUES** **(08 Hours)**
  Sampling and A to D conversion, Quantization techniques—Uniform and Non-uniform, A-law and μ-law, Pulse Code Modulation, Pulse Amplitude Modulation, Pulse Position Modulation, Pulse Width Modulation, TDM, DPCM and ADPCM, Delta Modulation

- **PRINCIPLES OF DIGITAL DATA TRANSMISSION** **(08 Hours)**
  Digital communication system, Line coding: properties of line coding, various line coding formats and their PSDs, Pulse shaping: Inter symbol Interference, Nyquist criterion for zero ISI, signaling with controlled ISI, Scrambling, Regenerative Repeater

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. List of Practicals:

1. Study of the Spectrum Analyzer.
2. Study of Various Signals and their Spectrum Using MATLAB.
3. DSB-SC and DSB-C AM Transmitter and Receiver.
4. FM Transmission and Reception Techniques.
5. AM and FM Simulation on MATLAB with AWGN Channel and Concept of SNR.
6. Study of various Pulse Modulation Techniques
7. Sampling and Pulse Modulation Technique
8. Pulse code modulation and demodulation technique
9. Differential pulse code modulation and demodulation
10. Delta and Adaptive Delta Modulation and demodulation technique.
11. Study of various Line coding formats

4. Books Recommended:

1. Lathi B. P., and Ding Zhi, "Modern Digital and Analog Communication Systems", 4th Ed., Oxford University Press 2010/ 5th Ed., 2018.
2. Proakis J. and Salehi M., "Fundamental of Communication Systems", 1st Ed., PHI/Pearson Education-LPE, 2006.
3. Carlson Bruce A., Paul B Crilly "Communication Systems- An Introduction to Signal and Noise in Electrical Communication", 5th Ed., McGraw-Hill, 2011.
4. Leon W. Couch, II "Digital and Analog Communication Systems", 8th Ed., Pearson Education-LPE, 2013.
5. Taub Herbert, Donald Schilling, Goutam Saha "Principal of Communication Systems", 4th Ed., Tata McGraw-Hill, 2013.

PROFESSIONAL ETHICS, ECONOMICS AND BUSINESS MANAGEMENT

L	T	P	Credit
3	1	0	04

MG 210 **Scheme**

1. Course Outcomes (COs):

At the end of the course the students will be able to:

CO1	Develop knowledge regarding Professional ethics
CO2	Develop knowledge of Economics in engineering
CO3	Develop managerial skills to become future engineering managers
CO4	Develop skills related to various functional areas of management (Marketing Management, Financial Management, Operations Management, Personnel Management, etc.)
CO5	Build knowledge about modern management concepts
CO6	Develop experiential learning through Assignments, Management games, Case study discussions, Group discussions, Group presentations, etc.

2. Syllabus:

- **PROFESSIONAL ETHICS** **(06 Hours)**
  Introduction, Meaning of Ethics, Approaches to Ethics, Major attributes of Ethics, Business Ethics, Factors influencing Ethics, Importance of Ethics, Ethics in Management, Organizational Ethics, Ethical aspects in Marketing, Mass communication and Ethics - Television, Whistle blowing, Education – Ethics and New Professional, Intellectual Properties and Ethics, Introduction to Professional Ethics, Engineering Ethics

- **ECONOMICS** **(08 Hours)**
  Introduction To Economics, Applications & Scopes of Economics, Micro & Macro Economics, Demand Analysis, Demand Forecasting, Factors of Production, Types of Cost, Market Structures, Break Even Analysis

- **MANAGEMENT** **(15 Hours)**
  Introduction to Management, Features of Management, Nature of Management, Development of Management Thoughts – Scientific Management by Taylor & Contribution of Henry Fayol, Coordination & Functions Of Management, Centralization & Decentralization, Decision Making; Fundamentals of Planning; Objectives & MBO; Types of Business Organizations: Private Sector, Public Sector & Joint Sector; Organizational Behaviour: Theories of Motivation, Theories of Leadership

- **FUNCTIONAL MANAGEMENT** **(14 Hours)**
  Marketing Management: Core Concepts of Marketing, Marketing Mix (4p), Segmentation – Targeting – Positioning, Marketing Research, Marketing Information System, Concept of International Marketing, Difference Between Domestic Marketing & International Marketing; Operations Management: Introduction to Operations Management, Types of Operation Systems, Types of Layouts, Material Handling, Purchasing & Store System, Inventory Management; Personnel Management: Roles & Functions of Personnel Manager, Recruitment, Selection, Training; Financial Management: Goal of Financial Management, Key Activities In Financial Management, Organization of Financial Management, Financial Institutions, Financial Instruments, Sources of Finance

- **MODERN MANAGEMENT ASPECTS** **(02 Hours)**
  Introduction To ERP, e – CRM, SCM, RE – Engineering, WTO, IPR Etc.

- **TUTORIAL** **(15 Hours)**

Case Study Discussion, Group Discussion, Management games and Assignments / Mini projects & presentation on related Topics

(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)

3. Tutorial:

1. Case Study Discussion
2. Group Discussion
3. Management games
4. Assignments / Mini projects & presentation on related Topics

4. Books Recommended:

1. Balachandran V. and Chandrasekaran, Corporate Governance, Ethics and Social Responsibility, PHI, 2nd Edition, 2011
2. Prasad L.M., Principles & Practice of Management, Sultan Chand & Sons, 8th Edition,2015
3. Banga T. R. & Sharma S.C., Industrial Organisation & Engineering Economics, Khanna Publishers, 25th Edition, 2015
4. Everett E. Adam, Ronald J. Ebert, Production and Operations Management, Prentice Hall of India, 5th edition, 2012
5. Kotler P., Keller K. L, Koshi A.& Jha M., Marketing Management – A South Asian Perspective, Pearson, 14th Edition, 2014
6. Tripathi P.C., Personnel Management & Industrial Relations, Sultan Chand & sons, 21st Edition, 2013
7. Chandra P., Financial Management, Tata McGraw Hill, 9th Edition, 2015

5. Reference Book:

1. Crane A. & Matten D., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Oxford University, 2010
2. Fritzsche D. J., Business Ethics: a Global and Managerial Perspectives, McGraw Hill Irwin, Singapore, 2004
3. Mandal S. K., Ethics in Business and Corporate Governance, Tata McGraw Hill, 2011

STATISTICAL SIGNAL ANALYSIS

L	T	P	Credit
3	1	0	04

EC 202 **Scheme**

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Describe probability, random variables, and random processes and parameters related to them
CO2	Classify different types of random variables and random processes.
CO3	Analyze random variables and random processes using knowledge of PDF, CDF, autocorrelation functions, Power spectral density, etc. and LTI systems with random inputs
CO4	Evaluate Moments & Characteristic inequalities and probabilistic limits
CO5	Design problems based on probability, Random variables and Random processes.

2. **Syllabus:**

- **COMBINATORIAL ANALYSIS** **(04 Hours)**
  Introduction, The Basic Principle of Counting, Permutations, Combinations, Multinomial Coefficients, The Number of Integer solutions of Equations

- **PROBABILITY THEORY** **(05 Hours)**
  Scope and History, Probability as Frequency of Occurrence, Set, Fields, Sample Space and Events, Axiomatic Definition of Probability, Mutually Exclusive Events, Joint Probability, Conditional Probability and Statistical Independence, Bays Theorem

- **RANDOM VARIABLES** **(12 Hours)**
  Continuous and Discrete Random Variables, Cumulative Distribution Function CDF), Probability Density Function (PDF), Properties of CDF and PDF, Mathematical Expectation, Moments of a random variable, Standard Probability distributions: Bernoulli, Binomial, Poisson, Uniform, Exponential, Gaussian, Chi-Square, Function of random Variable, Transformations of Random Variables, Moment Generating Function, Characteristic Functions

- **MULTIPLE RANDOM VARIABLES** **(08 Hours)**
  Joint Distribution Functions, Marginal Distributions, Conditional Distributions, Joint Expectation, Sum of Independent random variables, Covariance, Conditional Expectation, Correlation between Rando variable, Multivariate Gaussian Distribution, Law of Large Numbers, Central Limit Theorem and its Significance

- **STOCHASTIC PROCESS** **(10 Hours)**
  Definition and Description of Random Processes, classification of random processes, Mean, Autocorrelation, Auto covariance functions Stationary Random Processes: Strict Sense Stationary and Wide Sense Stationary, Joint Statistical Averages of Two Random Processes, Cross Correlation and Cross Covariance, Ergodicity, Ergodic Processes, Markov Process: Markov Chain, Probability distribution and stationary distribution of Markov chain, Chapman Kolmogorov theorem, Binomial, Poisson and Normal Processes

- **RANDOM PROCESSES IN LINEAR SYSTEMS** **(06 Hours)**
  Transmission of a Random Process Through LTI System, Power spectral density and cross-spectral density Functions, Examples with White Noise as Input, Linear Shift Invariant Discrete Time System with a WSS Sequence as Input

- **TUTORIALS** **(14 Hours)**

(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)

3. Books Recommended:

1. Papoulis A., S. Unnikrishna Pillai, “Probability, Random Variables, and Stochastic Processes”, 4th Ed., McGraw-Hill, 2006
2. V. Sundarapandian, “Probability, Statistics and Queueing theory, 1st Edition, PHI 2009
3. Alberto Leon-Garcia, “Probability, Statistics, and Random Processes for Electrical Engineering”, 3rd Ed., Pearson, 2007
4. Steven Kay, “Intuitive Probability and Random Processes using MATLAB”, 1st Ed., Springer, 2006
5. Sheldon Ross, “A First Course in Probability”, 9th Ed., Pearson, 2012
6. Montgomery and Ruger, “Applied Statistics and Probability for Engineers”, 1st Ed., John Wiley, 2006

LINEAR IC APPLICATIONS

L	T	P	Credit
3	0	2	04

EC 204 **Scheme**

1. Course Outcomes (COs):

At the end of the course the students will be able to:

CO1	Describe an op-amp fundamentals and its specifications.
CO2	Analyze and design active filters and oscillators using op-amp and functional ICs.
CO3	Classify the working principle of data converters and select appropriate D/A and A/D converters for signal processing applications.
CO4	Compare the working of multivibrators using special application IC 555 and general-purpose op-amp.
CO5	Design the linear and nonlinear applications of an op-amp using IC 741.

2. Syllabus:

- **OPERATIONAL AMPLIFIER FUNDAMENTALS** **(10 Hours)**
  Operational Amplifier, Basic Op-Amp Configuration, An Op-Amp with Negative Feedback, Voltage Series and Voltage Shunt Configurations, Difference Amplifiers, Instrumentation Amplifier, Specification of an Op-Amp, Offset Voltages and Currents, CMRR, Slew Rate, PSRR, Input Bias and Offset Currents, Frequency Response, GBW Product, Compensated Op-amp and Non-Compensated Op-Amp.

- **GENERAL LINEAR APPLICATIONS** **(06 Hours)**
  Summing, Scaling, and Averaging Amplifiers, Concept of Negative Resistance, Voltage to Current Converter with Floating and Grounded Load, Current to Voltage Converter, Integrator and Differentiator, Gyrator, Frequency-dependent negative resistance circuit.

- **ACTIVE FILTERS AND OSCILLATORS** **(10 Hours)**
  First Order Active Filters, Second-Order Active Filters, Multiple Feedback Filters (Band Pass and Band Reject Filters), All-Pass Filter, Cascade design of filters, Magnitude, and Frequency scaling concepts, Oscillators, Phase Shift and Wien Bridge Oscillators, Square, Triangular and Saw Tooth Wave Generators.

- **NON-LINEAR CIRCUITS** **(05 Hours)**
  Schmitt Trigger, Voltage Comparator, Voltage Limiters and Window Detector, Concept of Clippers and Clampers Circuit using passive component, Clippers and Clampers using Op Amp, Precision Rectifiers.

- **MULTI-VIBRATOR CIRCUIT** **(07 Hours)**
  Concept of Multi-vibrator Circuit using passive component, the 555 Timer, Astable Mode operation, Monostable Mode operations, Applications of 555 Timer Circuit.

- **D/A AND A/D CONVERTERS** **(07 Hours)**
  Introduction, D/A Converters, Performance Parameters of D/A Converter, Basic D/A Conversion Techniques, Sources of Errors in D/A Converters, D/A Converter IC, A/D Converters, Performance parameters of A/D Converter, Counter Type A/D converter, Successive approximation Conversion, Flash A/D converter, Single and Dual Slope A/D converter, A/D Converter IC.

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. List of Practicals:

1. Design and implement Zero Crossing Detector, Positive Level Detector, and Negative Level Detector or inverting and non-inverting configuration using IC 741.
2. To study the effect of Loading and input impedance for Inverting and Non-inverting negative feedback amplifiers using IC 741.
3. Design and implement circuits for testing specifications of IC 741.
4. Design and implement Inverting and Non-inverting negative feedback amplifiers for given gain using IC 741. Also, analyze the frequency response.
5. Design and implement Summing, Averaging, and Scaling amplifiers. Also, implement 4 input Subtractors using IC 741.
6. Design and implement a Practical Integrator for a given cut-off frequency using IC 741. Also, analyze the frequency response.
7. Design and implement a Practical Differentiator for a given cut-off frequency using IC 741. Also, analyze the frequency response.
8. Design and implement 1st and 2nd order Low-pass filters for a given cut-off frequency using IC 741. Also, analyze the frequency response.
9. Design and implement 1st and 2nd order High-pass filter for a given cut-off frequency using IC 741. Also, analyze the frequency response.
10. Design and implement a Notch filter for a given notch frequency using IC 741. Also, analyze the frequency response.
11. Design and implement an All-pass filter for a given phase difference using IC 741.
12. Design and implement RC Phase shift and Wein bridge oscillator using IC 741.
13. Design and implement a square wave Generator using IC 741.
14. Design and implement a Monostable and Astable Multivibrator using a 555 timer.
15. Design and implement a Voltage Regulator using IC 7805. Also, perform Load and Line Regulation.

4. Books Recommended:

1. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Ed., McGraw-Hill, Published: 2016.
2. Coughlin and Driscol, "Op-Amps and Linear Integrated Circuits", 6th Ed., PHI, 2003
3. Gayakwad Ramakant, "Op-Amps and Linear Integrated Circuits", 4th Ed., PHI, 2003.
4. Salivahanan S., "Linear Integrated Circuits", 4th Reprint, McGraw-Hill, 2010.
5. Roy Choudary D. and Shail B. Jain, Linear Integrated circuits, 4th Ed., New Age International Publishers, 2010.

5. Reference Book:

1. William D. Stanley, “Operational Amplifiers with Linear Integrated Circuits”, 4th Ed., Old Dominion University, Pearson Education, 2002.

ELECTROMAGNETIC WAVES

L	T	P	Credit
3	0	2	04

EC 206 **Scheme**

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Describe the basic concepts and theorems of electromagnetic theory and its applications.
CO2	Explain the wave propagation and radiation phenomenon in different environments
CO3	Apply the principles of electromagnetic theory and wave propagation to model transmission line and radiating systems.
CO4	Analyze the theoretical concepts based on Maxwell's equation, transmission line theory and antennas.
CO5	Evaluate the wave propagation behavior between two mediums.
CO6	Formulate the aspects of electromagnetic theory for different applications.

2. **Syllabus:**

- **ELECTROMAGNETIC THEOREM and MAXWELL'S EQUATIONS (12 Hours)**
  Divergence and Stoke's Theorem, Coulomb's law, Gauss's law and Applications, Electric Potential, Poisson's and Laplace Equations, Biot-Savart's law, Faraday's law and Ampere's Work law in the Differential Vector form , Flux rule for Motional EMF, Magnetic Vector Potential, Introduction to The Equation of Continuity For Time Varying Fields, Inconsistency of Ampere's Law, Maxwell's Equation, Condition at a Boundary Surface, Poynting Theorem.

- **ELECTROMAGNETIC WAVES (10 Hours)**
  Solution for Free Space Conditions, Uniform Plane Waves and Propagation, The Wave Equations for a Conducting Medium, Sinusoidal Time Variations, Conductors and Dielectrics, Polarization, Reflection by a Perfect Conductor: Normal Incidence and Oblique Incidence, Reflection by a Perfect Dielectric: Normal Incidence and Oblique Incidence, Reflection at the Surface of a Conductive Medium.

- **RADIATION (10 Hours)**
  Potential functions and the Electromagnetic field, Oscillating Electric Dipole derivations for E and H field components in spherical coordinate systems, Power Radiated by a Current Element, Application to Antennas, Radiation from Half wave Dipoles, Derivation for Radiation Resistance, Application of Reciprocity Theorem to Antennas, Equality of Directional Patterns and Effective Lengths of Transmitting and Receiving Antennas, Directional Properties of Dipole Antennas, Antenna Parameters and Definitions.

- **TRANSMISSION LINE ANALYSIS (08 Hours)**
  Transmission Line Equations, Voltage and Current Waves, Solutions for Different Terminations, Transmission-line Loading, Impedance Transformation and Matching, Smith Chart, Quarter-wave and Half-wave Transformers.

- **ATMOSPHERIC WAVE PROPAGATION (05 Hours)**
  Plane Earth Reflection, Spherical Earth Propagation, Tropospheric Waves. The Ionosphere, Reflection and Refraction Waves by the Ionosphere, Regular and Irregular Variations of the Ionosphere.

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY (30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. **List of Practicals:**

1. To obtain Radiation Pattern of a Dipole Antenna in two planes.
2. To observe Current Distribution on a Dipole Antenna.
3. To obtain radiation Pattern of a Yagi-Uda Antenna in two planes.
4. Measurement of Dielectric Constant using Solid Dielectric Cell
5. To determine the Standing Wave-Ratio and Reflection Coefficient for different loads
6. To measure an unknown impedance of the given load using a Smith chart
7. Phase shift measurement of the given DUT
8. To perform gain measurement of different antennas.
9. Return loss measurement of given DUT
10. Insertion loss measurement of given DUT
11. To simulate Dipole antenna / Microstrip Patch Antena in HFSS/CST
12. To simulate waveguide-based components in HFSS/CST

4. **Books Recommended:**

1. E.C. Jordan & G. Balmain, “Electromagnetic Waves and Radiating Systems”, 2nd Ed., PHI, Reprint 2011.
2. R. K. Shevgaonkar, “Electromagnetic Waves”, 1st Ed., Tata McGraw Hill, 2006.
3. M.N.O. Sadiku, “Principles of Electromagnetics”, 4th Ed., Oxford University Press, 2011.
4. W.H. Hayt, “Engineering Electromagnetics”, 7th Ed., McGraw Hill, 2006.
5. Roger F. Harrington, “Time-Harmonic Electromagnetic Fields”, Wiley-IEEE Press, 2001.

DIGITAL INTEGRATED CIRCUITS

L	T	P	Credit
3	0	2	04

EC 208 **Scheme**

1. Course Outcomes (COs):

At the end of the course the students will be able to:

CO1	Understand the operation of MOS transistors and scaling trends in MOSFETs and illustrate various short channel effects.
CO2	Recognize the fundamental concepts of various logic families with their comparative analysis
CO3	Illustrate the various processing techniques of NMOS and CMOS technology.
CO4	Analyse the design of an inverter using CMOS logic and estimate the switching parameters, power dissipation and CMOS-TTL interfacing.
CO5	Evaluate the performance of different sequential and combinational circuits using CMOS logic.
CO6	Design the sequential and combinational circuits using CMOS with layout and stick diagrams.

2. Syllabus:

- **MOS TRANSISTORS** **(10 Hours)**
  Fundamental of MOSFET operation and MOSFET capacitances, MOSFET I-V Characteristics, MOSFET Model, Modeling of MOS Transistor using Spice, Scaling and Small Geometry Effects, Fabrication Process Flow, CMOS N-Well Process and Twin Tub Process.

- **OVERVIEW OF HIGH-SPEED LOGIC FAMILIES** **(10 Hours)**
  BJT Inverter, DC Switching Characteristic, Introduction to RTL, DTL, DCTL, HTL,TTL, Schottky TTL, and ECL Logic Family, Concept of Noise margin, Fan Out and Propagation Delay, NMOS, PMOS, CMOS, Bi- CMOS Circuits

- **NMOS AND CMOS LOGIC DESIGN** **(10 Hours)**
  Various NMOS Inverters, Determination of VTC, Calculation of VTC Critical Points, CMOS Inverter Technology, VTC, Static Characteristics, Dynamic Behaviour, Static and Dynamic Power Dissipation, Power-Delay Product, TTL-CMOS Interfacing.

- **CMOS COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUITS** **(15 Hours)**
  CMOS Logic Circuits, Complex Logic Circuits, Pass transistor and Transmission gate, Behavior of MOS Logic Elements. The Bistability Principle, SR Latch Circuit, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop. Layout Design Rules, Full-Custom Mask Layout Design and Stick Diagram

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. List of Practicals:

1. Introduction to SPICE circuit simulator
2. Realization of MOSFET characteristics using circuit simulator characteristics and BSIM models.
3. Realization of NOR gate using RTL logic. Obtain & plot its transfer characteristics and determine noise margins, fan-out and propagation delay.
4. Realization of NAND gate using TTL logic. Obtain & plot Its transfer characteristics and determine noise margins, fan-out and propagation delay

5. Implementation of CMOS inverter, obtain & plot its transfer characteristics, determine noise margins and measure propagation delay
6. Realization of inverter gate using BiCMOS logic, obtain & plot its transfer characteristics, determine noise margins
7. Design and implementation of TTL-CMOS & CMOS-TTL interfacing.
8. Design and implementation of pass transistor and transmission gate-based logic circuits.
9. Design and implement of JK & SR flip-flop using CMOS.
10. Layout of CMOS inverter and parasitic extraction and obtain VTC of extracted net list.
11. Design and implementation of inverter and NAND gate circuits using the DTL logic family
12. Design and implementation of inverter and NAND gate circuits using the ECL logic family

4. Books Recommended:

1. Taub H. and Schilling D., "Digital Integrated Electronics", International Ed., McGraw-Hill, 2008
2. R P Jain, “Modern Digital Electronics”, 4th Ed. Tata McGraw-Hill New Delhi.
3. Sung-Mo Kang and Leblebici Y., "CMOS Digital Integrated Circuits: Analysis and Design", 3rd Ed., Tata McGraw-Hill; 2003.
4. Rabaey Jan, Chandrakasan Anantha Nikolic, "Digital Integrated Circuits: A Design Perspective", 2nd Ed., Pearson Education, 2008.
5. Hodges D. A. and Jackson H. G. "Analysis And Design Of Digital Integrated Circuits", 3rd Ed., McGraw-Hill, 2004.
6. Baker R. J., Li H. W. and Boyce D. E., "CMOS Circuits Design Layout and Simulation", 2nd Ed., PHI 2005.

CONTROL SYSTEMS

L	T	P	Credit
3	0	2	04

EE 258 **Scheme**

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Describe various types of control systems and to impart knowledge of mathematical modelling of physical systems
CO2	Explain the response of various control systems in the time domain.
CO3	Demonstrate the stability of control systems using a variety of methods.
CO4	Analyze the response and stability of control systems using frequency domain techniques
CO5	Design of PD, PI, and PID controllers.
CO6	Demonstrate various control systems applications with laboratory experiments

2. **Syllabus:**

- **INTRODUCTION TO CONTROL SYSTEMS** **(03 Hours)**
  Open loop control and close loop control; illustrative examples of control systems.

- **MATHEMATICAL MODELS OF PHYSICAL SYSTEMS** **(10 Hours)**
  Linear and non-linear systems; equations and transfer functions for linear mechanical translational systems and linear electrical network; Force-Voltage and Force-Current analogy; Block diagram representation of control systems; Block diagram reduction; ; Signal flow graph and Mason's gain formula, Transfer functions of armature-controlled and field-controlled DC motors.

- **TIME DOMAIN ANALYSIS OF CONTROL SYSTEMS** **(06 Hours)**
  Typical test signals; Response of first-order systems; Transient response of a second-order system due to step input; Time domain specifications of a second-order system; Steady-state errors; Static error coefficients.

- **CONCEPTS OF STABILITY** **(12 Hours)**
  Introduction to stability, definition through impulse response function, asymptotic stability and relative stability, Routh-Hurwitz stability criterion. Basic Properties of Root Loci, Construction of Root Loci, Effects of Adding Poles and Zeros.

- **FREQUENCY DOMAIN ANALYSIS OF CONTROL SYSTEMS** **(10 Hours)**
  Steady-state response of a system due to sinusoidal input; Frequency response; Logarithmic plots or Bode diagrams; Log-magnitude versus phase plots; Polar plots; conformal mapping, principal of argument, Nyquist stability criterion, Stability analysis; Relative stability; Gain margin and phase margin; Closed loop frequency response.

- **INTRODUCTION TO COMPENSATORS AND CONTROLLERS** **(04 Hours)**
  Introduction to phase lag, phase lead and phase lag-lead compensators and their applications. P, PI, PID Controllers

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. **List of Practicals:**

1. To obtain the open-loop response and open-loop transfer function of an OVEN.
2. To control the speed of a two-phase AC Servo motor using an auto-tunable PI controller.
3. To understand the practical Air blower control system and to control the speed of the blower using Programmable Logic Controller (PLC) and VFD from SCADA.
4. a) To obtain no load speed vs control voltage curve for the two-phase servo motor.
   b) To obtain speed–torque curves for the various control voltages of the servo motor.
5. To obtain a close loop response of an OVEN.
6. To understand the transient behavior of a practical Air blower control system.
7. To obtain the frequency response of the phase lead network
8. a) To obtain step response and to find transient time domain specification for a second-order system using MATLAB.
   b) To obtain the Bode plot and Root locus using MATLAB.
9. a) To obtain step response and to find transient time domain specification for a second-order system using MATLAB.
   b) To obtain the Bode plot and Root locus using MATLAB.

4. Books Recommended:

1. I.J. Nagrath, M. Gopal, “Control system engineering”, New Age International Publishers, 3rd Ed., 2001.
2. K. Ogata, “Modern control system engineering”, Pearson Education Asia, 4th Ed., 2002.
3. B.C. Kuo, “Automatic control system”, Prentice Hall of India, 7th Ed., 1995
4. R.C. Dorf, R.H. Bishop, “Modern control system”, Pearson Education Asia. 8th Ed., 2004.
5. N. S. Nice, “Control System Engineering”, John willey& sons, 4th Ed., 2004

Department of Electronics Engineering

B. Tech. (Minor) Electronics and Communication Engineering

Minor Courses:

B. Tech. Minor in Electronics Engineering (for Mechanical, Civil, and Chemical Engineering students)				
Sr. No.	**Subject**	**Code**	**Scheme**	**Credits**
1	Analog Electronics	EC2XX	3-0-2	04
2	Digital Electronics and Microcontrollers	EC3XX	3-0-2	04
3	Communication and Signal Processing	EC3XX	3-0-2	04
4	Sensors and Instrumentation	EC4XX	3-0-2	04

ANALOG ELECTRONICS

L	T	P	Credit
3	0	2	04

EC 2XX **Scheme**

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Understand the basics of semiconductors and Diodes
CO2	Explain Transistors and MOSFETs.
CO3	Discuss Optoelectronic devices
CO4	Analyse working of Rectifiers, filters, and regulators circuits
CO5	Classify and analyse Amplifiers and Oscillators circuits
CO6	Illustrate OP-AMP circuits and 555 Timer applications.

2. **Syllabus:**

- **SEMICONDUCTOR DIODES AND APPLICATIONS** **(09 Hours)**
  Quantitative theory of PN diode, volt-ampere characteristics, and its temperature dependence, narrow-base diode, transition and diffusion capacitance of p-n junction diodes, breakdown of junctions on the reverse bias, small signal models of the diode, PN diode Application as Rectifier, Half Wave Rectifier, Centre Tap and Bridge Rectifier, Filter circuits, C, LC and pie filter with circuit Diagram and waveforms. Zener Diode theory, Construction, Operation with forward and reverse VI characteristics, Zener Voltage Regulator, construction and application of Schottky and Varactor Diodes.

- **TRANSISTORS AND MOSFETs** **(10 Hours)**
  Transistors- definition, terminals, types, symbols, formation of NPN and PNP, ratings. Transistor biasing- definition, importance, list types, stabilization, thermal runaway, heat sink, and voltage divider method. List configurations and applications. Alpha and Beta- definitions, relation. CE input and output characteristics- cut off, saturation, and active regions. Transistor as a switch. List applications. FET- definition, types. MOSFET- definition, types, symbols. N type enhancement mode- construction, working, characteristics, switch. List applications and ratings, BJT, Differentiate BJT and MOSFET.

- **SPECIAL PURPOSE DIODE** **(05 Hours)**
  Electron emission– types, applications. Symbols, working and applications of–photo diode, opto isolator, photo voltaic cell, LED, LDR, LCD, opto coupler.

- **AMPLIFIERS AND OSCILLATORS** **(10 Hours)**
  Amplifier- definition, faithful amplification, classification based on configuration, power, and frequency. Transistor CE amplifier with biasing. Working of class A, B, C, and Push pull amplifier. Two stage RC coupled amplifier-working, gain in dB, frequency response. Feedback- definition, types, advantages and disadvantages, applications. Oscillators- definition, classification, LC tank circuit, criteria. RC phase shift and crystal oscillator- working, applications.CRT- construction, working and applications

- **OPERATIONAL AMPLIFIER** **(11 Hours)**
  Differential amplifier-Dual input balanced output differential amplifier, block diagram of typical Op-Amp, schematic symbol, interpreting data sheet, the ideal Op-Amp, equivalent circuit of an Op-Amp, Op-Amp Parameters-Input Impedance, Output impedance, input offset voltage, Open Loop Voltage gain, input bias current, slew rate open loop Op-Amp configurations

  Application: Voltage series feedback amplifier, Voltage shunt feedback amplifier, DC and AC amplifiers, summing, scaling and averaging amplifiers, voltage to current converter, integrator, differentiator, basic comparator, zero-crossing detector, Schmitt trigger

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. **List of Practicals:**

1. To study the Active/Passive Components and Various Instruments
2. To study and plot the volt-ampere characteristics of pn junction diode in Forward and Reverse bias and obtain the cut-in voltage.
3. To study and design Half Wave Rectifier with and without filter and calculate its ripple factors.
4. To study and design Zener diode based voltage regulator and calculate the line and load regulation.
5. To study and design Full Wave Rectifier with and without filter and calculate its ripple factors.
6. To study and plot the I/P and O/P characteristics of BJT / MOSFET
7. To study and design single RC coupled Amplifier using BJT/MOSFET.
8. To study and design Inverting & Non Inverting Amplifier using Op-Amp
9. To study and design Adder/Subtractor using Op-Amp
10. To study and Design RC Phase Shift Oscillator using BJT/op-amp
11. To study and Design square wave generator using op-amp
12. Minor Project

4. **Reference Books:**

1. Electronics Principles and applications by Charles A Schuler and Roger L Tokhiem, Sixth Edition, Mc. Graw Hill , 2008.
2. Electronics Principles by Malvino, Mc. Graw Hill, Third edition. 2000.
3. Electronics Devices and Circuits by Allan Mottershed, PHI Learning Pvt. Ltd., First Edition.
4. Electronics Analog and Digital by I. J. Nagrath, PHI Learning Pvt. Ltd., 2013 Edition.
5. Linear Integrated Circuits by Ramakant A. Gayakwad, PHI Learning Pvt. Ltd., Fourth Edition

DIGITAL ELECTRONICS AND MICROCONTROLLERS

L	T	P	Credit
3	0	2	04

EC 3XX **Scheme**

1. Course Outcomes (COs):

At the end of the course the students will be able to:

CO1	Apply Boolean algebra to understand binary logic and logic circuits.
CO2	Formulate combinational logic problems and solve using truth table. Optimize using K-map and other equivalent techniques
CO3	Design and realize synchronous Sequential logic circuits
CO4	Understand operation counters, registers and memory
CO5	Investigate organization of computer and describe internal architecture of 8051microcontroller
CO6	Develop Assembly programs of microcontroller to implement algorithms

2. Syllabus:

- **BOOLEAN ALGEBRA AND SIMPLIFICATION (06 Hours)**
  Basic Logic Operation and Logic Gates, Truth Table, Basic Postulates and Fundamental Theorems of Boolean Algebra, Minterms and Maxterms, Standard Representations of Logic Functions- SoP and PoS Forms, Introduction to K maps, Simplification of Boolean Functions using K-Map.

- **COMBINATIONAL LOGIC CIRCUITS (09 Hours)**
  Full adder and Full subtractor design, Binary Parallel Adder, Carry Look-ahead Adder, Magnitude comparator, BCD adder, Encoder Priority Encoder, Decoder, Multiplexer and De-multiplexer Circuits, Implementation of Boolean Functions using Decoder and Multiplexer, Arithmetic and Logic Units.

- **LATCHES AND FLIP-FLOPS (08 Hours)**
  Cross Coupled SR Flip-Flop Using NAND or NOR Gates, Clocked Flip-flops, D-Types and Toggle Flip-flops, Truth Tables and Excitation Tables for Flip-flop. Master Slave Configuration, Edge Triggered and Level Triggered Flip-flop, Flip-flop with Preset and Clear.

- **SEQUENTIAL LOGIC CIRCUIT (08 Hours)**
  Introduction to State Machine, Mealy and Moore Model, State Machine Notation, State Diagram, State Table, Flip flop excitation table, Design procedure of clocked sequential circuits.

  Registers with parallel load, Shift Left and Shift Right Register, Serial-in-Parallel-Out(SIPO) and Parallel-In-Serial-Out(PISO), Ripple counter, and synchronous counters.

- **INTRODUCTION TO MICROCONTROLLERS (06 Hours)**
  Internal Organization of Computer, Buses of the computing system, CPU with RAM and ROM, ALU), Introduction to 8051 8-bit microcontroller, Internal architecture of 8051, and Addressing modes. A brief overview of I/O Ports, Timers, and Serial communication. Advanced microcontrollers.

- **8051 ASSEMBLY LANGUAGE PROGRAMMING (08 Hours)**
  8051 data types and registers, Instructions for moving data, Arithmetic and Logical instructions Jump and CALL instructions, and Example programs in assembly language.

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY (30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. List of Practicals:

((Following practicals are to be performed using discrete components)

1. Verify truth table of variety of logic gates
2. Flip-flops using NAND/ NOR Gate.
3. Half-Adder/ Half-subtarctor Circuits
4. Full-Adder/ Full-subtarctor Circuits .
5. 4-Bit Gray To Binary/ Binary To Gray Code convertor using Select input.
6. RS and D flip flop using NAND gates
7. JK and T flip flops using NAND gates
8. Shift registers using D flip flops
9. 4-bit ripple counter
10. Implement mod 5 synchronous counter

(Following 8051 assembly programming PracticalS are to be performed Keil uVision tool)

11. Move block of Data from source to destination Keil uVision
12. Write assembly code to read data from array and compute sum
13. Develop assembly code to convert BCD to binary.
14. Write assembly code to convert Binary number to BCD

4. Books Recommended:

1. Mano Morris, “Digital Logic and Computer Design”, Pearson Education, 2019 Edition.
2. Anand Kumar, “Fundamentals of Digital Circuits”, PHI, 4th Ed., 2016.
3. Jain R. P. and Anand M. H. S., “Digital Electronics Practices using Integrated Circuits”, TMH, 1st Ed., 2004.
4. K. Ayala, “The 8051 Microcontroller”, Cengage Learning, 3rd Ed., 2009.
5. Muhammad A. Mazidi and Janice G. Mazidi, “The 8051 Microcontroller and Embedded Systems”, Pearson, 2nd Ed.,2013.

COMMUNICATION AND SIGNAL PROCESSING

L	T	P	Credit
3	0	2	04

EC 3XX **Scheme**

1. **Course Outcomes (COs):**

At the end of the course the students will be able to:

CO1	Describe the basic knowledge of Communication techniques including analog and digital communication and details of wireless link
CO2	Explain about signal processing aspects involved in analog digital communication with time and frequency domain fundamentals.
CO3	Apply the concepts to the problems of communication techniques for optimizing the performance, may be using signal processing aspects.
CO4	Compare performance analysis of various modulation and coding techniques for a link, case study and problem solving as per given parameters.
CO5	Evaluate various stages of communication link and signal processing performance parameters by experimentation using modern tools/simulators and hardware.
CO6	Design the communication link with optimum parameter selection criteria satisfying given requirements.

2. **Syllabus:**

- **TRANSMISSION OF SIGNALS** **(08 Hours)**
  Fourier Series, Fourier Transform Properties and their applications in communication systems, The Exponential Fourier Series, Aperiodic signal representation by Fourier Integral, Transmission of some useful functions, Signal Transmission Through a Linear System and Convolution concepts, Ideal versus Practical Filter, Channel as a filter

- **NOISE** **(03 Hours)**
  Various Types of Noises: Internal (Shot, Thermal, Agitation, Transit Time) Noise and External (Atmospheric, Extra-Terrestrial, Industrial) Noise, White Noise and Filtered Noise, AWGN Properties

- **AMPLITUDE MODULATION AND DEMODULATION ECHNIQUES** **(06 Hours)**
  Modulation, Antenna requirements, Transmission mediums, Baseband Vs Carrier Communications, DSB-C And DSB-SC Amplitude Modulation, Bandwidth Efficient AM: SSB, Vestigial Sideband (VSB) Transmission, Frequency Division Multiplexing.

- **FREQUENCY MODULATION AND DEMODULATION** **(04 Hours)**
  Nonlinear Modulation, Bessel's function, Carson's Rule, Bandwidth of Angle Modulated Waves, NBFM and WBFM, Generating FM Waves, Demodulation of FM Signals.

- **SAMPLING AND PULSE MODULATION TECHNIQUES** **(08 Hours)**
  Sampling theorem, Periodic Sampling, Frequency-Domain Representation of Sampling, Reconstruction of a Bandlimited Signals, Discrete-Time Processing of Continuous-Time Signals, Continuous the Sampling Processing of Discrete-Time Processing. Sampling and A to D conversion of signals, Quantization techniques—Uniform and Non-uniform, A-law and μ-law, Pulse Code Modulation, Pulse Amplitude Modulation, Pulse Position Modulation, Pulse Width modulation.

- **DIGITAL DATA TRANSMISSION AND RECEPTION USING SIGNAL PROCESSING** **(08 Hours)**
  Digital Communication System, Line Coding, Pulse Shaping For Optimum Transmission, ISI and ISI-Free transmission, Band-limiting of Rectangular Pulses, Raised Cosine Filtering, Regenerative Repeaters, Matched Filter And Equalizers, Eye Diagrams

- **BANDPASS SIGNAL TRANSMISSION-DIGITAL CARRIER SYSTEM** **(08 Hours)**

Representation Of Digital Modulated Signal, ASK, PSK, FSK, QAM (MODEMs) with Mathematics and Constellation Diagram, Spectral Characteristics of Digitally Modulated Signals. M-Ary Digital Carrier Modulation.

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. List of Practicals:

1. AM with Performance Analysis under Channel Effects.
2. FM with Performance Analysis under Channel Effects.
3. Sampling theorem
4. FDM and TDM
5. Simulation of ASK, FSK and PSK with study of constellation diagram.
6. Simulation of Line Coding Techniques.
7. Simulation and Implement the Effect of Raised Cosine Filter and pulse shaping.
8. Simulation of Eye Diagram,.
9. Source Coding Techniques
10. Error Control Coding Techniques.

4. Books Recommended:

1. Lathi B.P. and Ding Zhu, "Modern Digital And Analog Communication Systems", 4th Ed., Oxford University Press, 2010.
2. John G. Proakis and Masoud Salehi, “Digital Communications”, 5th Ed., McGraw-Hill, 2014.
3. Bhattacharya Amitabh, "Digital Communication", 1st Ed., Tata McGraw-Hill, 2006.

SENSORS & INSTRUMENTATION

L	T	P	Credit
3	0	2	04

EC 4XX **Scheme**

1. Course Outcomes (COs):

At the end of the course the students will be able to:

CO1	Explain the different types of sensors, signal conditioning and data acquisition methods with working principle
CO2	Apply the concepts of sensors and instrumentation for various applications
CO3	Analyze different sensors and signal conditioning methods for various real time applications.
CO4	Evaluate the applications of sensors and data acquisition methods in instrumentation.
CO5	Design the sensors systems for different applications

2. Syllabus:

- **CONCEPTS AND TERMINOLOGY** **(04 Hours)**
  Definition of Sensor, Transducer And Actuator, Transducer/Sensor Classification, Criteria to Choose a Sensor, Sensor Classification, Measurement Systems, General Input-Output Configuration, Static and Dynamic Characteristics of Sensors.

- **PASSIVE SENSORS** **(10 Hours)**
  Potentiometers, Strain Gages, Resistive Temperature Detectors (RTDs), Thermistors, Light-Dependent Resistors (LDRs), Resistive Hygrometers, Resistive Gas Sensors, Capacitive Sensors, Inductive Sensors, Hall effect Sensors, Optical Sensors, Acoustic Sensors, SAW Sensors

- **SELF-GENERATING SENSORS** **(08 Hours)**
  Principle of operation, construction, theory, advantages and disadvantages and applications of following transducers: Thermocouple, Piezo-electric transducer, Pyroelectric transducers, Photo-voltaic transducer, Electrochemical transducer.

- **SIGNAL CONDITIONING FOR SENSORS** **(09 Hours)**
  Voltage Dividers, Wheatstone Bridge, Sensor bridge calibration and balance, Differential And Instrumentation Amplifiers, Interference, Specific Signal Conditioners for Sensors, Telemetry system.

- **DATA ACQUISITION METHODS** **(09 Hours)**
  Basic block diagram, Analog and Digital IO, Timers, Type of ADC: Successive approximation and sigma-delta, Types of DAC: Weighted Resistor and R-2R Ladder type, Use of Data Sockets for Networked Communication.

- **ADVANCEMENTS IN SENSORS AND INSTRUMENTATION** **(05 Hours)**
  Sensors For Robotics, Sensors Used In Smartphones, Sensors Used In Smart City, MEMS, Nano Sensors, Smart Sensors, Integrated Sensors, IoT Applications, Study of Sensor IC/Module datasheet.

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3. List of Practicals:

1. To study the characteristics of the Potentiometer.
2. To study the characteristics of Variable Capacitor
3. To study the characteristics of Strain Gauge.
4. To study the characteristics of Light Dependent Resistor.
5. To study the characteristics of LVDT

6. To study the characteristics of the Resistance Temperature Detector
7. To study the characteristics of a Thermistor.
8. To study the characteristics of Thermocouples.
9. Design and Implement a Simple R to V, V to I, and V to V Convertor given specifications.
10. Bridge Linearity technique using Op-AMP.
11. Instrumentation amplifier using Feedback.
12. DATA acquisition using DAQ card.

4. <u>Books Recommended:</u>

1. Arun K. Ghosh, Introduction to Measurements and Instrumentation, PHI 4th Edition 2012.
2. Arun K. Ghosh, Introduction to Transducers, PHI, 2014.
3. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
4. S. Vijayachitra, Transducers Engineering, PHI 2016.
5. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.

5. <u>Reference Books:</u>

1. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition2013
2. Gary Johnson / Lab VIEW Graphical Programing II Edition /McGraw Hill 1997.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Department Mechanical Engineering

Annexure 66.32
of 66th meeting of the IAAC

B.Tech. I Mechanical Engineering

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	First Semester (1st year of UG)				
1	Elements of Thermal and Fluid Systems	ME101	3-0-2	4	85
2	Engineering Mechanics	ME103	3-1-0	4	70
3	Energy and Environmental Engineering	EG110	3-0-2	4	85
4	Fundamentals of Computer and Programming	CS110	3-0-2	4	85
5	Engineering Mathematics	MA117	3-1-0	4	70
			Total	**20**	**395**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	MEv01 MEP01	0-0-10	5	200 (20 x 10)
	Second Semester (1st year of UG)				
1	Engineering Thermodynamics	ME102	3-1-0	4	70
2	Workshop Practice	ME104	0-0-4	2	70
3	Elements of Materials and Manufacturing	ME106	3-0-2	4	85
4	Engineering Drawing	ME110	2-0-4	4	100
5	Applied Electrical and Electronics Engineering	EE106	3-0-2	4	85
6	English and Professional Communication	HS110	3-1-0	4	77
			Total	**22**	**487**
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	MEv02 MEP02	0-0-10	5	200 (20 x 10)

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Department of Mechanical Engineering

B.Tech. II Mechanical Engineering

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	Third Semester (2nd year of UG)				
1	Measurement and Instrumentation	ME201	3-0-2	4	85
2	Theory of Machines	ME203	3-1-2	5	100
3	Metallurgy	ME205	3-0-2	4	85
4	Fluid Mechanics	ME207	3-1-2	5	100
5	Elective-I	ME2xx	3-0-0	3	55
			Total	**21**	**425**
6	Vocational / Professional Mechanical Practice - II	MEv03	0-0-8	**5**	200 (20 x 10)
	Fourth Semester (2nd year of UG)				
1	Fluid Machines	ME202	3-0-2	4	85
2	Heat Transfer	ME204	3-0-2	4	85
3	Industrial Engineering	ME206	3-0-0	3	55
4	Dynamics of Machines	ME208	3-1-2	5	100
5	Elective – II	ME2xx	3-0-0	3	55
			Total	**20**	**380**
6	Vocational / Professional Software Practice – II	MEv04	0-0-8	5	200 (20 x 10)

Sr. No.	Elective	Code	Scheme L-T-P
	Elective - I [Semester - III]		
1	Numerical Methods for Mechanical Engineers	ME251	
2	Energy and Exergy Analysis of Thermal system	ME253	
3	Maintenance and Safety Engineering	ME255	
4	Experimental Stress analysis	ME257	
5	Engineering Estimating & Costing	ME259	
6	Plastics & Ceramics	ME261	
7	Corrosion Engineering	ME263	
	Elective - II [Semester - IV]		
1	Experimental Fluid Mechanics	ME252	
2	Theory of Elasticity and Plasticity	ME254	
3	Condition Monitoring	ME256	
4	Total Quality Management	ME258	
5	Advance Engineering Materials	ME260	
6	Risk, Reliability & Life Testing	ME262	
7	Concurrent Engineering	ME264	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Measurements and Instrumentation ME201	Scheme	L	T	P	Credit
		3	0	2	04

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Draw block diagram of different measurement instruments.
CO2	Describe basic concepts of mechanical measurement, errors in measurements and uncertainty.
CO3	Identify the type of measurement instruments and their relevant specification for a particular process or parameter measurement.
CO4	Choose the appropriate instrument to measure the temperature, pressure and flow
CO5	Measure the force, torque, strain, displacement, velocity and acceleration in a measurement system
CO6	Characterize the behavior of a control system in terms of different performance parameters.

2.	**Syllabus**	
	BASIC CONCEPTS & IMPORTANCE OF MEASUREMENTS	**(07 Hours)**
	Aim of measurement, methods of measurement, generalized measurement systems, Instruments & its classifications, performance characteristics of instruments, Statistic & dynamic characteristics, Errors in measurements.	
	TEMPERATURE MEASUREMENTS	**(06 Hours)**
	Temperature scales, Ideal gas, Temperature measuring devices, Thermometer, Bi- metallic strip, Electrical resistance thermometer, Thermistors and thermocouples, Laws of thermocouples and their applications, Construction and calibration of thermocouples, Radiation pyrometers, total radiation pyrometers	
	PRESSURE MEASUREMENT	**(07 Hours)**
	Definition of pressure, Units, Types of pressure measurement devices, Manometers, Dead weight tester, Bourdon tube pressure gauge, Diaphragms and bellows, Low pressure measurement, McLeod gauge, Pirani thermal conductivity gauge, Knudsen gauge, Ionization gauge,	

	FLOW MEASUREMENTS	**(07 Hours)**
	Types of flow measuring devices, Constructional features, Obstruction meters like orifice, Venturi nozzle and their calibration, Flow measurement by drag effects (rotameter), Pitot tube, Hot wire anemometers, Magnetic flow Meters, Flow visualization Techniques, Shadowgraph, Interferometer.	
	MEASUREMENT OF FORCE, TORQUE AND STRAIN	**(07 Hours)**
	Load cells, cantilever beams, proving rings, differential transformers. Measurement of torque: Torque measurement on rotating shaft, Prony brake and eddy current dynamometer. Measurement of strain: Mechanical strain gauges, electrical strain gauges, strain gauge: materials, gauge factors, theory of strain gauges and method of measurement, Rosettes, bridge arrangement, temperature compensation.	
	DISPLACEMENT, VELOCITY, SPEED AND ACCELERATION MEASUREMENTS	**(06 Hours)**
	Working principal of Resistive Potentiometer, Linear variable differential transducers, Electro Magnetic Transducers, Mechanical, Electrical and Photoelectric Tachometers, Piezoelectric Accelerometer, Seismic Accelerometer	
	CONTROL SYSTEMS	**(05 Hours)**
	Basic concepts of control systems, classifications of control system, close loop control systems, open loop control system, automatic control systems, servo mechanism, regulator, representation through model, analogous system, block diagram, mathematical block diagram, signal flow graph.	
	(Total Contact Time: = 45 Hours)	

3.	**Practical**
1	To calibrate the thermocouples.
2	To demonstrate temperature by using RTD & thermistor
3	To determine the fluid flow velocity through orifice meter, Venturimeter,
4	To determine the fluid flow velocity through rotameter and magnetic flow meter.
5	To demonstrate temperature of force by using strain gauge.
6	To demonstrate temperature pressure measurement through dead weight tester.
7	To demonstrate temperature measurements of speed of machine elements.
8	To demonstrate temperature measurement of temperature by using optical pyrometer.

5.	**Books Recommended**
1	O. E. Doeblin and D. N. Manik, Measurements System, 7th Edition, McGraw Hill, 2019

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

2	Richard S. Figiliola,Theory and Design for Mechanical Measurements; 6th Edition, Wiley India, 2015
3	D. S. Kumar, Mechanical Measurement and control,5th edition, Metropolitan Book Co. (P) Ltd.,(2015)
4	A. K. Sawhney and Puneet Sawhney, A Course in Mechanical Measurements and Instrumentation and Control, Dhanpat Rai & Co., 2017
5	R. K. Rajput, Mechanical Measurements and Instrumentation, Kataria and sons, 2013

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Theory of Machines ME203	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**2**	**05**

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Understanding of various concepts related to machines and mechanisms
CO2	Apply the kinematic analyses in existing real life mechanisms
CO3	Analyze the kinematic requirements and shape of the cam and follower mechanism
CO4	Evaluate gears and gear trains for specific applications
CO5	Design of Belt, Rope and Chain Drives
CO6	Develop steering gear and straight line motion mechanism

2.	**Syllabus**	
	MACHINES AND MECHANISMS	**(06 Hours)**
	Introduction, Mechanism and machine, Rigid and resistant body, Link, Kinematic pair, Types of motion, Degrees of freedom (mobility), Classification of kinematic pairs, Kinematic chain, Linkage, Mechanisms, Kinematic inversion, Inversions of slider crank chain, Double slider-crank chain	
	VELOCITY ANALYSIS	**(09 Hours)**
	Trace the Loci of points in simple mechanisms, Absolute and Relative motions, Vectors, Addition and Subtraction of vectors, Motion of a link, Angular velocity, Rotation of a rigid body, Translation and rotation of a rigid body, Velocity analysis of mechanisms by relative velocity method (graphical), Instantaneous centre, Kennedy's Theorem, Locating I- centres, Velocity analysis by instantaneous centers, Centrode.	
	ACCELERATION ANALYSIS	**(10 Hours)**
	Definition of acceleration, Angular acceleration, A general case of acceleration, Radial and transverse components of acceleration, The Coriolis component of acceleration, Acceleration analysis of mechanisms, Acceleration diagrams, Coriolis Acceleration component, Kinematic analysis of mechanisms with computer assisted software: Modeling and assembly of the linkages, joints and constraints, motion animation of the mechanism, Kinematic analysis of the existing or real life mechanism.	

	BELTS, ROPES AND CHAINS	**(06 Hours)**
	Introduction, Belt and rope drives, Open and crossed belt drives, Velocity ratio, Slip, Materials for belt and ropes, Law of belting, Length of belt, Ratio of friction tensions, Power transmitted, Centrifugal effect on belts, Maximum power transmitted by a belt, Initial tension, Creep, Chains, Cha in length, Angular speed ratio, Classification of chains	
	GEARS AND GEAR TRAINS	**(07 Hours)**
	Introduction, Classification of gears, Gear terminology, Law of gearing, Velocity of sliding, Forms of teeth, Cycloidal profile teeth, Involute profile Teeth, Comparison of cycloidal and involute tooth forms, Birth of contact, Arc of contact, number of pairs of teeth in contact, Interference in involute gears, Minimum number of teeth, Interference between rack and pinion, Undercutting, Introduction to helical, Spiral, Worm, Worm gear and bevel gears. Types of Gear trains. Kinematic analysis of gear trains: Simple, compound and Epicyclic gear trains, Differential of an Automobile.	
	CAMS	**(07 Hours)**
	Introduction, Types of cams, Types of followers, Cam terminology, Displacement diagrams, Motions of the follower, Graphical construction of cam profile for constant velocity, uniform acceleration and retardation, SHM and cycloidal motion of follower, analytical calculation for displacement, velocity and acceleration.	
	(Total Contact Time: = 45 Hours)	

3.	**Tutorials**
1	Draw and explain various types of mechanisms and their inversions.
2	Draw velocity diagram of a mechanisms using instantaneous centre method.
3	Draw velocity and acceleration diagrams for mechanisms.
4	Draw velocity and acceleration diagram of a mechanism involving Coriolis component of acceleration.
5	Demonstration of Kinematic analysis of existing or real life mechanisms with computer assisted software – I
6	Demonstration of Kinematic analysis of existing or real life mechanisms with computer assisted software – II
7	Draw and explain various types of cams and followers.
8	Draw the layout of cam profile for a reciprocating radial knife edge follower to provide constant velocity to the follower, and derive the equation of displacement, velocity and acceleration of follower in terms of cam rotation angle.
9	Draw the layout of cam profile for an offset reciprocating roller follower to provide constant acceleration and retardation motion to the follower, and derive the equation of displacement, velocity and acceleration of follower in terms of cam rotation angle.

10	Draw the layout cam profile for a flat faced reciprocating follower to provide SHM motion to the follower, and derive the equation of displacement, velocity and acceleration of follower in terms of cam rotation angle.
11	Draw the layout of cam profile for an oscillating follower to provide cycloidal motion to the follower, and derive the equation of displacement, velocity and acceleration of follower in terms of cam rotation angle.

4.	**Practical**
1	To study and demonstrate various types of mechanisms and their inversions.
2	To draw velocity diagram of a mechanisms using instantaneous centre method.
3	To draw velocity and acceleration diagrams for mechanisms.
4	To draw velocity and acceleration diagram of a mechanism involving Coriolis component of acceleration.
5	Kinematic analysis of existing or real life mechanisms with computer assisted software – I
6	Kinematic analysis of existing or real life mechanisms with computer assisted software – II
7	To study and demonstrate various types of cams and followers.
8	To draw the layout of cam profile for a reciprocating radial knife edge follower to provide constant velocity to the follower
9	To draw the layout of cam profile for an offset reciprocating roller follower to provide constant acceleration and retardation motion to the follower
10	To draw the layout cam profile for a flat faced reciprocating follower to provide SHM motion to the follower
11	To draw the layout of cam profile for an oscillating follower to provide cycloidal motion to the follower

5.	**Books Recommended**
1	S. S. Rattan, Theory of machines. Tata McGraw-Hill Education, 2014.
2	J. J. Uicker, G. R. Pennock and J.E. Shigley, Theory of Machines and Mechanisms, 3rd Edition, Oxford University Press, 2011.
3	J.S., Rao and R.V. Dukkipati, Mechanism and Machine Theory, New edge international publishers, 2007.
4	A. Ghosh, and A.K. Mallik, Theory of mechanisms and machines, Affiliated East-West Press Private Limited, 2002.
5	A. G. Ambekar, Mechanism and Machine Theory, Prentice Hall of India Private Limited, 2007.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Metallurgy ME205	Scheme	L	T	P	Credit
		3	0	2	04

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Describe the importance of metallurgical industries and explain the basic principles of metallography and extraction of metallic elements.
CO2	Explain the microstructure of ferrous and non-ferrous alloys with their properties and applications.
CO3	Explain the phase-equilibria and phase diagrams for binary alloys.
CO4	Interpret the elastic and plastic deformation of metallic materials.
CO5	Analyse solidification mechanisms and heat-treatment techniques of ferrous and nonferrous alloys.
CO6	Choose the non-destructive testing technique based on the advantages and limitations.

2.	**Syllabus**	
	INTRODUCTION AND SCOPE	**(07 Hours)**
	Various fields of metallurgical engineering, Status of metallurgical industry in India, Sources of metals, Basic outline of the principles of production of iron and steel, copper, aluminium. Basic concepts of metallography. Testing of material with UTM, Testing of hardness and impact strength, Non-Metals: Plastics, Ceramics, Composite materials, Nano materials, Powder Metallurgy	
	STRUCTURE-PROPERTY CORRELATIONSHIP IN METALS	**(06 Hours)**
	Ferrous: Allotropic forms of Iron, Wrought Iron, Cast Irons - Grey, White, Malleable and Spheroidal Graphite, Steel - Plain carbon steel, Alloying of steels, Stainless steels, Tool steels, Maraging steels, Applications of ferrous metals. Non-ferrous: Copper & Copper alloys - Brass, Bronze, Cupro-Nickel; Aluminum and Aluminum alloys, Titanium alloys, Nickel based super alloys, Applications of Non-ferrous metals.	

	SOLIDIFICATION OF METALS	**(04 Hours)**
	Solidification of pure metals, Nucleation, Growth, Applications of controlled Nucleation & controlled growth.	
	DEFORMATION OF METALS	**(06 Hours)**
	Elastic & plastic deformation of metals, Strengthening mechanisms, Importance of grain size, directional properties, Recovery, Recrystallization and grain growth	
	EQUILIBRIUM PHASE DIAGRAMS	**(08 Hours)**
	Objectives & classification, Basic terms - system, phases & structural constituent, Phase systems – Isomorphous, Eutectic. Eutectoid, Peritectic. Interpretation of phase diagrams - Lever rule, Gibb's phase rule, Equilibrium phase diagram of Fe-Fe3C system, Equilibrium phase diagrams of non-ferrous alloys.	
	HEAT TREATMENT	**(08 Hours)**
	Purpose, Definition and Classification of heat-treatment processes for steels, Heat treatments for bulk materials - Annealing, Normalizing, Hardening, Tempering, Isothermal cooling transformation diagram (ICT/TTT) and Continuous cooling transformation (CCT) diagrams for steels, Various surface hardening heat-treatment of steels; Heat-treatment of Al alloys - Solution treatment, Solution quenching & Precipitation hardening.	
	NON-DESTRUCTIVE TESTING TECHNIQUES	**(06 Hours)**
	Importance, principle, procedure, equipment, advantages & limitations of various non-destructive techniques - visual inspection, radiography, ultrasonic testing, magnetic particle inspection, liquid penetrant inspection, eddy current testing	
	(Total Contact Time: = 45 Hours)	

3.	**Practical**
1	To study construction and working of metallurgical microscope.
2	To preparation specimen for microscopic observation
3	To study structure, properties and applications of ferrous alloys.
4	To study Fe-Fe3C equilibrium phase diagram and its applications.
5	To study Fe-Fe3C equilibrium phase diagram and its applications.
6	To study T-T-T & C-C-T diagram of steels.
7	To estimate effect of severity of quenching media in hardening heat-treatment of steels.
8	To determine hardenability of steel using Jominy end quench test.

4.	**Books Recommended**
1	R. Balasubramanian, Callister's Materials Science and Engineering, John Wiley & Sons, 2014.
2	D. R. Askland, P. P. Fulay, W. J. Wright, The Science and Engineering of Materials, Cengage Learning, 2015.
3	S. H. Avner, Introduction to Physical Metallurgy, McGraw-Hill, 2017.
4	O. P. Khanna, A Text book of Materials Science And Metallurgy, Dhanpat Rai Publications.
5	W. Smith, J. Hashemi, R. Prakash, Materials Science & Engineering, McGraw Hill, 2014.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Fluid Mechanics ME207	Scheme	L	T	P	Credit
		3	1	2	05

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Understand the concept of performance evaluation of Prototypes using dimensionless numbers.
CO2	Analyse mass balance in a flow system using continuity equations in Cartesian and cylindrical coordinates.
CO3	Compute local Velocity and Acceleration in the complex fluid flow domain.
CO4	Use Bernoulli's equation for the solution of fluid dynamic problems.
CO5	Evaluate fluid flow properties for laminar and turbulent flow through pipes and channels
CO6	Apply Navier Stokes equations to analyse fluid flow systems

2.	**Syllabus**	
	FLUID KINEMATICS	**(12 Hours)**
	Velocity Field, Steady and unsteady Flows, One, Two and Three Dimensional Flows, Uniform and non-uniform flows, Steam Lines and Stream Tubes, Path Lines and Streak Lines, Euler and Lagrangian Methods, Substantial Derivative and Acceleration, Translation, Rotation and Deformations, Vorticity, Rotational and Irrotational flows, Circulation, Velocity Potential function, Equation of Continuity in differential form for Cartesian and cylindrical coordinate system, Equation of Stream Line, Discharge in Terms of Steam Function, Stream Function and Velocity Potential function, Laplace Equation in terms of Stream Function and Velocity Potential function, Boundary Conditions, Flow Nets, Differential and Integral Approach Applied to Conservation of Mass, Momentum and Energy Principles..	
	FLUID DYNAMICS	**(10 Hours)**
	Newton's Laws of Motion, Reynold's Transport Theorem, Euler's Equation, Bernoulli's Equation, Flow Through Confined Passages, Navier-Stokes Equation, Exact solution of Navier-Stokes Equation for simple flows. Vortex flow, Free vortex flow and forced vortex flow.	

	DIMENSIONAL ANALYSIS	**(04 Hours)**
	Dimensions, Dimensional Homogeneity, Buckingham-π Theorem, Dimensional Grouping, Non - Dimensional Numbers, Geometrical, Kinematics and Dynamic Similarity.	
	LAMINAR AND TURBULENT FLOWS	**(06 Hours)**
	Concepts of Laminar and Turbulent Flows, Laminar Flow Through Round Pipes, Laminar Flow between Parallel Plates for Moving and Stationary plates, Measurement of Viscosity. Concept of Eddy Viscosity, Prandtl's Mixing Length Theory, Viscous Sub layer, Smooth and Rough Pipes, Nickuradse Experiment, Moody's Chart, Viscous flow of incompressible fluids.	
	PIPE SYSTEMS	**(05 Hours)**
	Major and Minor losses in pipes, Losses in Fittings, Power Transmission Through Pipes, Pipes connected in Series and Parallel, Branched Pipes, Total Energy line and Hydraulic Gradient Lines. Water distribution system.	
	BOUNDARY LAYER THEORY	**(05 Hours)**
	Concept of Boundary Layer, Boundary Layer over Flat Plates and Tubes, Boundary Layer Parameters, Boundary Layer Thickness, Momentum Thickness, Displacement Thickness, Von - Karman Momentum Integral Equation, Boundary Layer Separation and Control, Concept of Drag, Streamlined and Bluff Bodies.	
	COMPRESSIBLE FLOW	**(03 Hours)**
	Classification and properties of fluids, compressible fluid flow, effect of mach number and compressibility, normal and oblique shocks, one dimensional isentropic flow.	
	(Total Contact Time: = 45 Hours)	

3.	**TUTORIAL**
	Solve Numericals based on following topics
1	Fluid kinematics - I
2	Fluid kinematics - II
3	Fluid Dynamics - I
4	Fluid Dynamics - II
5	Dimensional Analysis
6	Laminar flow

7	Turbulent flow
8	Pipe systems
9	Numerical and equation derivations based on boundary layer theory
10	Numerical and equation derivations based on Compressible flow

4.	**Practical**
1	Flow of an Incompressible Fluid through an Orifice meter and its calibration for measurement of discharge.
2	Flow of an Incompressible Fluid through a Nozzle meter and its calibration it for measurement of discharge.
3	Flow of an Incompressible Fluid through a Venturi Meter and its Calibration for measurement of discharge.
4	Flow of an Incompressible Fluid through a Centrifugal Head Meter and its Calibration for measurement of discharge.
5	Forced Vortex flow of water in the vessel.
6	Variation of friction factor with Reynolds number for Laminar flow through circular pipe
7	Variation of friction factor with Reynolds number for Turbulent flow through circular pipe
8	Determination of the velocity distribution in circular pipe.
9	Study of types of Pipes, Pipe symbols, Pipe Fittings and Valves.

5.	**Books Recommended**
1	F. M. White, Fluids Mechanics, McGraw -Hill Inc., 2015.
2	V. L. Streeter, E. B. Wylie, Fluid Mechanics, McGraw -Hill Book Co. Inc., 2001.
3	A. K. Mohanty, Fluid Mechanics, Prentice -Hall India Private Ltd., 2004.
4	J. F. Douglas, J. M. Gasiorek, J. A. Swaffield, Fluid Mechanics, Pearson Education Pvt. Ltd., 2001.
5	S. K. Som, G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Co. Pvt. Ltd., 2017.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Numerical Methods for Mechanical Engineers ME251	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Formulate mathematical model, apply numerical methods to solve the engineering problems, and estimate errors associated with numerical methods
CO2	use computer language to solve the problem numerically
CO3	perform integration and differentiation using numerical techniques
CO4	apply bracketing and close methods to find root of the given problem
CO5	solve ODEs and PDEs using numerical methods
CO6	apply optimization method to solve 1-D optimization problem

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Introduction to Numerical Methods, Mathematical Modelling and Engineering Problem Solving, conservation laws and engineering	
	Programming and Software	**(04 Hours)**
	Introduction to packages and programming, Structured programming, Modular Programming, Excel, Basics of C/C++/Python/MATLAB/FORTRAN	
	Approximations and Errors	**(04 Hours)**
	Measuring Errors, Sources of Error, Binary Representation of numbers, Propagation of Errors, Taylor Theorem Revisit, Truncation errors, Round off errors	
	Roots of Equations	**(05 Hours)**
	Bracketing Method: Graphical Method, Bisection method, False position method, Incremental Searches. Open Method: Fixed point iteration, Newton-Rapson method, Secant method	
	Simultaneous Linear Equations	**(05 Hours)**
	Introduction to Matrix Algebra, Systems of Equations, Gaussian Elimination, Gauss-Seidel Method, LU Decomposition, Adequacy of Solutions, Cholesky and LDLT Method	

	Differentiation	**(05 Hours)**
	Primer on Differential Calculus, Differentiation of Continuous Functions: Forward difference approximation, backward difference approximation, central difference approximation, higher order finite difference approximation, Richardson extrapolation differentiation, Differentiation of Discrete Functions	
	Integration	**(04 Hours)**
	Primer on Integral Calculus, Trapezoidal Rule, Simpson's 1/3rd Rule, Romberg Integration, Gauss-Quadrature Rule, Discrete Data Integration, Improper Integration, Simpson's 3/8 Rule	
	Ordinary Differential Equations	**(05 Hours)**
	Primer on Ordinary Differential Equations, Initial Value Problems, Euler's Methods, Runge-Kutta methods, Predictor - Corrector Method, Higher Order/Coupled ODEs, Boundary Value Problems, Shooting Method, Finite Difference Method	
	Partial Differential Equations	**(04 Hours)**
	Introduction to Partial Differential Equations, Parabolic Partial Differential Equations, Elliptic Partial Differential Equations	
	Optimization	**(05 Hours)**
	Golden Section Search Method, Newton's Method, Multidimensional Direct Search Method, Multidimensional Gradient Method	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	Chapra, S.C., Canale, R.P., "Numerical Methods for Engineers", 8th edition, Mcgraw hill, 2021
2	Grewal, B.S., "Numerical Methods in Engineering & Science", 11th edition, Khanna Publication, 2013
3	Cheney, W., Kincaid, D., "Numerical Mathematics and Computing", 7th edition, Cengage, 2013
4	Gerald, C., Wheatley, P., "Applied Numerical Analysis", 7th edition, Pearson Education India, 2007
5	Isaacson, E., H. B. Keller, H.B., "Analysis of Numerical Methods", Dover Publications, 1994

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Energy and Exergy Analysis of Thermal Systems ME253	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Explain the importance of the exergy and its difference from energy analysis
CO2	Apply the first law and second law of thermodynamics to various thermal systems
CO3	Determine the physical and chemical exergy of a given system
CO4	Illustrate pictorial representation of exergy balance
CO5	Perform exergy analysis of different thermal systems
CO6	Apply exergy analysis knowledge to thermal systems to improve the overall performance of plant

2.	**Syllabus**	
	INTRODUCTION	**(06 Hours)**
	Fundamentals of mass, energy and entropy balance, and requirement of exergy analysis	
	BASICS OF EXERGY ANALYSIS	**(10 Hours)**
	Energy and exergy analysis, Exergy classifications, Exergy of closed systems, Exergy of flows, Exergy consumption, Procedure for energy and exergy analysis, reference environment, Exergy analysis implications	
	EXERGY ANALYSIS OF THERMODYNAMIC PROCESSES	**(11 Hours)**
	Mixing and separation process, heat transfer across a finite temperature difference, expansion and compression processes, Chemical process in combustion.	
	ELEMENTS OF PLANT ANALYSIS	**(06 Hours)**
	Control mass analysis, control region analysis, Criteria of performance, Pictorial representation of exergy balance, Energy and exergy properties diagram	
	EXERGY ANALYSIS OF THERMAL POWER PLANTS	**(12 Hours)**
	Gas turbine power plant with external and internal irreversibility, regeneration cogeneration, reheater, and intercooler, combined steam and gas turbine power plant, Brayton cycle steam turbine power plants with external and internal irreversibility, super	

	heater, reheater, vacuum condenser, regenerative feed water heating, combined feed water heating and reheating. Combined power plants
	(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	Bejan, G. Tsatsaronis, M. J. Moran, M. Moran, Thermal Design and Optimization, John Wiley & Sons, Inc.. 2012
2	Dincer Marc A. Rosen, Exergy, Energy, Environment and Sustainable Development, Elsevier Science, 2013.
3	Bejan, Advanced Engineering Thermodynamics, John Wiley & Sons, Inc., New York. 2016
4	T. J. Kotas, The exergy Method of Thermal Plant Analysis, Butterworth-Heinemann,2013
5	M. J. Moran, Availability Analysis – A Guide to Efficient Energy Use, ASME, 1989

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Maintenance and Safety Engineering ME255	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Explain the principles, functions and practices adapted in industry for the successful management of maintenance activities.
CO2	Apply the knowledge of Predictive maintenance and conditioning monitoring concepts for industrial applications.
CO3	Distinguish various repair methods of basic machine elements
CO4	Apply the concept of failure pattern, system reliability: Series, Parallel and Mixed configurations.
CO5	Explain the safety engineering aspects in industry.
CO6	Explain the safety codes and standards.

2.	**Syllabus**	
	OBJECTIVE OF MAINTENANCE	**(09 Hours)**
	Types of maintenance Breakdown, preventive and predictive maintenance - Repair cycle - Repair Complexity, Lubrication and Lubricants. Maintenance of Mechanical transmission systems and process plants.	
	PREDECTIVE MAINTENANCE	**(09 Hours)**
	Vibration and noise as maintenance tool - wear debris analysis - Condition monitoring concepts applied to industries - Total Productive Maintenance (TPM) - Economics of Maintenance- Computer aided maintenance	
	RELIABILITY	**(10 Hours)**
	Definition, concept of reliability based design, failure rate, MTTF, MTBF, failure pattern, system reliability: Series, Parallel and Mixed configurations - Availability and Maintainability concepts- Applications	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	SAFETY AND PRODUCTIVITY	**(09 Hours)**
	Causes of accidents in industries accident reporting and investigation - measuring safety performance - Safety organizations and functions - Factories act and rules	
	SAFETY CODES AND STANDARDS	**(08 Hours)**
	General Safety considerations in Material Handling equipment - Machine Shop machineries-pressure vessels and pressurized pipelines, welding equipment operation and inspection of extinguishers prevention and spread of fire emergency exit facilities	
		(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	P. Gopalakrishnan, Maintenance and Spare Parts Management, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2013
2	L. S. Srinath, Reliability Engineering, Affiliated East West press, 2005
3	Rolland P. Blake, Industrial Safety, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
4	R. C. Mishra and K. Pathak, Maintenance Engineering and Management, 2nd Edition, Prentice Hall of India Pvt.Ltd.,New Delhi, 2012.
5	E. Balagurusamy, Reliability Engineering, McGraw Hill Education, 2017
6	H. P. Garg, Industrial Maintenance, S. Chand & Co Ltd., New Delhi, 2010

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Experimental Stress Analysis ME257	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Illustrate theoretical concepts of stress and strain measurements.
CO2	Evaluate stress and strain of mechanical systems using electrical resistance strain gauges.
CO3	Understand the utility of strain rosettes.
CO4	Apply the photo elastic technique for principal stress measurement on 2-D and 3-D objects.
CO5	Analyse various brittle coating techniques.
CO6	Evaluate stress analysis through destructive and non-destructive techniques.

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Basic concepts in dynamic measurements, calibration, standards, measurement systems and system response, general consideration in data analysis, distortion, analysis of experimental data, types and causes of experimental errors.	
	DISPLACEMENT SENSORS	**(05 Hours)**
	Mechanical, optical, acoustical and electrical extensometers, principles of measurements, accuracy, sensitivity and range of measurements, capacitance gauges, laser displacement sensors	
	ELECTRICAL RESISTANCE STRAIN GAGES	**(05 Hours)**
	Introduction to strain gauge, principle of operation, types and their uses, materials for strain gauges, calibration and temperature compensation, data acquisition, strain sensitivity in metallic alloys, gauge construction, adhesives and mounting techniques, gauge sensitivity and gauge factor, performance characteristics, environmental effects, strain gauge circuits, potentiometer, Wheatstone's bridge, constant current circuits.	

	STRAIN ANALYSIS METHODS	**(07 Hours)**
	Introduction to rosettes, two element, three element rectangular and delta rosettes, stress gage, plane shear gauge, stress intensity factor gauge. Mass balance measurement, elastic element for force measurements, torque measurement.	
	PHOTO ELASTICITY	**(08 Hours)**
	Introduction to photoelasticity, two dimensional photo elasticity, photo elastic materials, photo elastic effects, stress optic law, transmission photo elasticity, plane and circular polariscopes, interpretation of fringe pattern, introduction to three dimensional photo elasticity	
	BRITTLE COATING TECHNIQUES	**(09 Hours)**
	Types of brittle coatings, coating stresses, crack pattern in brittle coating, refrigeration and load relaxation techniques, crack detection, strain analysis through Moire fringes, geometrical and displacement approach	
	EXPERIMENTS IN MATERIAL TESTING	**(07 Hours)**
	Creep test, fatigue test, calibration of proving rings, calibration of photo elastic model for stress fringe value, fundamentals of NDT, radiography, thermography, ultrasonic, eddy current testing, fluorescent penetrant testing.	
		(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	K. Ramesh. Digital Photo elasticity – Advanced Techniques and Applications, Springer, 2000.
2	S. Singh. Experimental Stress Analysis, Khanna Publishers, New Delhi, 1996
3	A. Freddi, G. Olmi and L. Cristofolini. Experimental Stress Analysis for Materials and Structures, Springer International Publishing, 2015.
4	W. Dally and W.F. Riley. Experimental Stress Analysis, McGraw-Hill, 1991
5	U. C. Jindal. Experimental Stress Analysis, Pearson Publications, 2018

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Engineering Estimation and Costing ME259	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Analyze the concept of estimation for various industrial applications
CO2	Analyze the concept of cost accounting and control.
CO3	Apply engineering economics and analyze the breakeven point for single and multiple product production cases.
CO4	Demonstrate the effects of depreciation and replacement policy in engineering economic analysis problems.
CO5	Explain the concepts of financial management and accounting.

2.	**Syllabus**	
	ESTIMATING	**(06 Hours)**
	Objectives of estimating –constituents of estimate, mechanical estimating – costing and cost estimation, functions of estimation organization and prerequisites of estimation, estimating such as design and drafting period, time & motion studies, time allowances etc., estimation of material, labour cost, production estimate sheet, advantages & elements of costing, classification of cost	
	COST ACCOUNTING AND CONTROL	**(06 Hours)**
	Cost accounting, elements of cost, factors affecting selling price, fixed cost, variable cost, computation of actual cost, nature of cost, type of cost and cost control	
	ENGINEERING ECONOMICS & BREAK EVEN ANALYSIS	**(11 Hours)**
	Introduction, time value of money, cash flows, taxation concept, tools for engineering economics, models, operation research, value engineering, make and buy decisions, economic batch size, locational economics, benefits cost ratio, break even analysis, analytical and graphical methods, single products and multiple product cases	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	DEPRECIATION AND REPLACEMENT ANALYSIS	**(11 Hours)**
	Concepts, classification, methods of depreciation, comparison of different depreciation method, selection of depreciation methods, obsolescence, reasons for replacement of equipment, development of systematic replacement programme/policy, replacement models, sudden failure,	
	FINANCIAL MANAGEMENT AND ACCOUNTING	**(11 Hours)**
	Definitions and functions of financial management, sources of funds, capitals and its classification, capitalization, sourcing of funds, shares, debentures, trade credits, pubic deposits, banking, foreign exchange and trade, nature of accounting, accounting terminology and types, rules for debit and credit, financial ratios, budget and budgetary control	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	J. Heizer, B. Render, C. Munson, and A. Sachan, Operations Management, 12th Edition, Pearson Education, 2017.
2	M. Mahajan, Industrial Engineering and Production Management, 1st Edition, DhanpatRai & Co. (P) Limited, 2015.
3	B.P. Sinha, Mechanical Estimating and Costing, 1st Edition, Tata McGraw Hill Publishing Co. Ltd., 1995.
4	T.R. Banga and S. C. Sharma, Industrial Organization and Engineering Economics, 24th Edition, Khanna Publishers, 2013.
5	S. K. Sharma and S. Sharma, Industrial Engineering &Organization management, Reprint Edition, S K Kataria and Sons, 2013.

B. Tech. II (DoME) Semester – III Plastics and Ceramics ME261	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Describe fundamentals of plastic and ceramic materials.
CO2	Identify the importance of manufacturing processes used to manufacture plastic and ceramic products.
CO3	Establish design guidelines and testing associated with production of plastic products.
CO4	Analyze plastic recycling and waste management practices.
CO5	Distinguish sintering mechanisms considered for ceramic materials.
CO6	Compile properties of various plastic and ceramic materials and its comparison with other classes of materials.

2.	**Syllabus**	
	INTRODUCTION	**(06 Hours)**
	Classification of materials, history of plastic materials, comparison of plastics with other engineering materials. Classification of plastics, thermoplastic, thermoset plastics, elastomers and polymers. Polymer structures, polymerization, properties of polymers, additive methods to modify polymers. National and International organizations dealing with plastic materials.	
	PROCESSING OF PLASTICS	**(10 Hours)**
	Injection molding, extrusion molding, blow molding, rotational molding, vacuum molding, thermoforming, compression molding, resin transfer molding, calendaring process, etc. Secondary processes for plastics i.e. machining, joining, painting, etc. Defects during processing of plastic products.	
	DESIGN AND TESTING OF PLASTICS PRODUCTS	**(06 Hours)**
	Commodity plastics, engineering plastics, specialty plastics. Design guidelines for products, design guidelines for various processes, importance of mold making. Concept of testing, specification and standards. Overview of various tests, significance of important thermal and mechanical properties of plastic materials.	

	PLASTICS RECYCLING AND WASTE MANAGEMENT	**(06 Hours)**
	Applicability and statistics of plastics in various sectors. Issues and challenges with plastics. Impact of plastics on environment and its remedies. Utility of plastics wastes, waste management practices, plastic recycling processes. Case studies for recycling and waste management.	
	CERAMIC MATERIALS	**(07 Hours)**
	Introduction to ceramic materials, history of ceramic materials, comparison of ceramics with other engineering materials. National and International organizations dealing with ceramics. Atomic bonding and crystal structures in ceramics, traditional and engineering ceramics, classification of ceramics based on properties and applications. Factors affecting properties of ceramics.	
	PROCESSING OF CERAMICS	**(10 Hours)**
	Material selection. Powder making processes. Processing of ceramic materials i.e. slip casting process, ceramic injection molding, tape casting process, etc. Significance of sintering in ceramics, sintering mechanisms, stages during sintering, Importance of phase equilibrium diagrams, Gibbs phase rule, silica phase diagram, phase diagrams for other ceramics.	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	T. L. Szabo, Plastics – Inside Out, 3rd Edition, Elsevier Butterworth-Heinemann, 2005.
2	R. J. Crawford and P. J. Martin, Plastics Engineering, 4th Edition, Elsevier Butterworth-Heinemann, 2020.
3	J. R. Fried, Polymer Science and Technology, 3rd Edition, Prentice Hall, 2014.
4	M.W. Barsoum, Fundamentals of Ceramics, 2nd Edition, CRC Press, 2019.
5	M. N. Rahaman, Ceramic Processing and Sintering, 2nd Edition, CRC Press, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – III Corrosion Engineering ME263	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Describe importance of corrosion and various terminology associated with corrosion.
CO2	Identify various types of corrosion, significance, causes and remedies.
CO3	Interpret corrosion issues of various grades of materials.
CO4	Analyze effect of different environments and conditions on corrosion behavior.
CO5	Predict and test corrosion rate of materials from available data.
CO6	Explain design guidelines and preventive methods to minimize corrosion of materials.

2.	**Syllabus**	
	INTRODUCTION TO CORROSION	**(04 Hours)**
	Definition, corrosion damage, statistics/summary of losses due to corrosion, importance of corrosion control, corrosion rate expressions, standards/societies related to corrosion, NACE terminology, origin of Pourbaix diagram.	
	TYPES OF CORROSION	**(07 Hours)**
	General corrosion, galvanic corrosion, crevice corrosion, pitting corrosion, intergranular corrosion, selective leaching, erosion corrosion, stress corrosion, overview of hydrogen cracking, high temperature corrosion. Case studies of failures due to various types of corrosion.	
	CORROSION OF VARIOUS MATERIALS	**(08 Hours)**
	Corrosion of carbon steels, stainless steels and alloy steels. Corrosion issues of aluminium, magnesium, copper, nickel, titanium, etc. and its alloys. Corrosion issues of composite materials and its control.	
	CORROSION IN SELECTED ENVIRONMENTS AND ITS CONTROL	**(10 Hours)**
	Atmospheric corrosion, corrosion due to sea water, microbiologically induced corrosion, overview of corrosion in human body, overview of corrosion in automobiles, overview of	

	corrosion in aircraft, corrosion of steel in concrete, corrosion in petrochemical industry, corrosion in paper and pulp industry and its control.	
	CORROSION TESTING	**(09 Hours)**
	Purpose of testing, importance of testing, laboratory, semi-plant and field tests, ASTM standards for testing, material selection and sample preparation, sequential procedure for laboratory and on- site corrosion investigations. Various tests like immersion tests, cabinet tests, Huey test, Streicher test, Warren test, slow strain rate test, electrochemical tests, high temperature and pressure test, paint test, etc. Testing of stress corrosion cracking and pitting. Cases studies for failure analysis related to surface degradation.	
	CORROSION PREVENTION	**(07 Hours)**
	Purification and alloying of metal, material selection, alteration of environment, design modifications, cathodic and anodic protection, coatings (metallic, inorganic, non-metallic and organic)	
		(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	M. G. Fontana, Corrosion Engineering, 3rd Edition, Tata McGraw-Hill, 2005.
2	R. W. Revie and H. H. Uhlig, Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering, 4th Edition, Wiley Publication, 2008.
3	R. Baboian, Corrosion Tests and Standards: Application and Interpretation, 2nd Edition, ASTM International, 2005.
4	E. Bardal, Corrosion and Protection, 1st Edition, Springer-Verlag London Ltd., 2004.
5	A. J. McEvily and J. Kasivitamnuay, Metal Failures: Mechanisms, Analysis, Prevention, 2nd Edition, Wiley Publication, 2013.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Fluid Machines ME301	Scheme	L	T	P	Credit
		3	0	2	04

1. Course Outcomes (COs):

At the end of the course, students will be able to

CO1	Describe basic principles of pumps, fans, blowers and compressors
CO2	Illustrate selection and application of various hydraulic turbines and pumps
CO3	Explain the working principles of hydraulic pumps, and envisage performance curves
CO4	Describe and understand the working principle of hydraulic turbines and its performance
CO5	Analyse the methodology to design and calculation for hydraulic pump and turbines
CO6	Develop the concept of fans, blower and compressor

2.	**Syllabus**	
	PRINCIPLE OF FLUID MACHINES	**(09 Hours)**
	Classification of fluid machines, Impulse momentum principle, Impact of jet on vanes, Basic equation of energy transfer in a fluid machines, free, force and spiral vortex flow, flow over the immersed bodies, lift & drag, concept of stream line bodies & bluff bodies, flow over cylinder & aerofoil.	
	HYDRAULIC TURBINES	**(12 Hours)**
	Working principle of impulse and reaction turbines, construction details and working of Pelton, Francis and Kaplan turbine, draft tube, velocity triangles, degree of reaction, losses, power and efficiency calculations, cavitation in reaction turbines, unit quantities, specific quantities, governing and performance characteristics curves of water turbines.	
	HYDRAULIC PUMPS	**(12 Hours)**
	Principle of dynamic action & positive displacement type of pump, classification, main components of centrifugal pump and function, priming, velocity triangle, work done and energy transfer in the centrifugal pump, losses, heads, and various efficiencies of the pump, performance characteristics of centrifugal pump, system characteristics, series and parallel operation, model analysis of centrifugal pump & specific speed, cavitation in pump & maximum suction lift, Reciprocating and rotary pumps.	
	FANS, BLOWERS AND COMPRESSORS	**(12 Hours)**

	Introduction to fans and blowers, construction and classification of compressor, governing equation, losses, performance curves, Positive displacement, centrifugal and axial flow compressor, Components & their functions, velocity triangle, performance, slip factor, pre whirl, Choking, Surging & stalling, degree of reaction. Reciprocating compressors: Theory and applications, numerical, Rotary compressors
	(Total Contact Time: = 45 Hours)

3.	**Practical**
1	Impact of jet on vanes
2	Performance test on Pelton Turbine
3	Performance test on Francis Turbine.
4	Performance test on gear pump.
5	Performance test on centrifugal pump
6	Performance test on jet pump.
7	Performance of centrifugal and axial flow compressors.
8	Performance of blower

4.	**Books Recommended**
1	Jagdish Lal, Hydraulic Machines including Fluidics, Metropolitan Book Company, 2016.
2	S. K. Som, G. Biswas, S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, McGraw Hill, 2017
3	S.M.Yahya, Turbines, Compressors and Fans, Tata McGraw Hill, 2017
4	Sayers, Anthony Terence. Hydraulic and compressible flow turbomachines. McGraw-Hill Book Company Limited, 1990.
5	Pillai Narayana N. and Ramakrishnan C. R. “Principles of Fluid Mechanics and Fluid Machines”, Universities Press (India), 2006.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Heat Transfer ME204	Scheme	L	T	P	Credit
		3	0	2	04

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Apply appropriate mode of heat transfer while analyzing complex engineering problems.
CO2	Compute steady state and transient heat conduction problems in slab, cylindrical and spherical systems.
CO3	Explore various Nusselt number correlations for forced and free convection systems.
CO4	Calculate surface to surface radiative heat transfer in engineering systems.
CO5	Design the heat transfer equipment
CO6	Investigate the performance of heat exchanger using LMTD and NTU-effectiveness methods.

2.	**Syllabus**	
	INTRODUCTION	**(1 Hours)**
	Modes of heat transfer, conduction, convection and radiation.	
	CONDUCTION	**(14 Hours)**
	Fourier’s law. General one and three-dimensional heat conduction equation in Cartesian, cylindrical and spherical co -ordinates. One-dimensional steady conduction through plane wall, cylinder and sphere. Contact Resistance and electrical analogy. Critical radius of insulation. Heat source systems in plane wall and cylinder. Heat conduction through extended surface. Effectiveness and fin efficiency. Derivation of governing differential equation (GDE) for pin fin. Solution GDE of pin fin subjected to different boundary conditions. Heat flow rate from finned system. One-dimensional unsteady state heat conduction. Lumped heat capacity analysis. Analysis of system with considerable temperature gradient. Heisler and Grober charts.	
	CONVECTION	**(15 Hours)**
	Forced Convection: Governing Differential Equation, Dimensionless number and their physical significance, Internal forced convection, External forced convection, Flow over tube banks, Reynolds analogy and Colburn analogy. Free Convection: Governing Differential	

	Equation, Dimensionless number and their physical significance, Empirical relations for plate and cylinder and their use, effect of turbulance. Combined natural and forced convection. Fundamentals of boiling & condensation heat transfer. Heat transfer during laminar and turbulent flow of an incompressible fluid over flat plate, hydrodynamic and thermal boundary layer.	
	RADIATION	**(08 Hours)**
	Thermal radiation, monochromatic and total emissive power. Basic laws of radiation, Stefan Boltzman law, wiens displacement law, plank distribution. Radiation shape factors, black and grey surfaces, heat transfer in presence of re-radiating surfaces, radiation network analysis.	
	HEAT EXCHANGERS	**(07 Hours)**
	Basic types of heat exchangers, fouling factors, LMTD, Effectiveness – NTU methods of design.	
		(Total Contact Time: = 45 Hours)

3.	**Practical**
1	To calibrate copper constantan of thermocouple.
2	To plot temperature distribution and analyse heat transfer through composite wall.
3	To determine thermal conductivity of insulating powder.
4	To find and compare heat transfer coefficient in natural convection
5	To assess emissivity of circular surface
6	To determine and compare heat transfer coefficient in internal forced convection phenomena.
7	To compute Stefan Boltzmann constant value
8	To determine pin-fin efficiency in natural and forced convection.
9	To calculate the overall heat transfer coefficient in shell and tube heat exchanger.

4.	**Books Recommended**
1	S. P. Sukhatme, Heat Transfer, Universities Press, 2012.
2	J. P. Holman, Heat Transfer, McGraw Hill, 2017.
3	Y. A. Cengel, A. J.Ghajar, Heat and Mass Transfer, McGraw Hill, 2017.
4	N. V. Suryanarayana, Engineering Heat Transfer, Penram International Publishing, 2015.
5	R. C. Sachdeva, Fundamentals of Heat and Mass Transfer, New Age International Publications, 2012.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV **Industrial Engineering** **ME206**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**03**

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Identify the factors influencing productivity in industrial engineering.
CO2	Classify the tools of method study and time study for creating the improved process and timing for doing a job.
CO3	Examine the factors affecting the plant layout and location decisions.
CO4	Explain qualitative and quantitative techniques for solving the problems of forecasting.
CO5	Compare deterministic and probabilistic inventory control models for evaluating the inventory level.
CO6	Develop an understanding of functions of production planning, control and human resources.

2.	**Syllabus**	
	INDUSTRIAL ENGINEERING AND PRODUCTIVITY	**(04 Hours)**
	Introduction, history, objectives, organization structure, scope, Productivity, factors influencing productivity, Productivity measurement, causes of low productivity and techniques of their elimination, Introduction to advance industrial engineering techniques.	
	WORK STUDY AND ERGONOMICS	**(10 Hours)**
	History, Scope, Objectives, Overview, Method study Objectives and procedure, Micro motion study, Method study tools, Time study procedure, Performance rating, Allowances, Predetermined Motion Time Systems (PMTS), Work Sampling, Ergonomics, Work science, Design factors, Effect of environment, Man-Machine System, Workload and Fatigues.	
	PLANT LOCATION AND LAYOUT	**(07 Hours)**
	Factors affecting location decisions, Methods of evaluating location alternative, Layout types, Work cells, Repetitive and product oriented layout, Computerized layout design procedure	

	FORECASTING	**(06 Hours)**
	Steps, qualitative and quantitative approaches, Monitoring and controlling forecast, Forecasting in service sector	
	INVENTORY CONTROL	**(07 Hours)**
	Managing inventory, Inventory models for independent demand, Probabilistic models and safety stock, Single period model, Fixed period model	
	PRODUCTION PLANNING AND CONTROL (PPC)	**(07 Hours)**
	Production Systems, Job, Batch, Mass and Continuous production system, Objectives of PPC, Functions of PPC. Forecasting models, Aggregate production planning, scheduling, material requirement planning, lean manufacturing.	
	HUMAN RESOURCE MANAGEMENT	**(04 Hours)**
	Functions of Human Resource Manager, Training and development, Job evaluation and Merit rating, Wage and Wage Incentives, Grievance handling, Discipline and welfare	
		(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	J. Heizer, B. Render, C. Munson, and A. Sachan, Operations Management, 12th Edition, Pearson Education, 2017.
2	E. S. Buffa and R. K. Sarin, Modern Production/ Operations Management, 8th Edition, John Wiley & Sons, 1987.
3	S. Eilon, Elements of Production Planning and Control, 3rd Edition, Universal Publishing Corporation, 1991.
4	N.V. S. Raju, Industrial Engineering and Management, 1st Edition, Cengage Learning, 2013.
5	M. Mahajan, Industrial Engineering and Production Management, 1st Edition, Dhanpat Rai & Co. (P) Limited, 2015.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Dynamics of Machines ME208	Scheme	L	T	P	Credit
		3	1	2	05

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Understand and apply free-body diagrams in existing mechanisms for static and dynamic analysis
CO2	Analyze and solve different types of governors' problems.
CO3	Apply and solve the effect of balancing for rotating unbalanced masses
CO4	Analyze and solve the effect of balancing for reciprocating unbalanced masses
CO5	Demonstrate the stability of automobiles, naval ships and other related devices considering the gyroscopic effect
CO6	Design and analysis of the flywheel considering the turning moment diagram

2.	**Syllabus**	
	STATIC FORCE ANALYSIS	**(10 Hours)**
	Forces, couples, conditions of static equilibrium, free body diagrams, static force analysis of mechanisms, spur gears, worm gears, principle of virtual work, Friction in Mechanisms	
	DYNAMIC FORCE ANALYSIS	**(13 Hours)**
	Inertia forces, D'alembert's principle, kinematics and inertia forces on planer mechanism, Dynamic analysis of four link and slider crank mechanism: Inertia force in reciprocating engines, Dynamic force analysis of different plane mechanisms graphical method, Flywheels: Turning moment diagrams, fluctuation of speed and energy.	
	BALANCING	**(09 Hours)**
	Introduction, static balancing, dynamic balancing of several masses in different planes. Balancing of inline engines, V-engines, radial engines, balancing machines.	
	GOVERNORS	**(08 Hours)**
	Introduction, types of governors, sensitiveness of a governor, hunting, isochronisms, stability, effort and power of a governor, controlling force.	

	GYROSCOPE	**(05 Hours)**
	Angular velocity, angular acceleration, gyroscopic couple, gyroscopic effect on naval ships and aircraft, stability of an automobile, stability of a two-wheel vehicle.	
	(Total Contact Time: = 45 Hours)	

3.	**TUTORIAL**
	Numerical based on following topics
1	Static force analysis of planer mechanism
2	Static force analysis of gears
3	Dynamic force analysis of planer mechanism-I
4	Dynamic force analysis of planer mechanism-II
5	Engine flywheel
6	Balancing of several masses rotating in different planes
7	Dynamic force analysis of reciprocating mass
8	Governors
9	Gyroscopic couple on naval ship and aircraft
10	Stability of automobile including two wheel vehicles considering gyroscopic effect

3.	**Practical**
1	To determine mass moment of inertia of connecting rod by compound pendulum mentioned.
2	To determine mass moment of inertia of connecting rod by bifilar method.
3	To determine mass moment of inertia of connecting rod by trifilar method.
4	To balance multi-rotor system by experimental and validation with analytical and graphical method.
5	To prepare the performance characteristic curves on Porter governor.
6	To prepare the performance characteristic curves on Proell governor.
7	To prepare the performance characteristic curves on Watt governor.
8	To find the gyroscopic couple acting on rotating disc.

4.	**Books Recommended**
1	S. S. Rattan, Theory of Machines, McGraw Hill Education (India) Private Limited, 2009.
2	J.E. Shigley, J. J. Uicker and G. R. Pennock, Theory of Machines and Mechanisms, 3rd Edition,

	Oxford University Press, 2005.
3	R. S. Khurmi and J. K. Gupta, Theory of Machines, S. Chand and Company Ltd., 2003.
4	J.S. Rao, and R.V. Dukkipati, Mechanism and Machine Theory, Wiley Eastern Ltd.,1989
5	A. Ghosh and A. K. Malick, Theory of Mechanisms and Machines, 3rd Edition, East West Press Pvt. Ltd., 2000.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Experimental Fluid Mechanics ME 252	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Explain the need of experiments in fluid mechanics.
CO2	Explain the concepts and methods of various measurements techniques in fluid mechanics.
CO3	Explore different analysis techniques commonly used in experimental work.
CO4	Explore modern experimental techniques in fluid mechanics.
CO5	Illustrate the techniques for flow visualization..
CO6	Interpret experimental data in fluid mechanics

2.	**Syllabus**	
	INTRODUCTION	**(04 Hours)**
	Need of Experiments, Model making, non-dimensional parameters	
	WIND TUNNELS	**(08 Hours)**
	Low Speed wind tunnel, Losses in wind tunnel Circuit, High Speed/ supersonic wind tunnels, Shock tubes, Hypersonic facilities.	
	MEASUREMENT OF MATERIAL PROPERTIES	**(10 Hours)**
	Density, Surface tension, Contact Angle, Viscosity, Thermal conductivity, Thermal diffusivity, Diffusion.	
	PRESSURE MEASUREMENTS	**(04 Hours)**
	Measurements of the pressure with the wall tapings, Measurements of the pressure with the static tubes, Pressure sensitive paints	
	VELOCITY, VORTICITY AND MACH NUMBER	**(04 Hours)**
	Pressure based velocity measurements, Thermal Anemometry, Particle based techniques	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	DENSITY BASED TECHNIQUES	**(05 Hours)**
	Shadow graphy, Schlieren method, background-oriented Schlieren, Interferometry.	
	TEMPERATURE MEASUREMENTS	**(05 Hours)**
	Thermochromics Liquid Crystals, infrared imaging, Temperature measurement by absorption, light scattering and laser induced fluorescence, Temperature sensitive paints	
	FLOW VISUALIZATION	**(05 Hours)**
	Aims and principles of flow visualizations, dye lines and contours in liquid flow, smoke visualization in air flows, hardware of flow visualization experiments, modern flow visualization techniques, image processing.	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	C. Tropea and A.L. Yarin, Springer handbook of experimental fluid mechanics, Springer Science & Business Media, 2007.
2	E.O. Doebelin and D. N. Manik. Measurement systems: application and design, Mc. GrawHill, 2019.
3	R. Goldstein, Fluid mechanics measurements, Taylor & Francis 1996.
4	S. P. Venktesh, Mechanical measurements, John Wiley & Sons, Ltd, 2015.
5	J. P. Holman, Experimental methods for engineers, Mc. Graw Hill, 2017.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Theory of Elasticity and Plasticity ME254	Scheme	L	T	P	Credit
		3	0	0	03

1. <u>Course Outcomes (COs):</u> At the end of the course, students will be able to	
CO1	Examine the theoretical concepts and principles underlying elasticity and plasticity.
CO2	Define plane stress and plane strain condition.
CO3	Apply concept of material yielding and plastic behaviour to solve engineering problems.
CO4	Explain stress-strain relations in elastic and plastic deformation
CO5	Explain load instability and tearing in sheet metal forming.
CO6	Describe slip - line field theory in plastic deformation.

2.	**Syllabus**	
	STRESS & STRAIN ANALYSIS	**(08 Hours)**
	Introduction, Definition of stress & strain, Stress & Strain Tensor, Principal Stresses & Strains, Stress & Strain invariants, Stress & Strain Deviator Tensor, for state of stress and state of strain, generalized Hooke's law, Hooke's law for isotropic and homogeneous materials, plane stress and plane strain	
	YIELD CRITERIA	**(06 Hours)**
	Criteria for yielding – Tresca criterion, Von mises Criterion, Effective stress -strain.	
	PLASTIC STRESS - STRAIN RELATIONSHIPS	**(12 Hours)**
	Stress - strain relation in plasticity, State of plastic stress - strain rate, Strain rate sensitivity, plastic Anisotropy, stress - stain relations for strain hardening metals, Saint Venant's theory of plastic flow, Levy-Mises (flow rule), Prandtl - Reuss Theory of elastic and plastic deformation	
	LOAD INSTABILITY AND TEARING	**(12 Hours)**
	Uniaxial tension of a perfect strip, Tension of an imperfect strip, Tensile instability in stretching continuous sheet - condition for local necking in uniaxial and biaxial tension.	

	SLIP - LINE FIELD THEORY	**(07 Hours)**
	Slip line theory, Hencky's theory of small plastic deformation plasticity conditions, Velocity Equations, Geometry of Slip-line, Geometrical Construction of Slip-line fields, Upper and Lower Bounds, Slip Line Characteristics, Hodograph.	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	R. Hill, The Mathematical Theory of Plasticity, Oxford University Press, London, 2004
2	S. J. Hu, Z. Marciniak, J. L. Duncan, Mechanics of Sheet Metal Forming, Butterworth-Heinemann, 2002.
3	S. Singh, Theory of Elasticity, Khanna Publishers, New Delhi, 2000.
4	U. C. Jindal, Experimental Stress Analysis, Pearson Education India, 2012.
5	H. Jane Helena, Theory of Elasticity and Plasticity, PHI, 2011

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV CONDITION MONITORING ME256	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Describe basic terminologies used in condition monitoring of rotating machinery.
CO2	Examine vibration analysis problems of simple rotating systems.
CO3	Understand and analyze geared nad branched rotor systems.
CO4	Identify rotating machinery faults using different methods.
CO5	Understand the utility of instrumentation and terminology used in signal analysis for condition monitoring.
CO6	Analyse various plots used in condition monitoring of rotors to predict rotor faults.

2.	**SYLLABUS**	
	INTRODUCTION TO CONDITION MONITORING	**(07 Hours)**
	Introduction to condition monitoring and Maintenance approach, Basics of vibration conventions and characteristics	
	VIBRATION ANALYSIS OF SIMPLE ROTOR SYSTEMS	**(12 Hours)**
	Symmetric rotors, Analytical methods for torsional vibration - Holzer`s method, Transfer Matrix method, Geared and Branched systems, Effect of isotropic and anisotropic supports, Whirling of rotor, Campbell diagram.	
	FAULT DIAGNOSIS IN ROTATING MACHINERY	**(14 Hours)**
	Types of rotating machinery faults and its detection - Unbalance, Misalignment, Bent rotors, Bearing defects, Oil Whirl, Oil whip, Looseness, Electric motor defect, Rotor stator rub etc., Non-destructive testing, Acoustic emission technique and applications	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	SIGNAL ANALYSIS IN CONDITION MONITORING	**(12 Hours)**
	Instrumentation and types of Transducers - Displacement, Velocity and Acceleration, Computer aided data acquisition, Oscilloscope, Vibration Exciter systems, Signal Analysis, Basics of FFT, Trend plot, Time domain plot, Frequency domain plot, Spectrum plot, Waterfall plot, RMS, Peak and Peak-peak value.	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	Rajiv Tiwari, Rotor Systems: Analysis and identification, CRC Press, 1st edition, 2017
2	Michael I. Friswell, John E. T. Penny, Seamus D. Garvey, Arthur W. Lees, Dynamics of Rotating machines, Cambridge University Press, 2010
3	A. Davies, Handbook of Condition Monitoring: Techniques and Methodology, Springer Science & Business Media, 1998.
4	J. S. Rao, Rotor Dynamics, New Age International Ltd. 3rd edition, 2018
5	Peter Tavner, Li Ran and Christopher Crabtree, “Condition Monitoring of Rotating Electrical Machines”, The Institution of Engineering and Technology, 3 rd Edition, 2020.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Total Quality Management ME258	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	Student will be familiarized with Quality Concepts, philosophies of Quality Gurus, Total Quality Management (TQM) and models of TQM.
CO2	Students will learn the key aspect of quality improvement cycle and learn to select and use appropriate tools and techniques for controlling, improving and measuring quality such as 5S, Kaizan, TPM, Poka Yoke, QFD, TEI, Quality Circles and Lean Manufacturing.
CO3	Students will learn the concept and methodology of Six Sigma.
CO4	Students will learn the basic frameworks for quality and performance improvement such as ISO Certifications, Total Quality Management (TQM).
CO5	Students will learn the Costs of Quality (COQ).
CO6	Students will learn to review and summarize the case studies of quality improvement in the manufacturing organizations.

2.	Syllabus	
	QUALITY CONCEPTS AND TOTAL QUALITY MANAGEMENT (TQM)	**(10 Hours)**
	Quality concepts & Quality management philosophies, TQM linkages with productivity - factors affecting quality & productivity, Quality – Productivity Determinant model, Traditional versus modern quality management, principles of Total Quality (TQ). Concepts, features and element of TQM, TQM versus traditional management practices, Models of TQM, TQM implementation – Strategic framework and Roadblocks. Philosophies of Quality Gurus	
	QUALITY TOOLS	**(04 Hours)**
	Seven basic (Fishbone Diagrams, Histograms, Pareto Analysis, Flowcharts, Scatter Plots and Run Charts) quality tools. Seven new quality tools (Affinity Diagrams, Relations Diagrams, Tree Diagrams, Matrix Diagrams, Arrow Diagrams, Process Decision Program Charts, Matrix Data Analysis)	
	QUALITY COST AND QUALITY CIRCLE	**(04 Hours)**

	Costs of quality (COQ), Juran's model of optimum quality costs, analysis of COQ for improvement, Quality Circle Philosophy, its structure, implementation & operation, Brainstorming – field of application, Types of Brainstorming, 5 – M checklists.	
	TOTAL ORGANIZATIONAL INVOLVEMENT AND TOTAL PRODUCTIVE MAINTENANCE	**(04 Hours)**
	Total employees involvement (TEI), Effective communications, training & mentoring, recognition & reward, feedback & performance appraisal competencies required for different managerial roles, techniques of TEI, reward, techniques of zero defects programme, Features of TPM, Causes of machine failures, types of maintenance, overall equipment effectiveness (OEE), Case studies	
	QUALITY FUNCTION DEPLOYMENT	**(03 Hours)**
	Voice of Customer (VOC), House of Quality, QFD methodology, Case studies	
	5 - S OF HOUSEKEEPING	**(04 Hours)**
	Seiri, Seiton, Seiso, Seiketsu and Shjitsuke, Audit of 5 - S (Auditor's checklist and Display of 5 - S status), Case studies	
	KAIZEN PDCA CYCLE AND POKA YOKE	**(05 Hours)**
	Kaizen versus innovation, The seven wastes, Techniques of Kaizen, kaizen implementation, Techniques, Pillars and working principles of Poka yoke, Case studies	
	SIX SIGMA AND PROCESS CAPABILITY ANALYSIS	**(05 Hours)**
	Methodology of Six Sigma – DMAIC, Statistics associated with Six Sigma, Determination of First– time yield (FTY) of process, Z value, Defects per unit (DPU), Defects per million opportunities (DPMO) and calculating of sigma value of the process, Process capability index, upper and lower capability indices, The CpK index, capability ratio, the Taguchi capability index etc.	
	QUALITY CERTIFICATIONS AND QUALITY AWARDS	**(03 Hours)**
	ISO 9000 series and QS 9000 series certification, ISO 9000 series of standards, ISO 9001 requirements Implementation, Documentation, Internal Audits, Registration.	
	FAILURE MODE & EFFECT ANALYSIS	**(03 Hours)**
	Design and Process FMEA, Case studies	
	(Total Contact Time: = 45 Hours)	

5.	**Books Recommended**
1	P. N. Mukherjee, Total Quality Management, 1st Edition, Prentice Hall India Learning Private Limited, 2006
2	P. M. Charantimath, Total Quality Management, 1st Edition, Pearson Education, 2003.
3	L. Suganthi and A. A. Samuel, Total Quality Management, New title edition, Prentice Hall India Learning Private Limited, 2004.
4	S. Ramasamy, Total Quality Management, 1st Edition, Tata Mcgraw Hill Publishing Co Ltd, 2015.
5	J. R. Evans and W. M. Lindsay, 6th Edition, The Management and Control of Quality, South-Western College Publication, 2004.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Advanced Engineering Materials ME260	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Explain major types of special steels, their properties and applications
CO2	Find out metals that can be used for high temperature applications
CO3	Select cast-irons for specific engineering applications
CO4	Correlate metallurgical aspects and application of light metals
CO5	Select nanomaterials for different industrial applications
CO6	Describe material properties and select the suitable material for biological, space and cryogenic service applications

2.	**Syllabus**	
	INTRODUCTION	**(02 Hours)**
	The urge for advancements in material development and processing.	
	SPECIAL STEELS	**(08 Hours)**
	Metallurgical aspects, Composition, Properties and applications of: different types of Stainless steels, Dual phase steels, TRIP steels, Maraging steels, High speed steels, Hadfield steels, Free cutting steels, Ausformed steels, Tool Steels, manganese steels, chrome steels, electrical steels, bearing steels, spring steels, heat resistant steels, creep steels, HSLA steels, materials in nuclear field, materials used in space	
	SPECIAL AND HIGH TEMPERATURE ALLOYS	**(06 Hours)**
	Ti alloys: physical and mechanical properties, thermomechanical treatment of Ti-alloys, Ti shape memory alloys, Fe based super alloys, Ni based alloys, Co based alloys, Strengthening mechanism, Composition, Properties and their applications. Engineering applications at elevated temperatures	

	ALLOY CAST IRON	**(04 Hours)**
	Austempered ductile iron; alloy cast irons, Ni hard, high silicon cast irons, heat resistant cast irons- high chrome cast iron- structure, property and engineering applications.	
	LIGHT METALS AND THEIR ALLOYS	**(04 Hours)**
	Aluminium, magnesium and titanium alloys: Metallurgical aspects, Properties and applications.	
	NANO MATERIALS	**(06 Hours)**
	Definition, Types, Properties and applications, Carbon nano tubes, Methods of production.	
	SMART MATERIALS AND BIOMATERIALS	**(5 Hours)**
	Shape memory alloys, Piezoelectric materials, Electro-rheological fluid, Magneto- rheological fluids, biocompatibility, bio functionality, Important bio metallic alloys like: Ni- Ti alloy and Co-Cr-Mo alloys. Applications	
	COMPOSITE MATERIALS	**(05 Hours)**
	PMC, CMC, MMC, processing and typical application**,** Special High Temperature High performance Carbon-Carbon composites.	
	MISCELLANEOUS ADVANCED MATERIALS	**(05 Hours)**
	Magnetic materials, aerospace materials, cryogenic materials, semi-conducting and superconducting materials.	
		(Total Contact Time: = 45 Hours)

3.	**Books Recommended**
1	J. F. Shackelford, B. R. W. Alexander, Materials Science and Engineering Handbook, CRC Press, LLC, 2001.
2	K. G. Budinski, M K Budinski, Engineering Materials: Properties and Selection, General Motors Corporation, Pearson, 2010.
3	I. J. Polmear, Light alloys: Metallurgy of Light Metals, Arnold, 1995.
4	Z. Abdullaeva, Nano and Biomaterials: Compounds, Properties, Characterization and Applications, Wiley-VCH Verlag, 2017.
5	K K Chawla, Composite Material Science and Engineering, Springer, 2012.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV Risk, Reliability and Life Testing ME262	Scheme	L	T	P	Credit
		3	0	0	03

1. Course Outcomes (COs): **At the end of the course, students will be able to**	
CO1	Examine the reliability of any product or system which ultimately maintains the customers' base of any industry.
CO2	Explain the components and systems through its life cycle.
CO3	Evaluate the probabilistic time analysis of products' successes and failures.
CO4	Predict reliability of any component or system which is essential before we put it into any use.
CO5	Estimate the life of a system and their components with concepts of highly accelerated life testing.

2.	**Syllabus**	
	BASIC CONCEPTS IN RELIABILITY	**(08 Hours)**
	Risk and Reliability, introduction and fundamentals of risk management and reliability engineering, bath tub curve, failure mechanism of mechanical components: causes, modes, function of mechanical elements, failure theories.	
	COMPONENT RELIABILITY	**(06 Hours)**
	Failure data analysis, reliability function, hazard rate, failure rate, and their relationship, MTTF, mean failure rate, MTBF.	
	SYSTEM RELIABILITY	**(06 Hours)**
	Series, parallel, mixed configuration, r-out of-n structure, solving complex systems, Reliability Logic Diagrams (RLD), techniques of reliability estimation: fault tree analysis, tie sets and cut sets, Olean algebra.	
	SYSTEM RELIABILITY IMPROVEMENT	**(08 Hours)**
	Use of better components, simplification, derating, redundancy, working environment control, maintenance, etc. redundancy techniques: introduction, component vs unit	

	redundancy, weakest link technique, mixed redundancy, standby redundancy, redundancy optimization, double failure and redundancy.	
	CASE APPLICATION OF COMPLEX SYSTEM	**(02 Hours)**
	Marine power plant, computer system, nuclear power plant, combats aircraft, etc.	
	RELIABILITY TESTING	**(07 Hours)**
	Introduction, objectives, assumptions, different types of test. Life testing in practice: methodology, problems and difficulties. Economics of reliability engineering.	
	ACCELERATED LIFE TESTING	**(08 Hours)**
	Introduction, basic concepts, data qualification. Accusations faster, stress combination methods, limitations, Accelerated Stress Testing (AST), step stress method for AST, various AST models, recent development recommended approach. Highly Accelerated Life Testing (HALT), Highly Accelerated Stress Screening (HASS).	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	L. S. Srinath, Mechanical Reliability, East-West Press Pvt. Ltd, New Delhi, 2002
2	L. S. Srinath, Reliability Engineering, 4th edition, East-West Press Pvt. Ltd, New Delhi, 2005
3	V. N. A. Naikan, Reliability Engineering and Life Testing, PHI Learning Pvt. Ltd. New Delhi, 2008
4	E. Balagurusamy, Reliability Engineering, TMH, New Delhi, 2017
5	D. T. Patrick, Practical Reliability Engineering, 4th edition, Wiley Publishing company, 2008

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

B. Tech. II (DoME) Semester – IV CONCURRENT ENGINEERING ME264	Scheme	L	T	P	Credit
		3	0	0	03

1. **Course Outcomes (COs):** **At the end of the course, students will be able to**	
CO1	Support the multi-disciplinary integrated product development teams and plan and implement a new product development program
CO2	Apply appropriate concurrent engineering tools and techniques to design and develop environment-friendly products by leveraging both manufacturing cost and lifecycle cost
CO3	Determine the customer needs and ensure that the product design is robust and meets the professional standards with better quality.
CO4	Design and develop the products with high reliability, maintainability, and availability.
CO5	Apply the information technology tools for collaborative product design and development.
CO6	Demonstrate the applications of concurrent design of structures, products and components.

2.	**Syllabus**	
	Introduction	**(07 Hours)**
	Motivation, definition, and philosophy of Concurrent Engineering (CE); sequential and concurrent processes; Principles of CE; Organizing for CE; CE teams and team dynamics; Role of CAD/CAM/CAE/CIM and automation in CE; Managing product development projects; Decomposition of product development stages; Benefits of CE; Implementation issues of CE.	
	Concurrent Engineering Tools and Techniques	**(24 Hours)**
	Design for manufacturing (DFM), Design for assembly (DFA); Factors influencing form design; Casting and machining considerations; Design for manufacturing and Assembly (DFMA) guidelines and examples; Lifecycle design of products with circular economy concept; Design for environment (DFE) with examples; Design for (-to-)cost; Design for X (DFX); Value engineering. Design for quality; Taguchi's methods for designing robust products; Design of Experiments (DOE) with examples; Design optimization; Quality function deployment (QFD) with examples. Design for reliability, maintainability and availability with examples; Failure modes and effects analysis (FMEA); Fault tree analysis (FTA); Rapid prototyping methods; Design simulation; Virtual and augmented reality environments for CE.	

	Role of Information Technology in Concurrent Engineering	**(07 Hours)**
	Information technology (IT) components and functions; Artificial Intelligence for IT operations used for product design; Collaborative product development; Collaborative product commerce, Cloud IoT for CE.	
	Selected Applications of Concurrent Engineering	**(076 Hours)**
	Design of aerospace and naval structures made of composite materials; Design of automotive components; Design of medical devices; Design of electronic products; Design of white goods parts.	
	(Total Contact Time: = 45 Hours)	

3.	**Books Recommended**
1	B. Prasad. Concurrent Engineering Fundamentals I & II, Prentice Hall, New Jersey, 1996.
2	I. Moustapha. Concurrent Engineering in Product Design and Development, New Age International, New Delhi, 2006
3	G. Boothroyd, P. Dewhurst, and W. Knight. Product Design for Manufacture and Assembly, 3rd Edition, Routledge, Boca Raton, 2010
4	J. R. Hartley. Concurrent Engineering: Shortening Lead Times, Raising Quality, and Lowering Costs, 4th Edition, Routledge, Boca Raton, 2017
5	K. T. Ulrich, S. D. Eppinger, and M. C. Yang. Product Design and Development, 7th Edition, McGraw Hill Education (India), Noida, 2020.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
Five Years Integrated M.Sc. Chemistry

(M. Sc. II) (Sem. – III)

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	Third Semester (2nd year of MSc)				
1	Chemistry of d- and f-block Elements	CY201	3-1-2	5	100
2	Hetero Functional Groups and Heterocycles	CY203	3-0-2	4	85
3	State and Properties of Matter	CY205	3-0-2	4	85
4	Optics	PH205	3-0-2	4	85
5	Quality Control and Quality Assurance	CY207	3-0-0	3	55
			Total	**20**	**410**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	CYV03 / CYP03	0-0-10	5	200 (20 x 10)

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
Five Years Integrated M.Sc. Chemistry

M.Sc. -II (Chem) Semester – III CHEMISTRY OF d- AND f-BLOCK ELEMENTS CY201	Scheme	L	T	P	Credit
		3	1	2	05

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Gain knowledge of basic chemistry of transition elements.
CO2	Identify d- and f- elements based on the structure and properties.
CO3	Differentiate between lanthanides and actinides.
CO4	Understand basic concepts of acids and bases.
CO5	Acquire knowledge on properties and use of non-aqueous solvents.

2.	**Syllabus**	
	d- BLOCK ELEMENTS	**(14 Hours)**
	Transition elements, position in periodic table, electronic configuration of atoms and ions, General characteristics such as oxidation state, size, melting and boiling points, reactivity, ionization energies, magnetic behaviour, colour, tendency to form complexes. Comparison of properties of first transition series with second and third transition series. Comparative account of Ti, Zr and Hf; Comparative account of Cr, Mo and W; Chemistry and extraction of Ti and Co. Preparation, properties and structure of following compounds: $TiCl_4$, TiO_2, Ziegler Natta Catalyst, CrO_2Cl_2.	
	f- BLOCK ELEMENTS	**(14 Hours)**
	Electronic configuration, general properties and occurrence of lanthanides and actinides, extraction of lanthanides from Monazite ore and separation methods (solvent extraction and ion exchange) of lanthanides; lanthanide contraction; General properties of lanthanides and actinides: electronegativity, electron affinity, ionization energy, atomic size, ionic radius, oxidation state, reduction potential, complex formation behaviour, chemical reactivity, colour and magnetism; Occurrence, methods of preparation and stabilities of transuranic elements; Comparison of lanthanides and actinides; applications of f-block elements.	
	PRINCIPLES OF METALLURGY	**(07 Hours)**
	Occurrence of metals, slags & fluxes, metals, nonmetals and metalloids, classification of ores, furnaces, ore dressing, purification of metals, physical methods, chemical methods, ion exchange methods and solvent extraction methods in metallurgy.	
	NON-AQUEOUS SOLVENTS	**(07 Hours)**
	Solvent classification, Characteristics of solvents (M.P. & B.P., latent heat of vaporization & fusion, and dielectric constant), effect of the physical properties of the solvent in chemical reactions, acid base reaction, redox reactions, complex formation reaction, precipitation reaction, solvolytic reactions, Elementary study of NH_3, HF and SO_2 as non- aqueous solvents.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Tutorials**
1	Problems based on electronic configuration of d- and f- block elements
2	Problems based on metal purification by electrochemical methods
3	Problem based on redox potential of d- and f- block elements
4	Problems based on color and magnetism of d-block elements
5	Problems based on color and magnetism of f- block elements
6	Problems based on electronegativity of d- and f- block elements
7	Problems based on Chemical reactivity of d- block elements
8	Problems based on Chemical reactivity of f- block elements
9	Problems based on oxidation states of d- block elements
10	Problems based on M.P. & B.P. of solvents
11	Problems based on dielectric constant
12	Problems based on complexation reactions
13	Problems based on redox reactions
14	Problem based on acid base reactions

4.	**Practical**
1	Systematic Inorganic Qualitative Analysis of Binary Mixtures: Cu^{2+} and Ni^{2+}
2	Systematic Inorganic Qualitative Analysis of Binary Mixtures: Zn^{2+} and Mn^{2+}
3	Systematic Inorganic Qualitative Analysis of Binary Mixtures: Pb^{2+} and Cu^{2+}
4	Systematic Inorganic Qualitative Analysis of Binary Mixtures: Sr^{2+} and NH_4^+
5	Systematic Inorganic Qualitative Analysis of Binary Mixtures: K^+ and Ba^{2+}
6	Systematic Inorganic Qualitative Analysis of Binary Mixtures: Ba^{2+} and Ca^{2+}
7	Systematic Inorganic Qualitative Analysis of Binary Mixtures: Co^{2+} and NH_4^+
8	Systematic Inorganic Qualitative Analysis of Binary Mixtures: Zn^{2+} and Ni^{2+}
9	Systematic Inorganic Qualitative Analysis of Binary Mixtures: Mg^{2+} and K^+
10	Systematic Inorganic Qualitative Analysis of Binary Mixtures: Hg^{2+} and Cu^{2+}

5.	**Books Recommended**
1	S. Glasstone, Thermodynamics for Chemists, 1st Edition, Affiliated East-West Press Pvt. Ltd., New Delhi, 2009.
2	R. P. Rastogi, R. R. Misra, An Introduction to Chemical Thermodynamics, 4th Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 1986.
3	B. R. Puri, L. R. Sharma, Principles of Physical Chemistry, 8th Edition, Vishal Publications, New Delhi, India, 2001.
4	S. Maity, N. Ghosh, Physical Chemistry Practical, 1st Edition, New Central Book Agency (P) Ltd., India, 2012.
5	M. C. Gupta, Statistical Thermodynamics, 2nd Edition, New Age International Pvt. Ltd., 1995.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
Five Years Integrated M.Sc. Chemistry

M.Sc. -II (Chem) Semester – III HETEROFUNCTIONAL GROUPS AND HETEROCYCLES CY203	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Understand and predict the properties of organic compounds.
CO2	Acquire knowledge on chemical properties of hetero functional groups.
CO3	Acquaint with particular properties and reactions for the most important carbohydrates and heterocycles as well as their different systems of nomenclature.
CO4	Understand stereochemistry and various types of stereo-chemical reactions.
CO5	Construct practical skills for the preparation of simple organic compounds.

2.	Syllabus	
	HETERO FUNCTIONAL GROUP	**(20 Hours)**
	Aliphatic and aromatic halides, hydroxy derivatives, aliphatic alcohols and phenols. Ethers – aliphatic, and aromatic carbonyl compounds. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides. Preparation and synthetic applications of ethyl acetoacetate and diethyl malonate, tautomerism. Aliphatic and aromatic carboxylic acids and their functional derivatives. Nitrogen containing compounds – preparations and reaction mechanisms.	
	STEREOCHEMISTRY	**(11 Hours)**
	Prochirality, chirality, CIP nomenclature of more than one chiral centre, methods of resolution, stereospecific and stereoselective synthesis, asymmetric synthesis, optical activity in absence of chiral carbon (biphenyl, allenes and spiranes), chirality due to helical shape.	
	HETEROCYCLIC COMPOUNDS	**(08 Hours)**
	Nomenclature, aromaticity, synthesis, properties, reactivity, uses and canonical structures of: pyrrole, furan, thiophene, pyridine, quinoline and isoquinoline.	
	CARBOHYDRATES	**(06 Hours)**
	Introduction, basic structural features and types of carbohydrates, reactions and conversions, role in biological systems. Introduction to disaccharides, glycosidic bond, structure determination of sucrose, lactose, maltose and gentiobiose.	
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	Practical
1	Reaction rate of SN2 reactions as a function of substrate structure.
2	Reaction rate of SN1 reactions as a function of substrate structure.
3	Preparation of nitrobenzene from benzene.
4	Preparation of 1, 3-Dinitrobenzene (m-Dinitrobenzene) from Nitrobenzene
5	Preparation of m-Nitroaniline from m-Dinitrobenzene
6	Preparation of anthraquinone from anthracene

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

7	Preparation of anthrone from anthraquinone
8	Preparation of benzophenone oxime from benzophenone
9	Preparation of 2-Naphthyl benzoate from β-Naphthol (2-Naphthol)
10	Preparation of glucosazone.

4.	**Books Recommended**
1	P. Y. Bruice, Organic Chemistry, 3rd Edition, International Edition, Prentice-Hall, New Jersey, 2009.
2	E. L. Eliel, S. H. Wilen, Stereochemistry of Organic Compounds, 1st Edition, John Wiley & Sons, New York, 2008.
3	R. T. Morrison, R. N. Boyd, Organic Chemistry, 7th Edition, Prentice Hall, New Jersey, 2011.
4	A. Streitwieser, Jr., C. H. Heathcock, Introduction to Organic Chemistry, 4th Edition, MacMillan, New York, 1998.
5	R. R. Gupta, M. Kumar, V. Gupta, Heterocyclic Chemistry, Volume 2, 1st Edition, Springer India Pvt. Ltd., New Delhi, 2009.

5.	**Additional Reading Material**
1	T. W. G. Solomons, C. B. Fryhle, Organic Chemistry, 9th Edition, Wiley India Pvt. Ltd., Navi Mumbai, 2009.
2	B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, Pearson India, Noida, 5th Edition, 2005.
3	P. Sykes, A Guidebook to Mechanism in Organic Chemistry, Pearson (publisher), 6th edition, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
Five Years Integrated M.Sc. Chemistry

M.Sc. -II (Chem) Semester – III STATES AND PROPERTIES OF MATTER CY205	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Memorize the basic theoretical knowledge of solids and liquids applicable in multidisciplinary fields.
CO2	Learn concepts of solutions and apply thermodynamic treatment in liquids.
CO3	Acquire fundamental knowledge of colloidal state.
CO4	Classify states of matter based on physical properties.
CO5	Perform the experiments related to physical chemistry approach which includes solution preparation and titration.

2.	Syllabus	
	SOLID STATE	**(08 Hours)**
	Unit cell, Bravais lattice and its types, Miller indices, X-ray diffraction, Bragg's law and its derivation, Calculation of basis per unit crystal, volume, density per unit cell, Diffraction techniques (Qualitative treatment only): single crystal and powder, Structure elucidation of ZnS (Wurtzite and blende), Specific heat of solids (Dulong Petit law, Einstein's theory, Debye correction qualitatively), Band theory, Superconductivity, Point defects (Schottky and Frenkel).	
	LIQUID STATE	**(10 Hours)**
	General features of liquid state (short and long range order/disorder, hole theory), intermolecular forces, Vapor pressure, Young and Laplace equation, effect of temperature on vapour pressure, determination of vapour pressure - static and dynamic methods, effect of vapour pressure on boiling points, Surface tension, Surface energy, excess pressure, capillary action, Contact angle, spreading of liquids, temperature dependence of surface tension, measurement of surface tension, viscosity of liquids, temperature dependence of viscosity of liquids, Poiseuille's equation and measurement of viscosity,	
	COLLOIDAL CHEMISTRY	**(09 Hours)**
	Colloids: Definition, general properties of colloids (optical and electrical), Types of colloidal system (Foam, aerosol, emulsion, smoke), Classifications of colloids (lyophilic and lyophobic), preparation and purification of colloids, properties of colloids (optical, and kinetics). Associated colloids, emulsions, gels, applications of colloids.	
	SOLUTIONS	**(09 Hours)**
	Types of solutions, ideal and non-ideal solutions, Raoult's law, applications of Raoult's law, thermodynamic properties of ideal solutions, vapor pressure and thermodynamics of non-ideal systems, general considerations (excess functions), solvents and solutes of non-ideal solutions, mixing quantities (ΔH_{mix}, ΔV_{mix}, ΔG_{mix}, ΔS_{mix}), molecular interpretation of the entropy of mixing, determination of mixing quantities.	
	THERMODYNAMICS OF LIQUIDS	**(09 Hours)**
	Activity and activity coefficients, fugacity, calculation of fugacity at low pressures, partial and apparent molar properties (chemical potential, enthalpy and volume), physical significance	

	of partial molar quantities, relation between partial molar quantities, chemical potential, Gibbs-Duhem equation, applications of Gibbs-Duhem equation methods for their determination of partial molar quantities (slope – intercept method).	
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practical**
1	Preparation of Solution, Calibration and Standard Deviation.
2	To determine the partition coefficient of I_2 between CCl_4 and water.
3	To determine the surface tension of a given solution by drop weight/count (stalagmometer) method.
4	To determine the rate constant of decomposition of H_2O_2 by acidified KI solution.
5	To prepare colloidal solution of (i) gelatin (ii) Sulphur (iii) Ferric hydroxide (iv) Molybdenum blue sol
6	To study the coagulation of the hydrophobic solution with monovalent, bivalent and trivalent counter ions and find out their coagulation value.
7	To determine the heat of neutralization of weak acid (say acetic acid) and calculate its heat of ionization.
8	Determine the solubility of benzoic acid and heat of dissolution.
9	Demonstration: To determine the viscosity coefficient of a given solution by Ostwald Viscometer.
10	Determine the heat of solution of two ionic compounds: NH_4Cl and $CaCl_2$.

4.	**Books Recommended**
1	B. R. Puri, L. R. Sharma, M.S. Pathania, Principles of Physical Chemistry, 47th edition, Vishal Publications, New Delhi, 2017.
2	G. Raj, Advanced Physical Chemistry, 4th edition, Goel Publishing House, Meerut, 1990.
3	A. R. West, Solid State Chemistry and its Applications, 2nd edition, student edition, John Wiley & Sons, New York, 2014.
4	P. Atkins, J. de Paula, J. Keeler Atkins' Physical Chemistry, 11th edition.
5	K. J. Laidler, Chemical Kinetics, 3rd edition, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
Five Years Integrated M.Sc. Chemistry

M.Sc. -II (Chem) Semester – III OPTICS PH205	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of this course, students should be able to**
CO1	Relate the key theoretical concepts of optics and optical technology, including the propagation of light, various optical phenomenon such as interference, diffraction, polarization and optical instrumentation.
CO2	Explain various underlying principles associated with optics and observe key optical phenomena experimentally.
CO3	Solve problems for various situation in optics by applying the simple optical systems on the basis of lenses, reflectors, prisms, spectrometer, *etc*.
CO4	Analyze the results obtained for various problems of optics and design systems/applications by utilizing the concepts studied.

2.	**Syllabus**	
	GEOMETRIC OPTICS	**06 Hours**
	Image formation, magnification, prisms, mirrors, thin lenses, eyepiece, fiber waveguides, Blindspot, cactus guides, telescopes, microscopes, cameras, aberrations: chromatic, spherical and coma.	
	LIGHT PROPAGATION	**05 Hours**
	Reflection, refraction, transmission and polarization, total internal reflection and reflection from metals.	
	COHERENCE AND INTERFERENCE	**12 Hours**
	Coherence time, coherence length, Fresnel’s Biprism, Interference with multiple beams, thin films, Anti-reflecting coatings, Newton’s rings, Michelson interferometer, Fabry-Perot, Technological applications of interference.	
	DIFFRACTION AND HOLOGRAPHY	**11 Hours**
	Fraunhofer & Fresnel zones, zone plates, diffraction through single slit, double slit, and grating, resolving power, 2-D Fourier transforms (various apertures, including variable), holography, optical image processing, focusing with a zone plate, Babinet’s Principle.	
	POLARIZATION AND ITS APPLICATIONS	**11 Hours**
	Fresnel equations, birefringence, calcite double refraction, circular birefringence, principles of use of uniaxial crystals in practical polarizers, compensators and wave plates, Production and analysis of completely polarized light, Optical activity, Polarimeters, Faraday rotation. Applications to DNA analysis, photonic devices, displays, quantum cryptography.	
	Practical will be based on the coverage of the above topics separately	**(45 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Practical**
1.	To study the variation of refractive index with the wavelength and hence to determine the dispersive power of the material of a given prism.
2.	To determine the wavelength of Sodium light by using bi-prism.
3.	To determine the wavelength of sodium light by Newton's Ring method.
4.	Michelson's interferometer with laser light.
5.	Magnetostriction in a metallic rod using Michelson interferometry.
6.	Fabry-Perot interferometer with sodium light source.
7.	To measure the wavelength of spectral lines of mercury source using diffraction grating and spectrometer.
8.	Diode Laser Diffraction Experiment (single slit, double slit, multiple slits, fine wire, cross wire, wire mesh, transmission grating, coarse grating, circular aperture).
9.	Verify the lass of Malus. Also, determine the specific rotation of the cane sugar solution using a Polarimeter.
10.	To study the Interference, Diffraction, and Polarization of Microwave.

4.	**Books Recommended**
1	Pedrotti, Frank L, Leno M Pedrotti, and Leno S Pedrotti, Introduction to Optics. 3rd Edition), San Fransisco: Benjamin Cummings, 2006.
2	E. Hecht, *Optics*, Pearson Education, 2019.
3	F. A. Jenkins and H. E. White, *Fundamentals of optics*, Tata McGraw Hill, 2017.
4	Griffiths D. J., Introduction to Electrodynamics, 3rd Ed. Prentice – Hall of India Private Limited, 1999.
5	Ghatak, A. K., Optics, McGraw Hill, 7th edition, 2020.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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M.Sc. -II (Chem) Semester – III	Scheme	L	T	P	Credit
QUALITY CONTROL AND QUALITY ASSURANCE		**3**	**0**	**0**	**03**
CY207					

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Compare quality control and quality assurance
CO2	Acquire knowledge on GLP and their application to quality assurance and quality control systems.
CO3	Describe the good manufacturing processes focused on application of quality assurance methods.
CO4	Understand the quality system inspection technique and its application to quality assurance and quality control systems.
CO5	Acquire knowledge of record, data management, ISO guidelines and standards.

2.	**Syllabus**	
	FUNDAMENTALS OF QC AND QA	**(08 Hours)**
	Concepts, evolution and scope of quality control and quality assurance, overview of ICH guidelines.	
	GOOD LABORATORY PRACTICES	**(09 Hours)**
	Scope of Good Laboratory Practices (GLP), quality assurance, protocol for conduct of non-clinical testing, control on animal house, report preparation and documentation, CPCSEA guidelines.	
	GOOD MANUFACUTIRNG PRACTICES	**(09 Hours)**
	Good Manufacturing Practices (GMP) guidelines according to schedule M, USFDA (inclusive of CDER and CBER), pharmaceutical inspection convention (PIC), good warehousing practice.	
	QUALITY CONTROL	**(09 Hours)**
	Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), in process quality control and finished products quality control.	
	RECORD AND DATA MANAGEMENT	**(10 Hours)**
	Documentation in pharmaceutical industry, policy, procedures and work instructions, records, standard operating procedures, master batch record, concepts of controlled and uncontrolled documents, ISO guidelines and standards.	
	(Total Contact Time: 45 Hours)	

3.	**Books Recommended**
1	Quality Assurance of Pharmaceuticals- A compendium of Guidelines and Related materials Vol I & II, WHO Publications.
2	Good Laboratory Practice Regulations, Sandy Weinberg, Marcel Dekker.
3	How to Practice GMP's – P P Sharma, 7th Edition Vandana Publications, Delhi.
4	ICH Quality Guidelines, A Teasdale, John Wiley & Sons Inc; 1st edition, 2017.
5	ISO 9000 and total quality management, S. K. Singh, 2018.

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4.	**Additional Reading Materials**
1	QA Manual – D.H. Shah, 1st edition, Business Horizons.
2	Good Manufacturing Practices for Pharmaceuticals a plan for total quality control – Sidney H. Willig, Vol. 52, Marcel Dekker Series.
3	Quality Systems and Controls for Pharmaceuticals, Dipak Kumar Sarkar, John Wiley & Sons

(M. Sc. II) (Sem. – IV)

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	Fourth Semester (2nd year of MSc)				
1	Coordination and Bioinorganic Chemistry	CY202	3-0-2	4	85
2	Organic Reaction Mechanism	CY204	3-1-2	5	100
3	Equilibrium and Changes	CY206	3-0-2	4	85
4	Dyes and Drugs	CY208	3-0-2	4	85
5	Biomolecules and Cell Biology	CY212	3-0-0	3	55
			Total	**20**	**410**
6	Laboratory Demonstration of Quality Control and Quality Assurance Practical Vocational Training / Professional Experience (Optional) (mandatory for exit)	CYV04 / CYP04	0-0-10	5	200 (20 x 10)

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M.Sc. -II (Chem) Semester – IV COORDINATION AND BIOINORGANIC CHEMISTRY CY202	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Learn the fundamentals of coordination compounds.
CO2	Discuss basic theories on bonding in coordination compounds.
CO3	Identify metal hydrides and their importance.
CO4	Explain role of metal ions in biological processes.
CO5	Explore the use of metal ions and complexes in medicine.

2.	Syllabus	
	COORDINATION CHEMISTRY	**(20 Hours)**
	Ligands, coordination numbers, coordination sphere, Nomenclature, Werner's theory, EAN, Chelates, isomerism in coordination compounds, Valence Bond theory, octahedral, tetrahedral and square planner complexes, Crystal field theory (CFT), Crystal field splitting of d-orbitals in octahedral, square planar and tetrahedral complexes, CFSE, factors affecting the magnitude of Δ, spectrochemical series, Jahn-Teller effect and other crystal-field effects, limitations of CFT, LFT, nephelauxetic series, molecular orbital theory of coordination chemistry, sigma and pi bonding in complexes, Magnetism of complexes.	
	BIOINORGANIC CHEMISTRY	**(20 Hours)**
	Biological roles of alkali and alkaline earth metal ions, ions transport (active) across biological membrane and its significance, mechanism of Na^+/K^+-ions pump; Metalloproteins and enzymes: role of metal ions in the active sites, structure and functions of enzymes containing Zn, Mg, Ca, Mo, Co and Cu; Carbonic anhydrase and carboxypeptidase, Zinc finger proteins; Bioinorganic chemistry of copper-electron transfer proteins, dioxygen transport and metabolism, Plastocyanin, haemocyanin, Ascorbate oxidase; nitrogen fixation, Essential and toxic metals ions in different biological processes, Porphyrins, Metalloporphyrins, haemoglobin, and myoglobin, ferritin and transferrin. Structures and functions of cytochromes, cytochrome c; iron-sulfur proteins (ferredoxines) and cytochrome c oxidase, photosynthesis: chlorophyll.	
	METALS IN MEDICINE	**(05 Hours)**
	Metal complexes in medicine: therapeutic applications of cis-platin, MRI (Mn and Fe) agents. Radiodiagnostic Agents. Toxicity of metals - Cd, Hg and Cr toxic effects with specific examples. Chelation therapy.	
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
		(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3.	Practical
1	Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodimetrically)
2	Estimation of (i) arsenite and (ii) antimony in tartar-emetic iodimetrically
3	Complexometric estimation of (i) Mg^{2+} and (ii) Zn^{2+} using EDTA

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4	Estimation of total hardness of water samples
5	Estimation of Al^{3+} by precipitating with oxime and weighing as $Al(oximate)_3$ (aluminiumoxinate)
6	Estimation of copper as CuSCN
7	Synthesis of metal complex and characterization of hexaaminecobalt(III) chloride or hexaaminenickel(II) chloride
8	Synthesis of metal complex and characterization of trisoxalatoferrate(III) trihydrate
9	Synthesis of metal complex and characterization of $[Ni(dmg)_2]$
10	Synthesis of metal complex and characterization of $[Mn(acac)_3]$

4.	**Books Recommended**
1	J. D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley-Blackwell, New Jersey, 1999.
2	J. E. Huheey, E. A. Keiter, R. L. Keiter, O. K. Medhi, Inorganic Chemistry-Principles of Structure and Reactivity, 4th Edition, Pearson Education, London, 2006.
3	W. Kaim, B. Schewederski, A. Klein, Bioinorganic Chemistry -- Inorganic Elements in the Chemistry of Life: An Introduction and Guide, 2nd Edition, John Wiley & Sons, New York, 2013.
4	P. Atkins, Shriver, Inorganic Chemistry, 5th Edition, Oxford, 2009.
5	S. J. Lippard, J. M. Berg, Principles of Bioinorganic Chemistry, University Science Books, Mill Valley, 1994.

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M.Sc.– II (Chem), Semester – IV ORGANIC REACTIONS AND MECHANISMS CY204	Scheme	L	T	P	Credit
		3	1	2	05

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Demonstrate the reactivity of aromatic compounds.
CO2	Acquire the basic concepts and knowledge of various substitution reactions.
CO3	Gain the knowledge in the reaction mechanisms and how the factors are influenced in substitution reactions.
CO4	Understand elimination reaction mechanisms.
CO5	Apply the practical knowledge in the identification of organic compounds.

2.	Syllabus	
	AROMATIC ELECTROPHILIC SUBSTITUTION REACTIONS	**(14 Hours)**
	Aromaticity, Huckel rule for polyenes and annulene, effect of substituents on reactivity, theory of activity and deactivity effects. Arenium ion mechanism, orientation and reactivity, ortho and para ratio, Ipso effect, orientation in other ring systems, calculation of partial rate factor, quantitative treatment of reactivity in substrates and electrophiles. Chemistry of naphthalene, anthracene and phenanthrene. Carcinogenicity. Nonbenzenoid aromatic compounds.	
	NUCLEOPHILIC SUBSTITUTION REACTIONS	**(15 Hours)**
	SN^2, SN^1, mixed SN^1 and SN^2 and SET mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and vinylic carbon. Reactivity effects of structure, attacking nucleophile, leaving group and reaction mechanism, solvent effect, phase transfer catalyst, ambident nucleophile and regioselectivity. Energy profile diagram, diazonium coupling Vilsmeier reaction, Gattermann – Koch reaction, and other carbocyclic rings. $ArSN^1$ and benzyne mechanisms, reactivity effect of substrate structure, leaving group and attacking nucleophile. Introduction of azide, phosphorus and sulphur nucleophiles.	
	REACTION MECHANISM	**(08 Hours)**
	Investigation of reaction mechanism, SN_i mechanism, nucleophilic substitution of allylic halides. Neighbouring group mechanism, neighbouring group participation by π- and σ-bonds, -OH,-NH_2,-COO, -halogen and aromatic ring, stereochemistry of reactions.	
	ELIMINATION REACTIONS	**(08 Hours)**
	E_1, E_2 and E_1CB mechanism and their spectrum orientation of the double bond, reactivity effects of substrate structures, attacking base, leaving groups and the medium, mechanism and orientation in pyrolytic elimination. Von-Richter and Sommlet-Houser rearrangement.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

3.	Tutorials
1	Discussion on the effect of substituents on electrophilic substation reactions

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2	Reaction mechanism based on the theory of activity and deactivity effects
3	Calculations based on partial rate factor
4	Practicing reaction mechanisms for naphthalene, anthracene and phenanthrene
5	Practicing reaction mechanisms for nonbenzenoid aromatic compounds
6	Practicing reaction mechanisms for SN^2 and SN^1, and effects of solvents and nucleophiles
7	Practicing reaction mechanisms for mixed SN^1 and SN^2 and SET mechanism
8	Discussion of nucleophilic substitution reaction mechanisms at an allylic, aliphatic trigonal and vinylic carbon
9	Discussion about the reactivity effects of structure, attacking nucleophile, leaving group
10	Practicing nucleophilic substitution reaction using ambident nucleophile
11	Discussion about regioselectivity in nucleophilic substitution reactions
12	Practicing some name reaction mechanisms involving nucleophiles
13	Discussion about neighbouring group participation by π- and σ- bonds, -OH,-NH_2,
14	Practicing the reaction mechanisms of E_1, E_2 and E_1CB reactions
15	Practicing pyrolytic elimination, Von-Richter and Sommlet-Houser rearrangements

4.	**Practical**
1	Systematic qualitative analysis of aromatic carboxylic acid
2	Systematic qualitative analysis of aromatic primary amine
3	Systematic qualitative analysis of hydrocarbon
4	Systematic qualitative analysis of monosaccharide
5	Systematic qualitative analysis of phenolic compound
6	Systematic qualitative analysis of aromatic nitro compound
7	Systematic qualitative analysis of carbonyl compound
8	Systematic qualitative analysis of neutral compound
9	Systematic qualitative analysis of nitro substituted aromatic primary amine
10	Systematic qualitative analysis of unsaturated carboxylic acid

5.	**Books Recommended**
1	M. B. Smith, J. March, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, 6th Edition, Wiley-Interscience, 2012.
2	A. Streitwieser, Jr., C. H. Heathcock, Introduction to Organic Chemistry, 4th Edition, MacMillan, New York , 1998.
3	J. Clayden, S. Warren, N. Greeves, P. Wothers**,** Organic Chemistry, 2nd Edition, Oxford University Press, 2012.
4	P. Volhardt, N. Schore**,** Organic Chemistry: Structure and Function, 7th Edition, W. H Freeman & Co., 2014.
5	R.L. Shriner, R.C. Fuson, D.Y. Curtin, Systematic Identification of Organic Compounds, 7th Edition, John Wiley & Sons, New York, 1998.

M.Sc. -II (Chem) Semester – IV EQUILIBRIUM AND CHANGES CY206	Scheme	L	T	P	Credit
		3	0	2	04

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Demonstrate successive relationships between varied equilibria constants and apply the mechanism of phase rule with phase diagram for various systems.
CO2	Learn the thermochemistry in deep and calculate heat of a reaction.
CO3	Define basics of EMF series and its application.
CO4	Accumulate a deep knowledge in surface phenomena applicable in multidisciplinary areas.
CO5	Perform the experiments related to physical chemistry approach which includes Kinetics, Conductometry, Colorimetry, pH-metry, and Potentiometry Titrations.

2.	**Syllabus**	
	THERMOCHEMISTRY	**(10 Hours)**
	Standard state, standard enthalpy of formation, Hess's law and its applications, heat of reaction at constant pressure and at constant volume, enthalpy of neutralization, bond dissociation energy and its calculation from thermochemical data, Kirchhoff's equation, Joule Thomson effect, inversion temperature. Nernst distribution law: Derivation, application and limitations, distribution coefficient, Henry's law, solvent extraction. Numericals.	
	IONIC EQUILIBRIA	**(09 Hours)**
	Ostwald's dilution law and its derivation, Strength of acids and bases on their dissociation constants, ionic product of water, pH scale, measurement of pH, Common Ion effect, buffer capacity, buffer in biological systems, Henderson's equations, hydrolysis of salts, hydrolysis constant, relationship between K_h, K_a, K_b, K_w, degree of hydrolysis, acid base indicators, concept of solubility product. Numericals.	
	PHASE EQUILIBRIA	**(09 Hours)**
	Definition of Phase, Phase boundaries, Components, degree of freedom, phase rule, Thermodynamic condition for phase equilibrium, Phase rule and its derivation, Phase equilibrium for one component system (for example H_2O, S, CO_2), First and second order phase transition, Clapeyron equation, Clausius-Clapeyron equation, Liquid vapor equilibrium for two component system, Critical solution temperature, completely immiscible systems, Simple eutectic systems: Zn-Cd, Pb-Ag.	
	ELECTROCHEMISTRY	**(09 Hours)**
	Single electrode potential, Hydrogen electrode, Galvanic cell, EMF series, Nernst equation, Reversible electrodes, metal-metal ion electrodes, Calomel electrode, Standard Hydrogen Electrode (SHE), Oxidation-Reduction electrodes, Potentiometric titration, Application of electrochemistry in Corrosion control by cathodic protection, batteries, and fuel cells, Interface of chemical sciences with other disciplines. Numericals.	
	SURFACE CHEMISTRY	**(08 Hours)**

	Adsorption (Physisorption and chemisorption), adsorption isotherms, BET equation for estimation of surface area. Solid-liquid interfaces, Contact angle and wetting, Solid-gas interface, Surface active agents and their classification, Gibbs adsorption from solution, Critical micellar concentration (CMC), micelles, thermodynamics of micellization, reverse micelles.	
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practical**
1	Demonstration of different types of electrodes (glass electrode, conductivity cell, potentiometric electrode).
2	To determine the rate constant and the order of the reaction of $KBrO_3$ and KI in acidic medium.
3	To study the triangular phase diagram of Acetic acid, Chloroform and Water.
4	To determine the amount of Acetic acid adsorbed at its different concentrations by charcoal and hence, to verify the Freundlich adsorption isotherm.
5	To determine the critical micelle concentration (CMC) of SDS by stalagmometer.
6	To study the effect of addition of an electrolyte ($NaCl/KCl/Na_2SO_4$) on the solubility of an organic acid (Benzoic acid/ salicylic acid) at room temperature.
7	To determine the solubility and solubility product of potassium hydrogen tartarate in water and in presence of different concentrations common ion (e.g., KCl) at R.T.
8	Demonstration: To find out the strength of HCl solution (N/10) by pH-metric titration against standard NaOH solution.
9	Potentiometric estimation of Mohr's salt solution with standard potassium dichromate solution and also determination of formal potential (reduction) of ferric-ferrous system.
10	To determine the dissociation/ ionisation constant (K_a) of weak electrolyte (Acetic acid).

4.	**Books Recommended**
1	G. M. Barrow, Physical Chemistry, 6th Edition, McGraw-Hill, New Delhi, 1996.
2	B. R. Puri, L. R. Sharma, ,M.S. PathaniaPrinciples of Physical Chemistry, 47th Edition, Vishal Publications, New Delhi, 2017.
3	G. Raj, Advanced Physical Chemistry, 4th Edition, Goel Publishing House, Meerut, 1990.
4	S. K. Maity, N. K. Ghosh, Physical Chemistry Practical, 1st Edition, New Central Book Agency (P) Ltd., Kolkata, 2012.
5	S. Glasstone, An Introduction to Electrochemistry, Maurice Press, 2011.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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M.Sc. -II (Chem) Semester – IV DYES AND DRUGS CY208	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Acquire knowledge of various theories of colour and chemical constitution.
CO2	Describe various dyestuff and categorize their applications.
CO3	Explain methodology followed in drug design and various theories of drug activity.
CO4	Discuss concept of drug disposition and elimination.
CO5	Gain knowledge about the chemistry of various class of drugs.

2.	Syllabus	
	THEORY OF COLOUR AND CHEMICAL CONSTITUTION	**(06 Hours)**
	Auxochrome, chromogen, chromophore of colourchemistry,colour and chemical constitutions. Theories to explain relation between colour and chemical constitutions: Witt's theory, Armstrong theory, Baeyer's theory, Nietzki's theory, Watson's theory. Modern theories: Valence bond theory (resonance theory) and Molecular orbital theory.	
	SYNTHESIS OF DYESTUFF AND PIGMENT OF VARIOUS CLASSES	**(06 Hours)**
	Chemical Synthesis of Nitro and Nitroso dyes; Azo dyes - Direct, Acid, Basic, Mordant, Disperse dye.Diphenyl methane dyes (DPM); Triphenyl Methane Dyes (TPM); Phthalocyanine; Xanthene dyes; Heterocyclic dyes such as acridine dyes; Indigo and Thioindigo; Solubilised vat dyes; Anthraquinone dyes such as Mordant vat, disperse and acid dyes; Reactive dyes such as procion dyes and vinyl sulphone dyes.	
	NON-TEXTILE APPLICATION OF DYES	**(04Hours)**
	Food colours, cosmetic dyes, dyes for paper and printing inks, dyes for paints, High tech dyes.	
	DRUGS	**(20 Hours)**
	Drug discovery and diversity, classification of drugs, chemistry of sulfa drugs, antipyretics and analgesics, antibiotics, antituberculor, antifungal and anti-inflammatory drugs. Synthesis of selective drugs: Ciprofloxacin, Ibuprofen, Atenolol, Captopril, Diazepam, Chloroquine, Sulphanilamide, Miconazole, Biotin, Ethambutol, Ranitidine, and Omeprazole, routes of drug administration, theories of drug action: Occupation theory, rate theory, induced fit theory.	
	DRUG DESIGN	**(03 Hours)**
	Methodology for Drug design, molecular basis of Drug specificity.	
	PHARMACOKINETICS	**(06 Hours)**
	Concept of drug disposition, elimination, importance of ADME parameters in drug disposition and in therapeutics.	
	Practical will be based on the coverage of the below topics separately	**(40 Hours)**
		(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Practical**
1	Preparation of methyl orange.
2	Preparation of Magneson II.
3	Preparation of p-nitroacetanilide.
4	Preparation of Magneson I.
5	Preparation of Orange -II
6	Preparation of 2,3Diphenylquinoxaline.
7	Synthesis of Aspirin
8	Synthesis of Benzocaine
9	Synthesis of Phenytoin
10	Synthesis of para red

4.	**Books Recommended**
1	R. Christie,Colour Chemistry, 2nd Edition, Royal Society of Chemistry, 2014.
2	G. R. Chatwal,The Synthetic Dyes, 4th Edition, Himalaya Publishing House, 2016.
3	G.L.Patrick,An introduction to Medicinal chemistry, 5th Edition, Oxford University Press, 2013.
4	V. F. Roche , S. W. Zito,T. L. Lamke, D. A. Williams, Foye's Principles of Medicinal Chemistry, 8th Edition, Wolters Kluwer Publisher, 2019.
5	A. Korolkovas, Essentials of Medicinal Chemistry, John Wiley & sons, 2ndEdition, 2008.

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M.Sc. -II (Chem) Semester – IV BIOMOLECULES AND CELL BIOLOGY CY212	Scheme	L	T	P	Credit
		3	0	0	03

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Summarize the basics of cell biology and biomolecule.
CO2	Discuss interfaces between chemistry and biology.
CO3	Acquire knowledge about genetic engineering.
CO4	Understand cell structure and metabolisms.
CO5	Apply fundamental knowledge of molecular biology.

2.	Syllabus	
	INTRODUCTION TO CELL BIOLOGY	**(10 Hours)**
	Cell and Cell Theory; Comparison between plant and animal cells; Cell wall; Plasma membrane; Membrane Transport (Including Vesicular Transport: Endocytosis and Exocytosis, Cytoskeleton; Protoplasm; Mitochondria; Chloroplast; Endoplasmic Reticulum (ER); Golgi complex; Lysosome, Ribosome; Nucleus; Chemical components of a cell; Cell division and cell cycle: Mitosis and meiosis (different phases in cell division), their regulation, steps in cell cycle, and control of cell cycle	
	BIOMOLECULES	**(12 Hours)**
	Lipids: Introduction, Definition, Classification, and Functions of lipids; Fatty acids; Essential fatty; acids; Reactions of lipids; Triacylglycerol or neutral fat; phospholipids glycolipids; cholesterol; Eicosaanoids; prosatglandins; lipoprotein. **Proteins**: Introduction of amino acids, peptides, and proteins, Protein isolation, and purification methods (dialysis salting out, pH precipitation, and solvent precipitation). Classification of proteins based on solubility, structure, and functions with examples. Color reactions of proteins – Biuret, Xanthoproteic, Millon's. Conjugated proteins, multimeric proteins, and metalloproteins. **Nucleic acids**: Structure of nitrogenous bases; Structure and function of nucleotides; Watson and Crick model of DNA. Melting of DNA (Tm), Types of nucleic acids; Structure of A, B, Z types of DNA; RNA- Composition, types (mRNA, tRNA, and rRNA); Structure of tRNA. DNA transcription and translation in pro and eukaryotes, genetic code.	
	ENZYMES	**(10 Hours)**
	Introduction to enzymes, Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes, Factors affecting the rate of chemical reactions, collision theory, Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis. Enzyme kinetics and Enzyme inhibition, Mechanism of action of enzymes, and regulation of enzyme activity.	
	CELLULAR MICROBIOLOGY AND VIROLOGY	**(13 Hours)**
	Bacteria: General characteristics and classification (based on morphology), fine structure of bacterial cells, Gram-positive and Gram-negative bacteria, mode of nutrition and reproduction. The cell wall of bacteria containing peptidoglycan and related molecules; the	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	outer membrane, and the cytoplasmic membrane. Membrane lipids, proteins, and carbohydrates. Example of some bacterial diseases. **Viruses**: General characteristics, and types of viruses based on structure and genetic material. Multiplication of viruses, Lytic and Lysogenic cycle. Consequences of virus infection to animals and humans. Discussion of emerging viruses such as Ebola, Severe acute and Middle East respiratory syndrome Coronavirus (SARS/MERS-CoV), Zika etc. **Fungi**: structure (range of thallus organization), cell wall composition, nutrition, and reproduction in fungi. Classification of fungi. Examples of some common fungal diseases.
	(Total Contact Time: 45 Hours)

3.	**Books Recommended**
1	R. Y. Stainer, J. L. Ingraham, M. L. Wheelis, P. R. Painter, General Microbiology, 5th Edition, The MacMillan Press Ltd, 1987.
2	D. L. Nelson, M.M. Cox, Lehninger's Principles of Biochemistry, 5th Edition, CBS Publications, 2008.
3	G. Plopper, D. B. Ivankovic, Principles of Cell Biology, 3rd Edition, Jones & Bartlett Learning, 2020.
4	D.S.T. Nicholl, An Introduction to Genetic Engineering, 4th Edition, Cambridge University Press, 2023
5	R. J. Simmonds, Chemistry of Biomolecules: An Introduction, Royal Society of Chemistry, 1992

4.	**Additional Books Recommended**
1	B. R. Glick, C. L. Patten, Molecular Biotechnology: Principles and Applications of Recombinant DNA, 6th Edition, American Society for Microbiology, 2022
2	M. J. Pelczar, R. D. Reid, Microbiology, 5th Edition, Tata McGraw Hill, 1986.

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Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	First Semester (1st year of MSc)				
1	Foundation Course in Mathematics-I	MA101	3-1-0	4	70
2	Calculus-I	MA103	3-1-0	4	70
3	Computer Programming using C/C++	MA131	3-0-2	4	85
4	English and Professional Communication	HS110	3-1-0	4	70
5	Fundamentals of Physics	PH113	3-0-2	4	85
			Total	**20**	**380**
6	Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV01 / MAP01	0-0-10	5	200 (20 x 10)
	Second Semester (1st year of MSc)				
1	Foundation Course in Mathematics-II	MA102	3-1-0	4	70
2	Calculus-II	MA104	3-1-0	4	70
3	Python Programming	MA132	3-0-2	4	85
4	Fundamentals of Physics-II	PH106	3-0-2	4	85
5	Chemistry	CY112	3-0-2	4	85
6	Indian Value System and Social Consciousness	HS120	2-0-0	2	35
			Total	**22**	**430**
7	Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV02 / MAP02	0-0-10	5	200 (20 x 10)
	Third Semester (2nd year of MSc)				
1	Element of Analysis	MA201	3-1-0	4	70
2	Analytical Geometry	MA203	3-1-0	4	70
3	Discrete Mathematical Structure	MA205	3-1-0	4	70
4	Data Structure	MA231	3-0-2	4	85
5	English and Professional Communication – II	HS201	3-1-0	4	70
			Total	**20**	**365**
6	Mathematical Software-I Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV03 / MAP03	0-0-10	5	200 (20 x 10)
	Fourth Semester (2nd year of MSc)				
1	Numerical Analysis	MA202	3-1-0	4	70
2	Linear Algebra	MA204	3-1-0	4	70
3	Elementary Number theory	MA232	3-1-0	4	70
4	Computational Life Science	MA233	3-1-0	4	70
5	Computer Networks	CS208	3-0-2	4	85
			Total	**20**	**365**
6	Mathematical Software-II Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV04 / MAP04	0-0-10	5	200 (20 x 10)
	Fifth Semester (3rd year of MSc)				

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1	Ordinary Differential Equations	MA301	3-1-0	4	70
2	Mechanics	MA303	3-1-0	4	70
3	Probability and Statistics-I	MA331	3-1-0	4	70
4	Analysis of Algorithms	MA332	3-1-0	4	70
5	Elective	MA3AA	3-X-X	3/4	55/70/85
			Total	**19-20**	**335-365**
6	Mini Project-I Preliminary Part-I Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV05 / MAP05	0-0-10	5	200 (20 x 10)
	Sixth Semester (3rd year of MSc)				
1	Complex Analysis	MA302	3-1-0	4	70
2	Continuum Mechanics	MA304	3-1-0	4	70
3	Metric Space	MA333	3-1-0	4	70
4	Fundamentals of Artificial Intelligence	CS300	3-0-2	4	85
5	Elective	MA3BB	3-X-X	3/4	55/70/85
			Total	**19-20**	**350-380**
6	Mini Project-I Preliminary Part-II Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV06 / MAP06	0-0-10	5	200 (20 x 10)
	Seventh Semester (4th year of MSc)				
1	Topology	MA401	3-1-0	4	70
2	Abstract Algebra	MA403	3-1-0	4	70
3	Fluid Dynamics	MA405	3-1-0	4	70
4	Optimization Techniques	MA431	3-1-0	4	70
5	Elective	MA4AA	3-X-X	3/4	55/70/85
			Total	**19-20**	**335-365**
6	Mini Project-II Preliminary Part-I Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV07 / MAP07	0-0-10	5	200 (20 X 10)
	Eighth Semester (4th year of MSc)				
1	Functional Analysis	MA402	3-1-0	4	70
2	Higher Transcendental Functions	MA404	3-1-0	4	70
3	Partial Differential Equations	MA406	3-1-0	4	70
4	Calculus of Variations & Integral Equations	MA432	3-1-0	4	70
5	Elective	MA4CC	3-X-X	3/4	55/70/85
			Total	**19-20**	**335-365**
6	Mini Project-II Preliminary Part-II Vocational Training / Professional Experience (Optional) (mandatory for exit)	MAV08 / MAP08	0-0-10	5	200 (20 X 10)
	Ninth Semester (5th year of MSc)				
1	Measure Theory and Integration	MA501	3-1-0	4	70
2	Advanced Mathematical Modelling and Simulation	MA503	3-0-2	4	85
3	Probability and Statistics-II	MA531	3-1-0	4	70

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4	Communication and Technical Writing Skill	HS501	3-1-0	4	70
5	Elective	MA5AA	3-X-X	3/4	55/70/85
			Total	**19-20**	**350-380**
	Tenth Semester (5th year of MSc)				
1	Dissertation	MAP10	0-0-40	20	800 (40x 20)
			Total	**20**	**800**

Sr. No.	Optional Core	Code	Scheme L-T-P
1	Computer Programming using C/C++	MA131	3-0-2
2	Python Programming	MA132	3-0-2
3	Data Structure	MA231	3-0-2
4	Elementary Number theory	MA232	3-1-0
5	Computational Life Science	MA233	3-1-0
6	Probability and Statistics-I	MA331	3-1-0
7	Analysis of Algorithms	MA332	3-1-0
8	Metric Space	MA333	3-1-0
9	Optimization Techniques	MA431	3-1-0
10	Calculus of Variations & Integral Equations	MA432	3-1-0
11	Probability and Statistics-II	MA531	3-1-0

Sr. No.	Elective	Code	Scheme L-T-P
1	Advance Mathematical Methods-I	MA351	3-1-0
2	Stochastic Differential Equations	MA352	3-1-0
3	Mathematical Modelling	MA353	3-1-0
4	Integral and Wavelet Transform	MA354	3-1-0
5	Mathematical Finance	MA355	3-1-0
6	Fuzzy Set theory	MA356	3-1-0
7	Block Chain Technology	CS360	3-0-2
8	Sobolev Space	MA451	3-1-0
9	Advance Mathematical Methods-II	MA452	3-1-0
10	Natural Language Processing	CS461	3-0-2
11	Data Analytics	MA453	3-0-2
12	Multi Objective Optimization	MA454	3-1-0
13	Evolutionary Algorithms	MA455	3-1-0
14	Advance Operations Research	MA551	3-1-0
15	Fluid Dynamics in Porous Media	MA552	3-1-0
16	Advanced Numerical Analysis	MA553	3-1-0
17	Linear Operator and Approximation Theory	MA554	3-1-0

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M.Sc. 2^{rd} Year (Mathematics) Semester – III Elements of Analysis MA 201	Scheme	L	T	P	Credit
		3	1	0	04

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Discuss the convergence and divergence of sequences and series
CO2	Predict the existence of Riemann integral with their properties
CO3	Demonstrate the convergence of improper integral
CO4	Examine the uniform convergence using different tests
CO5	Develop the Fourier series in different intervals

2.	**Syllabus**	
	REAL SEQUENCES AND INFINITE SERIES	**(14 Hours)**
	Sequences, Limit points of a sequence, Limits inferior and superior, Convergent sequences, Non Convergent sequences, Cauchy's general principle of convergence, Algebra of sequences, Some important theorems, Monotonic sequences. Positive terms series, Comparison test, Cauchy's root test, D'Alembert ratio test, Series with arbitrary terms.	
	THE RIEMANN INTEGRAL	**(06 Hours)**
	Definitions and existence of the integral, Refinement of partitions, Darboux's theorem, Conditions of integrability, Integrability of the sum and difference of Integrable functions, The integral as a limit of sums, Some integrable functions, Integration and differentiation, The fundamental theorem of calculus, Mean value theorem, Integration by parts, Change of variable in an integral, Second mean value theorem.	
	VECTOR OPERATORS	**(05 Hours)**
	Green's, Gauss' & Stokes' theorem with proof.	
	IMPROPER INTEGRAL	**(06 HOURS)**
	Introduction, Integration of unbounded functions with finite limit of integration, Comparison tests for convergence of $\int_a^b f(x)dx$, Infinite range of integration, Integrand as a	

	product of functions.	
	UNIFORM CONVERGENCE	**(08 HOURS)**
	Pointwise convergence, Uniform convergence on an interval, Tests for uniform convergence, Properties of uniformly convergent sequences and series, The Weierstrass approximation theorem.	
	FOURIER SERIES	**(06 Hours)**
	Trigonometric series, Some preliminary theorems, The main theorem, Intervals other than $[-\pi, \pi]$.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
		(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)

3.	Tutorials
1	Tutorial on convergent and monotonic sequences.
2	Tutorial on Riemann integral, Green's, Stokes' and Gauss' theorem.
3	Tutorial on integration of unbounded functions and comparison tests of convergence.
4	Tutorial on pointwise convergence, uniform convergence and Weierstrass approximation theorem.
5	Tutorial on trigonometric series.

4.	<u>Books Recommended:</u>
1	W. Rudin, Principles of Mathematical Analysis, 3rd Edition, McGraw Hill, New York, 1976.
2	R. R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing, 1970.
3	T. Apostol, Mathematical Analysis, 2nd Edition, Narosa Publishers, 2002.
4	H. L. Royden, Real Analysis, 4th Edition, Macmilan Publishing Co. Inc., New York,1993.
5	S. Narayan and M. D. Raisinghania, Elements of Real Analysis, 7th Edition, S. Chand Publication, New Delhi, 1980.

M.Sc. 2nd Year (Mathematics) Semester – III Analytical Geometry MA 203	Scheme	L	T	P	Credit
		3	1	0	04

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1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	demonstrate the fundamentals of analytical geometry in Cartesian and polar coordinates
CO2	discuss the equation of straight line in different forms and related properties
CO3	solve the problems related to plane and sphere
CO4	evaluate the equation of cone and cylinder and their tangent plane
CO5	elaborate the equations and other properties related to plan section and conicoids

2.	**Syllabus**	
	ORIENTATION OF COORDINATE GEOMETRY	**(08 Hours)**
	Distance between two points, Coordinates of a point which divides the line joining the given points in a given ratio, Equation of surfaces, Cylindrical coordinates, Polar coordinates, Angle between two lines, Direction cosines of a line, Direction ratios of a line, Projections, Projection of a line segment.	
	STRAIGHT LINE	**(09 Hours)**
	General equation of straight line, Equations of a line in symmetrical form, Reduction of general equation of a line into symmetrical form, Angles between two lines, Angle between line and plane, Line intersecting two given lines, Locus of a line, Distance of a point from a line, Shortest distance between two lines, Equations of two skew lines in simplified form, Intersection of three planes.	
	PLANE AND SPHERE	**(09 Hours)**
	General equation of a plane, Normal form of the equation of a plane, Projection of a segment, Angles between two planes, Equation of a plane in various forms, Length of perpendicular from a point to a plane, General equation of a plane passing through the line of intersection of two planes, General equation of sphere, Equation of sphere passing through four points, Sphere on the join of two points as diameter, Intersection of two sphere, Intersection of sphere and plane, Intersection of sphere and line, Angle of intersection of two sphere, Orthogonal sphere, Radical sphere.	
	THE CYLINDER AND CONE	**(10 HOURS)**

	Equation of a cylinder, Right circular cylinder and its equation, Interpretation of equations, Equation of tangent plane to a given cylinder, Cone and its equation, Cone with vertex at origin, Right circular cone, Condition for general equation of second degree to represent a cone, Tangent plane to a cone and condition of tangency, Reciprocal cone, Cone with three mutually perpendicular generators, Number of mutually perpendicular generators, Intersection of a plane through the vertex and a cone.	
	PLANE SECTION AND CONICOIDS	**(09 HOURS)**
	Some standard equation of central conicoids, Diametral planes and principal planes, Tangent lines and tangent plane at a point, Condition of tangency of a plane, Section with a given centre, Locus of the mid-points of a system of parallel chords, Polar plane, Polar lines, Enveloping cone, Classification of central conicoids, Normal to an ellipsoid, Conjugate diametral plane and diameters of ellipsoid, Paraboloids: Equation, Classification and Properties, Conicoids: General equation and examples.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)	

3.	**Tutorials**
1	Tutorial 1 will be based on distance, equation of surfaces, direction cosines, direction ratios and projection.
2	Tutorial 2 will be based on equation of straight line, angles between two lines and intersection of three planes.
3	Tutorial 3 will be based on equation of planes, equation of sphere and their intersection.
4	Tutorial 4 will be based on equation of cylinder, equation of cone and mutually perpendicular generators.
5	Tutorial 5 will be based on equation of cylinder, equation of cone and mutually perpendicular generators.

4.	**Books Recommended:**
1.	R. Ballabh, A Textbook of Coordinate Geometry, 3rd Edition, Prakashan Kendra, Lucknow, 1965.
2.	S. Narayan and P. K. Mittal, Analytical Solid Geometry, 17th Revised Edition, S.Chand & Company, New Delhi, 2007.

3.	R. J. T. Bell, An Elementary Treatise on Coordinate Geometry of Three Dimensions, MacMillon & Co. Ltd., 1960.
4.	C. Smith, An Elementary Treatise on Solid Geometry, MacMillon & Co. Ltd., 1931.
5.	P. K. Jain and K. Ahmad, A Text Book of Analytical Geometry of Three Dimensions, New Age International Publishers, New Delhi, 2005.

M.Sc. 2rd Year (Mathematics) Semester – III	Scheme	L	T	P	Credit

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DISCRETE MATHEMATICAL STRUCTURE **MA 205**		**3**	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	apply knowledge of Mathematical Logic in programming
CO2	analyze the problems for developing the solution, its correctness and performance using graphs
CO3	analyze the real world problems using group theory, relations, lattices and Boolean algebra
CO4	develop an algorithm using Asymptotic analysis
CO5	design solutions for various types of problems in different disciplines like information security, optimization, mathematical analysis

2.	**Syllabus**	
	MATHEMATICAL LOGIC AND PROGRAM VERIFICATION	**(10 Hours)**
	Propositions, logical operators and propositional algebra, Predicates and quantifiers, Interaction of quantifiers with logical operators, Logical interference & proof techniques, Formal verification of computer programs (elements of Hoare logic).	
	GRAPH THEORY	**(10 Hours)**
	Graphs, Definition and basic concepts of finite and infinite graph, Incidence and Degree, Isomorphism, Subgraph, Walk, Path & Circuits, Operations on graphs, Connected Graph, Disconnected graph and Components, Complete graph, Regular graph, Bipartite graph, Euler's graph, Hamiltonian paths and Circuits, Weighted graphs, Applications, Directed & Undirected graphs, Connectivity of graphs.	
	TREES	**(06 Hours)**
	Definition & properties of trees, Pendent vertices in a tree, Distance between two vertices, Centre, Radius and diameter of a tree, Rooted and binary trees, Representation of Algebraic structure by Binary trees, Binary search trees, Spanning trees and fundamental circuits.	
	LATTICES	**(06 Hours)**
	Definition and properties of lattice, Sublattice, Distributive and modular lattices, Complemented and bounded lattices, Complete lattices.	
	BOOLEAN ALGEBRA	**(06 Hours)**

	Introduction, Definition, Properties of Boolean algebra, Boolean variables, Boolean expression, Boolean function, Min term, Max term, Canonical forms, Switching network from Boolean expression, Karnaugh map method.	
	ASYMPTOTIC ANALYSIS	**(07 Hours)**
	Complexity analysis, Time and storage analysis, Big-oh, Big-Omega, Big–Theta notation, Illustration and application to real problems.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)	

3.	**Tutorials**
1	Tutorial on Mathematical Logic and Verification
2	Tutorial on Graph Theory
3	Tutorial on Trees
4	Tutorial on Lattices
5	Tutorial on Boolean Algebra
6	Tutorial on Asymptotic Analysis

4.	**Books Recommended:**
1.	K. H. Rosen, Discrete Mathematics and its Applications, 6th Edition, McGraw-Hill, 2006.
2.	B. Kolman, R. C. Busby, and S. Ross, Discrete Mathematical Structure, 5th Edition, Prentice Hall Inc., 2003.
3.	J. P. Tremblay and R. Manohar, Discrete Mathematical Structure with Applications to Computer Science, McGraw Hill Book Co., 1999.
4.	N. Deo, Graph Theory with Applications to Engineering & Computer Science, Prentice Hall of India Pvt. Ltd., 2000.
5.	D. F. Stanat and D. F. McAllister, Discrete Mathematics in Computer Science, Prentice-Hall, Englewood Cliffs, New Jersey, 1977.

M.Sc. 2nd Year (Mathematics) Semester – III **DATA STRUCTURE** **MA 231**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	recognize the need of different data structures and understand its characteristics
CO2	apply different data structures for given problems
CO3	design and analyse different data structures, sorting and searching techniques
CO4	evaluate data structure operations theoretically and experimentally
CO5	solve the complex engineering problems

2.	**Syllabus**	
	INTRODUCTION TO DATA STRUCTURES	**(03 Hours)**
	Review of Concepts: Information and meaning, Abstract data types, Internal representation of primitive data structures, Arrays, Strings, Structures, Pointers.	
	LINEAR LISTS	**(06 Hours)**
	Sequential and linked representations of linear lists, Comparison of insertion, Deletion and search operations for sequential and linked lists, Doubly linked lists, Circular lists, Lists in Standard Template Library (STL), Applications of lists.	
	STACKS	**(06 Hours)**
	Sequential and linked implementations, Representative applications such as Recursion, Expression evaluation viz., Infix, Prefix and Postfix, Parenthesis matching, Towers of Hanoi, Wire routing in a circuit, Finding path in a maze.	
	QUEUES	**(06 Hours)**
	Operations of queues, Circular Queue, Priority Queue, Dequeue, Applications of queues, Simulation of time sharing operating systems, Continuous network monitoring system, etc.	
	SORTING AND SEARCHING	**(05 Hours)**
	Sorting methods, Bubble sort, Selection sort, Quick sort, Radix sort, Bucket sort, Dictionaries, Hashing, Analysis of collision resolution techniques, Searching methods, Linear search, Binary search, Character strings and different string operations.	
	TREES	**(08 Hours)**
	Binary trees and their properties, Terminology, Sequential and linked implementations, Tree traversal methods and algorithms, Complete Binary trees, General trees, AVL trees, Threaded trees, Arithmetic expression evaluation, Infix-prefix-postfix notation conversion,	

	Heaps as priority queues, Heap implementation, Insertion and deletion operations, Heapsort, Heaps in Huffman coding, Tournament trees, Bin packing.	
	MULTIWAY TRESS	**(04 Hours)**
	Issues in large dictionaries, M-way search trees, B-trees, Search, insert and delete operations, Height of B-tree, 2-3 trees, Sets and multisets in STL.	
	GRAPHS	**(07 Hours)**
	Definition, Terminology, Directed and undirected graphs, Properties, Connectivity in graphs, Applications, Adjacency matrix and linked adjacency chains, Graph traversal, Breadth first and depth first traversal, Spanning trees, Shortest path and transitive Closure, Activity networks, Topological Sort and critical paths.	
	Practical will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours= 75 Hours)	

3.	**Practical's**
1	Implementation of Array and its applications
2	Implementation of Stack and its applications
3	Implementation of Queue and its applications
4	Implementation of Link List and its applications
5	Implementation of Trees and its applications
6	Implementation of Graph and its applications
7	Implementation of Hashing functions and collision resolution techniques
8	Mini Project (Implementation using above Data Structure)

4.	**Books Recommended:**
1.	J. P. Trembley and P. G. Sorenson, An Introduction to Data Structures with Applications, 2nd Edition, Tata McGraw Hill Education, 1991.
2.	Y. Langsam, M. J. Augenstein and A. M. Tanenbaum, Data Structures using C and C++, 2nd Edition, Pearson Education India, 2007.
3.	E. Horowitz and S. Sahani, Fundamentals of Data Structures in C, 2nd Edition, Silicon Press, 2007.
4.	T. H. Cormen, C. E. Leiserson and R. L. Rivest, Introduction to Algorithms, 3rd Edition, MIT Press, 2009.

5.	R. L. Kruse, C. L. Tondo and B. Leung, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2001.

<table>
<tr><td rowspan="2">M.Sc. 2nd Year (Mathematics) Semester – III
ENGLISH AND PROFESSIONAL COMMUNICATION-II
HS201</td><td rowspan="2">Scheme</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>04</td></tr>
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1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	express themselves using appropriate vocabulary and grammar
CO2	draft scientific reports and formal proposals
CO3	comprehend scientific and general content more skilfully and meaningfully
CO4	predict human transactions and behavioural modes
CO5	communicate effectively through various means and at varied levels

2.	**Syllabus**	
	FUNCTIONAL ENGLISH GRAMMAR	**(08 Hours)**
	Language functions, Modals, Tenses, Active and Passive Voice, Conditional sentences, Concord errors.	
	TECHNICAL WRITING	**(08 Hours)**
	Formal and informal report- Information and recommendation reports, Progress and Periodic report, Feasibility and trip report, Proposal writing- types, logistics of proposals, the deliverables of proposals persuasion and proposal, the structure of the proposal.	
	LISTENING AND READING COMPREHENSION	**(10 Hours)**
	Listening and note taking, Paraphrasing, Reading using SQ3R, Predicting, Understanding Gist reading and listening general and scientific texts and developing vocabulary.	
	LANGUAGE THROUGH LITERATURE	**(09 Hours)**
	Short Stories: 1. The Remarkable Rocket by Oscar Wild. 2. An Astrologer's Day by R. K. Narayan. 3. The Case of the Lower-Case Letter by Jack Delany.	
	GROUP COMMUNICATION & ACADEMIC WRITING	**(10 Hours)**
	Transactional analysis; SOP; LOR; Research paper, Dissertation, Thesis; Types of group communication- Seminar, Conferences, Convention, Symposium, Panel discussion etc.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**

	(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)

3.	**Tutorials**
1	Language functions, Modals, Tenses, Active and Passive Voice
2	Conditional sentences, Concord errors.
3	Formal and informal report- Information and recommendation reports, Progress and Periodic report, Feasibility and trip report.
4	Feasibility and trip report, Proposal writing- types, logistics of proposals, the deliverables of proposals persuasion and proposal, the structure of the proposal.
5	Listening and note taking, Paraphrasing, Reading using SQ3R.
6	Predicting, Understanding Gist reading and listening general and scientific texts and developing vocabulary.
7	The Remarkable Rocket by Oscar Wild, An Astrologer's Day by R. K. Narayan, The Case of the Lower-Case Letter by Jack Delany.
8	SOP; LOR; Research paper, Dissertation, Thesis; Types of group communication- Seminar, Conferences, Convention, Symposium, Panel discussion etc.

4.	**Books Recommended:**
1	M. Markel, Practical Strategies for Technical Communication, 2nd Edition, Bedford/St. Martin's, 2016.
2	R. V. Lesikar and M. E. Flatley, Basic Business Communication Skills for Empowering the Internet Generation, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.
3	L. J. Gurak and J. M. Lannon, Strategies for Technical Communication in The Workplace, Pearson, 2013.
4	C. L. Bovee, J. V. Thill and M. Chaturvedi, Business Communication Today, 9th Edition, Pearson, 2009.
5	W. S. Pfeiffer and T. V. S. Padmaja, Technical Communication: A Practical Approach, 6th Edition, Pearson, 2013.

M.Sc. 2rd Year (Mathematics) Semester – IV **NUMERICAL ANALYSIS** **MA202**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	design an algorithm to solve a mathematical problem numerically
CO2	analyze an algorithm's accuracy, efficiency and convergence properties
CO3	develop a computer code for the designed algorithm
CO4	analyze classical techniques and recognize common pitfalls in numerical analysis
CO5	solve initial value problems using computational methods

2.	<u>**Syllabus**</u>	
	PRELIMINARIES OF COMPUTING	**(03 Hours)**
	Errors, Types of errors, Propagation of Error, Floating point arithmetic, Approximation using Taylor's series.	
	SOLUTION OF NONLINEAR EQUATIONS	**(08 Hours)**
	Bisection Method, Methods of false position, Newton's method, Modified Newton's method, Fixed point iterative method, Newton's and fixed point iterative method for system of nonlinear equations. Roots of polynomials, Error and convergence analysis of these methods.	
	SOLUTION OF SYSTEM OF LINEAR EQUATIONS	**(08 Hours)**
	Direct Methods: Gauss elimination with pivoting, LU decomposition method, Cholesky decomposition method, Error analysis for direct methods, Iterative methods: Jacobi, Gauss Seidel method, SOR method, Vector and matrix norm, Convergence of iterative methods, Eigenvalue problems: Jacobi's and Power method.	
	INTERPOLATION	**(12 Hours)**
	Finite difference operators, Divided difference operators, Relation between difference operators, Application of difference operators, Polynomial Interpolation, Existence and uniqueness of interpolating polynomials, Lagrange and Newton's interpolation, Newton's forward and backward difference formula, Error in interpolation.	
	DIFFERENTIATION AND INTEGRATION	**(07 Hours)**
	Numerical differentiation: Methods based on interpolation and finite differences, Error in approximation, Order of approximation, Numerical Integration: Quadrature formula, Newton Cotes Methods, Trapezoidal and Simpson's rules with error analysis. Gauss quadrature methods with error analysis.	

	INITIAL VALUE PROBLEMS (ODE)	**(07 Hours)**
	Picard's method, Taylor's series method, Euler and Runge-Kutta methods for initial value problems of order one and higher and system of first order ODEs with error analysis.	
	Practical will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)	

3.	**Tutorials**
1	Tutorial on nonlinear equations.
2	Tutorial on system of nonlinear equations.
3	Tutorial on system of linear equations using direct methods.
4	Tutorial on system of linear equations using indirect methods.
5	Tutorial on the eigenvalue of a matrix.
6	Tutorial on interpolating arbitrary spaced and equally spaced data.
7	Tutorial on approximate the derivative numerically.
8	Tutorial on integrate a function numerically.
9	To solve the initial value problems of order one and more and system of first order ODEs.

4.	**Books Recommended:**
1	K. E. Atkinson, An Introduction to Numerical Analysis, 2nd Edition, John Wiley & Sons, 2008.
2	R. L. Burden and J. D. Faires, Numerical Analysis, 9th Edition, Cengage Learning, 2011.
3	S. D. Konte and C. de-Boor, Elementary Numerical Analysis: An Algorithmic Approach, 3rd Edition, McGraw-Hill, 1981.
4	M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods: For Scientific and Engineering Computation, 6th Edition, New Age International Publishers, 2014.
5	J. H. Mathews and K. D. Fink, Numerical Methods using MATLAB, 4th Edition, Pearson India Education Services Pvt. Ltd., 2015.

M.Sc. 2rd Year (Mathematics) Semester – IV **Linear Algebra** **MA204**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Five Years Integrated M.Sc. Mathematics (2nd Year Scheme and Syllabus)

1.	**Course Outcomes (COs):**
CO1	evaluate the solution of system of linear equation through elimination and decomposition procedure
CO2	determine the basis and dimension of vector spaces and subspaces
CO3	discuss the matrix representation of a linear transformation given bases of the relevant vector spaces
CO4	adapt the knowledge of eigenvalues and eigenvectors for matrix diagonalization
CO5	interpret the applications of linear algebra and special matrices

2.	**Syllabus**	
	Matrices	**(05 Hours)**
	Properties of matrices, Non-singular Matrices, Reduced Row-Echelon form, Consistency and Solution of system of linear equations.	
	Vector Spaces	**(08 Hours)**
	Fields, Vector spaces over a field, Subspaces, Linear Independence and Dependence, Coordinates, Bases and Dimension.	
	LINEAR TRANSFORMATIONS	**(08 Hours)**
	Rank Nullity Theorem, Duality and transpose, Isomorphism, Matrix representation of linear transformation, Change of basis, Similar matrices, Linear functional and Dual Space.	
	INNER PRODUCT SPACES	**(08 Hours)**
	Cauchy-Schwarz's inequality, Gram-Schmidt orthonormalization, Orthonormal basis, Orthogonal projection, Projection theorem, Fundamental subspaces and their relations.	
	DIAGONALIZATION	**(08 Hours)**
	Eigenvalues and eigenvectors, Characteristic polynomials, Minimal polynomials, Cayley-Hamilton theorem, Diagonalizability, Invariant subspaces, Adjoint of an operator, Normal, Unitary and Self-Adjoint operators, Schur's lemma, Diagonalization of normal matrices, Triangularization, Rational canonical form, Jordon canonical fom.	
	SOME APPLICATIONS	**(08 Hours)**

	Lagrange interpolation, QR and SVD decompositions, Least square solutions, Least square fittings, Pseudo-inverses, Rayleigh quotients, Special matrices and their properties.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)	

3.	**Tutorials**
1	Tutorial on matrices and system of equations.
2	Tutorial on fields, subspaces, basis and dimension.
3	Tutorial on linear transformations, gram Schmidt orthonormalization and projection theorem.
4	Tutorial on eigen values, eigen vectors, characteristic polynomials and canonical form.
5	Tutorial on Lagrange interpolation, QR and SVD decomposition, pseudo inverses and special matrices.

4.	**Books Recommended:**
1	K. Hoffman and R. Kunze, Linear Algebra, PHI Publication, 2015.
2	G. Strang, Linear Algebra and its Applications, 4th edition, Cengage Learning, 2007.
3	S. Lang, Linear Algebra: Undergraduate Texts in Mathematics, Springer-Verlag, New York, 1989.
4	G. William, Linear Algebra with Applications, 6th Revised Edition, Jones and Bartlett Publishers Inc., 2007.
5	G. William, Linear Algebra with Applications, 6th Revised Edition, Jones and Bartlett Publishers Inc., 2007.

M.Sc. 2rd Year (Mathematics) Semester – IV **ELEMENTARY NUMBER THEORY** **MA232**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Mathematics
Five Years Integrated M.Sc. Mathematics (2nd Year Scheme and Syllabus)

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	explain congruence relations and number theoretic functions
CO2	demonstrate Fermat's theorem and its applications
CO3	solve Diophantine equations
CO4	elaborate primitive roots and quadratic reciprocity
CO5	adapt the knowledge of various techniques in cryptography

2.	**Syllabus**	
	INTRODUCTION	**(07 Hours)**
	Divisibility, Greatest Common Divisor (gcd), Euclidean Algorithm, Primes and their elementary properties, Fundamental theorem of Arithmetic.	
	CONGRUENCE RELATION	**(08 Hours)**
	Congruence and their Basic properties, Chinese Remainder Theorem, Euler's phi-function, Fermat's Little Theorem, Wilson's Theorem, Euler's theorem.	
	NUMBER THEORETIC FUNCTIONS	**(12 Hours)**
	Greatest integer function, Arithmetic functions, Mobius inversion formula, Fibonacci numbers, Representation of an integer as sum of two and four squares, Diophantine Equations: $ax + by = c$, $x^2 + y^2 = z^2$ and $x^4 + y^4 = z^4$.	
	PRIMITIVE ROOTS, INDICES AND RESIDUES	**(12 Hours)**
	Order of an integer modulo n, Primitive roots for primes, Theory of indices, Residue classes and Residued residue classes, Quadratic residues, Legendre symbol, Gauss's Lemma about Legendre symbol, Law of quadratic reciprocity, Jacobi symbol.	
	INTRODUCTION TO CRYPTOGRAPHY	**(06Hours)**
	Basic definitions of plaintext, ciphertext, cipher, enciphering (encrypting), deciphering (decrypting), The Caesar cipher, Monoalphabetic and Poly alphabetic ciphers, Nonalphabetic ciphers, Exponential cryptosystem, Applications of Euler's theorem in cryptography, Introduction to public-key cryptography and RSA cryptosystems.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**

	(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)

3.	**Tutorials**
1	Tutorial on divisibility, gcd, Euclidean Algorithm.
2	Tutorial on primes and their elementary properties, fundamental theorem of Arithmetic..
3	Tutorial on congruence relation
4	Tutorial on number theoretic functions.
5	Tutorial on diophantine equations.
6	Tutorial On Primitive roots, indices and residues.
7	Tutorial on The Caesar cipher, Monoalphabetic and Poly alphabetic ciphers, Nonalphabetic ciphers, Exponential cryptosystem.
8	Tutorial on exponential cryptosystem, applications of Euler's theorem in cryptography.
9	Tutorial on public-key cryptography and RSA cryptosystems.

4.	**Books Recommended:**
1	T. Apostol, Introduction to Analytic Number theory, Springer-Verlag, 1976.
2	A. Baker, A Concise Introduction to the Theory of Numbers, Cambridge University Press, 1990.
3	D. M. Burton, Elementary Number Theory, 6th Edition, McGraw Hill, 2007.
4	G. H. Hardy, and E. M. Wright, An Introduction to the Theory of Numbers, 6th Edition, Oxford University Press, 2008.
5	I. Niven, H. S. Zuckerman and L. Montgomery, An Introduction to the Theory of Numbers, 6th Edition, Wiley, New York, 2003.

M.Sc. 2^{rd} Year (Mathematics) Semester – IV Computational Life Science MA233	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	exhibit enhanced knowledge of evolution theory
CO2	assess biological inferences that depend on population genetics
CO3	demonstrate knowledge of biological systems and microbiology
CO4	utilize the concepts of network models in biology
CO5	apply biological mechanisms in technology

2.	**Syllabus**	
	THEORY OF EVOLUTION	**(08 Hours)**
	Evolution of life: Origin of Life, Structure and types of cell, Cell organelles, Biomolecules of cell, Evolutionary Invasion Analysis: Introduction to Game Theory, Concept of evolutionary stability, General technique for invasion analysis.	
	POPULATION GENETICS	**(07 Hours)**
	Stochastic models of genetics, Genetic structure and selection in subdivided populations, Kin selection and limited dispersal.	
	BIOLOGICAL SYSTEMS	**(08 Hours)**
	Body systems required to sustain human physiology, Special sense organs including hearing, taste, smell and visual receptors, Diffusion in biology: Constructing diffusion models, Diffusion as approximation of stochastic systems, Biological waves, Pattern formation and Turing bifurcations, Chemo-taxis.	
	MICROBIOLOGY	**(08 Hours)**
	Microbiology, Microbial taxonomy: principle and its types, Classical approach: numerical, chemical, serological and genetic, Diversity analysis Methods, Nutrition, Microbiological media and Microbial growth curve.	
	NETWORK MODELS IN BIOLOGY	**(07 Hours)**
	Networks in biology: Spread of disease in contact networks, Random graphs, moment closure techniques in complex graphs.	
	MOLECULAR BIOLOGY	**(07 Hours)**

	Molecular Sequences: Nucleotide and protein, Sequence comparisons: Dynamic programming, heuristic methods, Pattern and profile, Small molecules and Protein structures and geometry optimization.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)	

3.	**Tutorials**
1	Origin of Life, Structure and types of cell, Biomolecules of cell, Game Theory, Concept of evolutionary stability, General technique for invasion analysis
2	Stochastic models of genetics, Selection in subdivided populations, Kin selection and limited dispersal.
3	Special sense organs including hearing, Diffusion in biology, Biological waves, Pattern formation and Turing bifurcations
4	Principle and its types, Classical approach, Diversity analysis Methods, Nutrition, Microbiological media and Microbial growth curve
5	Spread of disease in contact networks, Random graphs, Techniques in complex graphs
6	Molecular Sequences: Nucleotide and protein, Sequence comparisons: Dynamic programming, heuristic methods
7	Pattern and profile, Small molecules and Protein structures and geometry optimization.

4.	**Books Recommended:**
1	A. R. Leach, Molecular Modelling: Principles and Applications, Addison-Wesley Pub. Co., 1997.
2	J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 8th Edition, W. H. Freeman & Co., 2015.
3	N. Hopkins, J. W. Roberts, J. A. Steitz, J. Watson and A. M. Weiner, Molecular Biology of the Gene, 7th Edition, Benjamin Cummings, 1987.
4	C. R. Cantor and P. R. Schimmel, Biophysical Chemistry (Parts I, II and III), W.H. Freeman & Co., 1980.
5	C. C. Chatterjee, Human Physiology, 13th revised Edition, Vol 1 & 2, CBS Publisher, 2020.

5.	**Additional Reference Book:**

1.	B. K. Hall, Evolution, Principles and Processes, Jones & Bartlett, 2011.
2.	O. A. Hougen, K. M. Watson and R. A. Ragatz, Chemical Process Principles Part-I: Material and Energy Balances, CBS Publishers New Delhi, 2nd Edition, 2004.
3.	D. Baxevanis, and B. F. F. Ouellette, Bioinformatics – A Practical Guide to the Analysis of Genes and Proteins, 2nd Edition, John Wiley and Sons Inc., 2001.
4.	B. Bernd, K. Juergen, S. Lewi, Complex Population Dynamics: Nonlinear Modeling in Ecology, Epidemiology And Genetics, World Scientific Publishing Co. Pvt. Ltd., 2007.

M.Sc. 2rd Year (Mathematics) Semester – IV **Computer Network** **CS208**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):**
CO1	understand computer network models and services offered at different layers of network protocol stack.
CO2	apply knowledge of data communication, data transmission techniques using various transmission media to deliver error free data and communicate with multiple nodes.
CO3	analyse various routing methods to identify effective routing protocols.
CO4	evaluate network performance by means of transport and flow control protocols, Congestion Control protocols and Quality of services.
CO5	create a computer network application using modern network tools and simulation software.

2.	**<u>Syllabus</u>**	
	Introduction	**(07 Hours)**
	Overview of computer networks and data communication, Computer networking protocols and standards, Types of computer networks, Network topology, Protocol hierarchies and design issues, Interfaces and services, Networking devices, OSI and TCP/IP reference models.	
	PHYSICAL LAYER	**(07 Hours)**
	Physical layer design issues, Data transmission techniques, Multiplexing, Transmission media, Asynchronous communication, Wireless transmission, ISDN, ATM, Cellular radio, Switching techniques and issues.	
	MEDIUM ACCESS CONTROL LAYER	**(08 Hours)**
	MAC layer design issues, Channel allocation methods, Multiple access protocols ALOHA, CSMA, CSMA/CD protocols, Collision free protocols, Limited contention Protocols, LAN Architectures, IEEE -802 standards, Ethernet(CSMA/CD), Token bus, Token ring, DQDB, FDDI, Bridges and recent developments.	
	NETWORK LAYER	**(07 Hours)**
	Network layer design issues, Routing algorithms and protocols, Congestion control algorithms and QoS, Internetworking, Addressing, N/W layer protocols and recent developments.	
	TRANSPORT LAYER	**(08 Hours)**

	Transport layer design issues, Transport services, Sockets, Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, Transport layer protocols, Real Time Transport Protocol (RTP), Stream Control Transmission Protocol (SCTP), Congestion control, QoS and Recent developments, Virtualization, Network Functions Virtualization(NFV), Software defined networks.	
	APPLICATION LAYER	**(08 Hours)**
	Client server model, Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP) and recent developments	
	Tutorials will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30Hours= 75 Hours)	

3.	**Tutorial**
1	Problem solving on basics of data communication and networking.
2	Problem solving on framing, error control and flow control of Data link layer.
3	Problem solving on various LAN standards.
4	Problem solving on logical address, sub net masking and routing protocols of Network Layer.
5	Problem solving on congestion control, flow control and error control of transport layer.
6	Problem solving on various services provided by application layer.

4.	**Practical**
1	Study network configuration commands and computer network setup.
2	Implementation of different Data Link and MAC Layer protocols.
3	Implementation of different Network Layer protocols.
4	Implementation of different Transport and Application Layer protocols.
5	Design and configure a network systems using modern network simulator softwares.

6	Implementation of Secured Socket Layer protocol.
7	Implementation of ICMP based message transmission over network.
8	Implementation of SMTP protocol for mail transfer.

4.	**Books Recommended:**
1	W. Stalling, Data and Computer Communication, 10*th* Edition, Pearson India, 2017.
2	B. Forouzan, Data Communication and Networking, 5*th* Edition, McGraw Hill, 2017.
3	D. E. Comer, Internet working with TCP/IP Volume – I, 6*th* Edition, Pearson India, 2015.
4	A. S. Tanenbaum, Computer Network, 5*th* Edition, Pearson India, 2013.
5	W. R. Stevens, TCP/IP Illustrated Volume - I, 2*nd* Edition, Addison Wesley, 2011.

M.Sc. 2rd Year (Mathematics) Semester – IV **Mathematical Software -II** **MAV04/MAP04**	**Scheme**	**L**	**T**	**P**	**Credit**
		0	**0**	**10**	**05**

1.	**Course Outcomes (COs):**
CO1	understand the various commands of Mathematica, R, and Maple
CO2	analyze data and generate reports based on the data.
CO3	adapt Mathematica, R, and Maple for scientific and engineering computational problems.
CO4	explain the use of data structure and loop functions.
CO5	analyze the effectiveness and uses of Mathematica, R, and Maple.

2.	**Syllabus**	
	Mathematics	**(65 Hours)**
	Starting Mathematica, Input and Output, Brackets and Braces, Exact and Approximate numbers and Built-in Constants, Loading in Additional Packages; Built-In Functions, Defining Functions and Equalities; Logical Operations; Lists, Generating Lists, Functions Involving Lists, Displaying Tables and Matrices, Plugging Into Expressions; Loops (Do, For, Until, While, Table, Nested Loops), Controls (Break, Continue, Return, Interrupt, Abort) etc.; Finding roots of the equations; Limits, Derivatives, Integrals, Series, Differential Equations; Matrix related command and functions; 2D and 3D Plots: Basic plots, plot options. Parametric plots.	
	Maple	**(65 Hours)**
	Maple input and output, the maple library, reading and writing files, Importing and exporting numerical data, defining functions, Loops and Conditionals; Symbolic Differentiation, Automatic Differentiation, Definite and Indefinite Integration, Numerical Integration; Sequence, Set, Array, Table, Last Name Evaluation, Function Call, Conversions between Composite Data Types; Generation of Matrices, Basic Operations on Matrices; Automatic Simplification, expand, combine, simplify, convert, Triconometric Simplification; 2D and 3D plots.	
	Introduction to R	**(70 Hours)**
	Installing R and R Studio, Installing basic packages; Variables in R, Scalars, Vectors, Arrays, Matrices, List, Data frames Using c, Cbind, Rbind, attach and detach functions in R Factors; While loop, If loop, For loop, if...else statement, break statement; Formal and Actual arguments, Named arguments, Global and local variables, Recursive functions; Creating matrices, Accessing elements of a Matrix, Operations on Matrices, Matrix transpose; Box plots, Histograms, Pareto charts, Pie	

	charts/ 3D, Line charts, scatterplots, Developing graphs (e.g., Graphs of the Probability density function and Distribution function).

4.	**Books Recommended:**
1	Stephen Wolfram, Mathematica Reference Guide, Addison Wesley, 1992.
2	Andre Heck, Introduction to Maple, Springer New York, 2012.
3	Andre Heck, Introduction to Maple, Springer New York, 2012.
4	Bruce W. Char, Keith O. Geddes, Gaston H. Gonnet, Benton L. Leong, Michael B. Monagan, Stephen M. Watt, First Leaves: A Tutorial Introduction to Maple V, Springer New York, 2012.
5	Norman Matloff, The Art of R Programming: A Tour of Statistical Software, No Starch Press, 2011.

Department of Humanities and Social Sciences

ENGLISH & PROFESSIONAL COMMUNICATION- II

M.Sc. II Maths Semester III **HS201: English and Professional Communication -II**	Scheme	L	T	P	Credit
		3	0	0	03

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	express themselves using appropriate vocabulary and grammar
CO2	draft scientific reports and formal proposals
CO3	comprehend scientific and general content more skilfully and meaningfully
CO4	predict human transactions and behavioural modes
CO5	communicate effectively through various means and at varied levels

2.	Syllabus	
	FUNCTIONAL ENGLISH GRAMMAR	**(8 Hours)**
	Language functions, Modals, Tenses, Active and Passive Voice, Conditional Sentences, Concord errors.	
	TECHNICAL WRITING	**(10 Hours)**
	Formal and informal report- Information and recommendation reports, Progress and Periodic Report, Feasibility and trip report. Proposal Writing- Types, logistics of proposals, the deliverables of proposals persuasion and proposal, the structure of the proposal. Writing collaboratively; Introduction to Intellectual property rights (IPR) Writing for internship.	
	LANGUAGE THROUGH LITERATURE	**10 Hours)**
	Short Stories: 1. The Remarkable Rocket by Oscar Wilde 2. An Astrologer's Day by R. K. Narayan 3. The Case of the Lower Case Letter by Jack Delany	
	LISTENING AND READING COMPREHENSION	**(7 Hours)**
	Listening and Note Taking, Paraphrasing, Reading using SQ3R, Predicting, Understanding Gist Reading and Listening General and Scientific Texts and Developing Vocabulary	
	GROUP COMMUNICATION AND ACADEMIC WRITING	**(10 Hours)**
	Transactional Analysis; SOP; LOR; Research Paper, Dissertation, Thesis; Types of Group Communication- Seminar, Conferences, Convention, Symposium, Panel	

	Discussion etc.
	(Total Contact Time: 45 Hours Lecture)

3.	**REFERENCE BOOKS**
1	**Sanjay Kumar and Pushp Lata.** *Communication Skills*, 2nd Edition, OUP, New Delhi, 2015.
2	**Meenakshi Raman and Sangeeta Sharma.** *Technical Communication Principles and Practice*, 3rd Edition, OUP, New Delhi, 2015.
3	**Raymond V. Lesikar and Marie E Flatley.** *Basic Business Communication skills for Empowering the Internet generation.* Tata McGraw Hill publishing company limited. New Delhi 2005.
4	**Courtland L. Bovee, John V. Thill, and Mukesh Chaturvedi.** *Business Communication Today*. Ninth Edition. Pearson, 2009.
5	**Mike Markel.** *Practical Strategies for Technical Communication*, Bedford/ St. Martin's Second Edition, 2016
6	**Laura J. Gurak and John M. Lannon.** *Strategies for Technical Communication in the Workplace*, Pearson, 2013.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

ANNEXURE I

Second Year of Five Years of Integrated M.Sc. (Physics)

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	Third Semester (2nd year of MSc)				
1	Solid State Physics	PH201	3-0-2	4	85
2	Classical Mechanics *	PH203	3-1-0	4	70
3	Optics	PH205	3-0-2	4	85
4	State and Properties of Matter	CY205	3-1-2	5	100
5	Discrete Mathematical Structure	MA205	3-1-0	4	70
			Total	**21**	**410**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	PHV03 / PHP03	0-0-10	5	200 (20 x 10)
	Fourth Semester (2nd year of MSc)				
1	Mathematical Methods in Physics	PH202	3-1-0	4	70
2	Quantum Mechanics-I *	PH204	3-1-0	4	70
3	Electromagnetic Theory-II	PH206	3-0-2	4	85
4	Laser and Photonics	PH208	3-1-0	4	70
5	Data Structure	CS102	3-1-2	5	100
			Total	**21**	**395**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	PHV04 / PHP04	0-0-10	5	200 (20 x 10)

*Pending approval of Senate on swapping with 'Quantum Mechanics-I (PH203) and Classical Mechanics (PH204)' (Ref. Res. 3 of 47th DAAC of DoP dtd. 15.01.24 [DoP/1276 dtd. 22.01.24])

COURSE OFFERRED TO OTHER DEPARTMENT

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	Third Semester (2nd year of MSc)				
1	Optics (*for Department of Chemistry students*)	PH205	3-0-2	4	85

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Second Year of Five Years of Integrated M.Sc. (Physics) M.Sc. - II, Semester - III SOLID STATE PHYSICS PH201	Scheme	L	T	P	Credit
		3	0	2	4

1.	Course Outcomes (COs): At the end of the semester students will be able to
CO1	Explain the basics of crystallography and identify the crystal structures
CO2	Demonstrate the concept of free electron theory of solids
CO3	Interpret the lattice vibrations and thermal properties of solids
CO4	Extend concept of energy band theory by various methods and apply to explain optical properties
CO5	Examine the properties of superconductors and interpret the concept of liquid crystals

2.	Syllabus	
	CRYSTALLOGRAPHY	**09 Hours**
	Symmetry elements in crystals, Single crystals and usage, Defects in crystals, Techniques of growing and studying different crystals, Determination of crystal structures by X-ray diffraction, Formulations of Bragg & Von Laue equations and their equivalence, Laue condition and Ewald's construction, Rotating crystal method, Laue method, Powder crystal methods, Geometrical structure factor, Atomic form factors.	
	FREE ELECTRON THEORY	**06 Hours**
	Drude theory of metals, Sommerfeld theory of metals, Sommerfeld theory of conduction, Failure of the free electron model.	
	LATTICE VIBRATION AND THERMAL PROPERTIES	**08 Hours**
	Vibrations of monoatomic lattice, Normal mode frequencies, Dispersion relation, Quantization of lattice vibrations, Phonon momentum, Inelastic scattering of neutrons by phonons, Surface vibrations, Inelastic neutron scattering. Anharmonic crystal interaction. Thermal conductivity, Lattice thermal resistivity.	
	ENERGY BAND THEORY	**12 Hours**
	Band theory of solids, Periodic potentials and Schrödinger equation, Bloch theorem, Kronig-Penney model, Origin of band gap, Distinction between conductors, Insulators and semiconductors, Electrical resistance of materials, Equation of motion of an electron, Resistivity and conductivity, Brillouin zones, electron motion in one dimension, Effective mass, Concept of a hole, Mobility and temperature dependence, Cyclotron resonance and Hall effect, Tight binding method, Band structure of real semiconductors, High electric field and hot electrons, Optical properties: absorption processes, Photoconductivity, Luminescence.	
	SUPERCONDUCTIVITY AND SUPERFLUIDITY	**10 Hours**

	Superconductivity: type-I and type-II superconductors, Josephson junctions, Superfluidity, Defects and dislocations, Ordered phases of matter: translational and orientational order, Kinds of liquid crystalline order, Quasi crystals.	
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**PRACTICALS**
1	To measure Hall coefficient of Germanium and calculation of charge carrier.
2	To study of the dispersion relation for the mono-atomic lattice. Determination of the cut-off frequency of the mono-atomic lattice.
3	To determine the resistivity and energy band gap of a given material (Ge,Si) using four probe method.
4	To measure the Lande’ g-factor in a free radical using an electron spin resonance spectrometer.
5	To study Crystal Growth by Solution method (KDP).
6	Ultrasonic Interferometer for the measurement of ultrasonic velocity in liquids.
7	Heat Capacity Kit for the measurement of heat capacity of solids.
8	To determine the Temperature Coefficient of a material.
9	To Study Thermoelectric Effect and to measure Seebeck and Peltier Coefficient.
10	To find the resistivity of material using two probe method.

4.	**Books Recommended**
1	Kittle C., Introduction to Solid State Physics, John Willey, 1976.
2	Sastry S. S., Introductory Methods of Numerical Analysis, 2nd Edition, PHI, 2012M. A. Omar, Elementary Solid State physics, Addison-Wesley Pvt. Ltd, New Delhi, 2000.
3	Dekker A. J., Solid State Physics, Macmillan India Ltd, 2000
4	Ashcroft N. W. and Mermin N.D., Solid State Physics, Holt-Saunders International Editing 1981.
5	Harrison W. A., Solid State Theory, Tata McGraw Hill Education, 1970.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Second Year of Five Years of Integrated M.Sc. (Physics) M.Sc. - II, Semester - III Classical Mechanics PH203*	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**4**

*Pending approval of Senate on swapping with 'Quantum Mechanics I (PH203)' (Ref. Res. 3 of 47th DAAC of DoP dtd. 15.01.24 [DoP/1276 dtd. 22.01.24])

1.	**Course Outcomes:** **At the end of the semester, students will be able to**
CO1	Relate the terminology and concepts of Newtonian Mechanics, Lagrangian and Hamiltonian approach, Central force, and small oscillations.
CO2	Explain various mechanisms, models, derivations, and approaches associated with classical mechanics.
CO3	Solve numerical problems for various situations in classical mechanics.
CO4	Analyze the results obtained for various physical problems of classical mechanics.

2.	**Syllabus:**	
	LAGRANGIAN DYNAMICS	**(12 Hours)**
	Constraints: Holonomic and nonholonomic, Scleronomic and rheonomic systems, Degrees of Freedom, Generalized Coordinates and Velocity, Generalized Force, Kinetic Energy, Principle of virtual work, D'Alembert's principle, Lagrange's equation of motion of first kind, Method of Lagrange multiplier, Lagrange's equation of motion of second kind, Energy equation for conservative fields, Cyclic coordinates, Generalized potential, Euler equation with more than one independent variable and also for non-holonomic constraints.	
	HAMILTONIAN DYNAMICS	**(05 Hours)**
	Generalized momentum and conservation theorems, Hamilton's equations, Conservation of energy.	
	VARIATIONAL PRINCIPLE	**(05 Hours)**
	Calculus of variation, deduction of Euler-Lagrange's equations, Hamilton's principle, Δ-variation, principle of least action, Hamilton-Jacobi equation.	
	TWO-BODY CENTRAL FORCE PROBLEM	**(07 Hours)**
	Equivalent one body problem and effective potential, Classification of orbits, Differential equation for orbits, Virial theorem, Kepler's laws and planetary motion, Stability of orbit, Scattering cross section, Rutherford scattering, Hyperbolic orbits.	
	CANONICAL TRANSFORMATION AND BRACKETS	**(09 Hours)**
	Canonical and Legendre transformations, Point transformations, Generating functions, Infinite contact transformations, Poisson's brackets, Angular momentum, Invariance with respect to canonical transformation, Phase space, Liouville's theorem.	
	SMALL OSCILLATIONS AND NORMAL MODES	**(07 Hours)**
	Potential energy in equilibrium, Stable, Unstable and neutral equilibrium, Coupled oscillators, Normal coordinates and normal modes, Secular equation.	

	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials:**
1.	Problems based on Lagrangian formulation.
2.	Problems based on Euler-Lagrange equations.
3.	Problems based on Lagrange multiplier.
4.	Problems based on Hamilton's equation in different coordinate systems.
5.	Problems based on Two-body central force and scattering cross-section.
6.	Problems based on variational principle.
7.	Problems based on Hamilton's principle.
8.	Problems based on transformations and generating functions.
9.	Problems based on Poisson's bracket.
10.	Problems based on normal mode frequencies.

4.	**BOOKS RECOMMENDED:**
1.	Goldstein H., Classical Mechanics, Narosa, 2018.
2.	Goldstein H., Poole C. P., and Safko J., Classical Mechanics, Third edition, Pearson, 2000.
3.	Landau L. D. & Lifshitz E M, Course on Theoretical Physics, Vol. 1: Mechanics, Addison- Wesley, 2002.
4.	Raychaudhuri A. K., Classical Mechanics, Oxford, 1983.
5.	Abraham R., Marsden J. E., Foundations of Mechanics, 1st Edition, CRC Press, 1994.
6.	Morin D., Introduction to Classical Mechanics with Problems and Solutions, Cambridge University Press, 2009.
7.	Thornton Stephen T. and Marion Jerry B., Classical Dynamics of Particle and Systems, Cengage Publications, 2012.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Second Year of Five Years of Integrated M.Sc. (Physics) M.Sc. - II, Semester - III OPTICS PH 205	Scheme	L	T	P	Credit
		3	0	2	4

1.	Course Outcomes (COs): At the end of this course, students should be able to
CO1	Relate the key theoretical concepts of optics and optical technology, including the propagation of light, various optical phenomenon such as interference, diffraction, polarization and optical instrumentation.
CO2	Explain various underlying principles associated with optics and observe key optical phenomena experimentally.
CO3	Solve problems for various situation in optics by applying the simple optical systems on the basis of lenses, reflectors, prisms, spectrometer, *etc*.
CO4	Analyze the results obtained for various problems of optics and design systems/applications by utilizing the concepts studied.

2.	Syllabus	
	GEOMETRIC OPTICS	**06 Hours**
	Image formation, Magnification, Prisms, mirrors, Thin lenses, Eyepiece, Fiber waveguides, Blindspot, Cactus guides, Telescopes, Microscopes, Cameras, Aberrations: chromatic, spherical and coma.	
	LIGHT PROPAGATION	**05 Hours**
	Reflection, Refraction, Transmission and polarization, Total internal reflection and reflection from metals.	
	COHERENCE AND INTERFERENCE	**12 Hours**
	Coherence time, Coherence length, Fresnel's Biprism, Interference with multiple beams, Thin films, Anti-reflecting coatings, Newton's rings, Michelson interferometer, Fabry-Perot, Technological applications of interference.	
	DIFFRACTION AND HOLOGRAPHY	**11 Hours**
	Fraunhofer & Fresnel zones, Zone plates, Diffraction through single slit, double slit and grating, Resolving power, 2-D Fourier transforms (various apertures, including variable), Holography, Optical image processing, Focusing with a zone plate, Babinet's Principle.	
	POLARIZATION AND ITS APPLICATIONS	**11 Hours**
	Fresnel equations, Birefringence, Calcite double refraction, Circular birefringence, Principles of use of uniaxial crystals in practical polarizers, Compensators and wave plates, Production and analysis of completely polarized light, Optical activity, Polarimeters, Faraday rotation, Applications to DNA analysis, Photonic devices, Displays, Quantum cryptography.	
	Practical will be based on the coverage of the above topics separately	**(45 Hours)**

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3.	**Practicals**
1.	To study the variation of refractive index with the wavelength and hence to determine the dispersive power of the material of a given prism.
2.	To determine the wavelength of Sodium light by using bi-prism.
3.	To determine the wavelength of sodium light by Newton's Ring method.
4.	Michelson's interferometer with laser light.
5.	Magnetostriction in a metallic rod using Michelson interferometry.
6.	Fabry-Perot interferometer with sodium light source.
7.	To measure the wavelength of spectral lines of mercury source using diffraction grating and spectrometer.
8.	Diode Laser Diffraction Experiment (single slit, double slit, multiple slits, fine wire, cross wire, wire mesh, transmission grating, coarse grating, circular aperture).
9.	Verify the lass of Malus. Also, determine the specific rotation of the cane sugar solution using a Polarimeter.
10.	To study the Interference, Diffraction, and Polarization of Microwave.

4.	**Books Recommended**
1	Pedrotti, F. L., Pedrotti L.M. and Pedrotti L. S., Introduction to Optics. 3rd Edition), San Fransisco: Benjamin Cummings, 2006.
2	Hecht E., *Optics*, Pearson Education, 2019.
3	Jenkins F. A. and White H. E., *Fundamentals of optics*, Tata McGraw Hill, 2017.
4	Griffiths D. J., Introduction to Electrodynamics, 3rd Ed. Prentice – Hall of India Private Limited, 1999.
5	Ghatak A. K., Optics, McGraw Hill, 7th edition, 2020.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Second Year of Five Years of Integrated M.Sc. (Physics) **M.Sc. - II, Semester - III** **STATES AND PROPERTIES OF MATTER** **CY 205**	**Scheme**	**L**	**T**	**P**	**Credit**
		03	**0**	**02**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Memorize the basic theoretical knowledge of solids and liquids applicable in multidisciplinary fields.
CO2	Learn concepts of solutions and apply thermodynamic treatment in liquids.
CO3	Acquire fundamental knowledge of colloidal state.
CO4	Classify states of matter based on physical properties.
CO5	Perform the experiments related to physical chemistry approach which includes solution preparation and titration.

2.	**Syllabus**	
	SOLID STATE	**(08 Hours)**
	Unit cell, Bravais lattice and its types, Miller indices, X-ray diffraction, Bragg's law and its derivation, Calculation of basis per unit crystal, volume, density per unit cell, Diffraction techniques (Qualitative treatment only): single crystal and powder, Structure elucidation of ZnS (Wurtzite and blende), Specific heat of solids (Dulong Petit law, Einstein's theory, Debye correction qualitatively), Band theory, Superconductivity, Point defects (Schottky and Frenkel).	
	LIQUID STATE	**(10 Hours)**
	General features of liquid state (short and long range order/disorder, hole theory), intermolecular forces, Vapor pressure, Young and Laplace equation, effect of temperature on vapour pressure, determination of vapour pressure - static and dynamic methods, effect of vapour pressure on boiling points, Surface tension, Surface energy, excess pressure, capillary action, Contact angle, spreading of liquids, temperature dependence of surface tension, measurement of surface tension, viscosity of liquids, temperature dependence of viscosity of liquids, Poiseuille's equation and measurement of viscosity.	
	COLLOIDAL CHEMISTRY	**(09 Hours)**
	Colloids: Definition, general properties of colloids (optical and electrical), Types of colloidal system (Foam, aerosol, emulsion, smoke), Classifications of colloids (lyophilic and lyophobic), preparation and purification of colloids, properties of colloids (optical, and kinetics). Associated colloids, emulsions, gels, applications of colloids.	
	SOLUTIONS	**(09 Hours)**
	Types of solutions, ideal and non-ideal solutions, Raoult's law, applications of Raoult's law, thermodynamic properties of ideal solutions, vapor pressure and thermodynamics of non-ideal systems, general considerations (excess functions), solvents and solutes of non-ideal solutions, mixing quantities (ΔH_{mix}, ΔV_{mix}, ΔG_{mix}, ΔS_{mix}), molecular interpretation of the entropy of mixing, determination of mixing quantities.	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	THERMODYNAMICS OF LIQUIDS	**(09 Hours)**
	Activity and activity coefficients, fugacity, calculation of fugacity at low pressures, partial and apparent molar properties (chemical potential, enthalpy and volume), physical significance of partial molar quantities, relation between partial molar quantities, chemical potential, Gibbs-Duhem equation, applications of Gibbs-Duhem equation methods for their determination of partial molar quantities (slope – intercept method).	
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practical**
1	Preparation of Solution, Calibration and Standard Deviation.
2	To determine the partition coefficient of I_2 between CCl_4 and water.
3	To determine the surface tension of a given solution by drop weight/count (stalagmometer) method.
4	To determine the rate constant of decomposition of H_2O_2 by acidified KI solution.
5	To prepare colloidal solution of (i) gelatin (ii) Sulphur (iii) Ferric hydroxide (iv) Molybdenum blue sol
6	To study the coagulation of the hydrophobic solution with monovalent, bivalent and trivalent counter ions and find out their coagulation value.
7	To determine the heat of neutralisation of weak acid (say acetic acid) and calculate its heat of ionisation.
8	Determine the solubility of benzoic acid and heat of dissolution.
9	Demonstration: To determine the viscosity coefficient of a given solution by Ostwald Viscometer.
10	Determine the heat of solution of two ionic compounds: NH_4Cl and $CaCl_2$.

4.	**Books Recommended**
1	B. R. Puri, L. R. Sharma, M.S. Pathania, Principles of Physical Chemistry, 47th edition, Vishal Publications, New Delhi, 2017.
2	G. Raj, Advanced Physical Chemistry, 4th edition, Goel Publishing House, Meerut, 1990.
3	A. R. West, Solid State Chemistry and its Applications, 2nd edition, student edition, John Wiley & Sons, New York, 2014.
4	P. Atkins, J. de Paula, J. Keeler Atkins' Physical Chemistry, 11th edition.
5	K. J. Laidler, Chemical Kinetics, 3rd edition, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Second Year of Five Years of Integrated M.Sc. (Physics) M.Sc. - II, Semester - III DISCRETE MATHEMATICAL STRUCTURE MA205	Scheme	L	T	P	Credit
		3	1	0	4

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	apply knowledge of Mathematical Logic in programming
CO2	analyze the problems for developing the solution, its correctness and performance using graphs
CO3	analyze the real-world problems using group theory, relations, lattices and Boolean algebra
CO4	develop an algorithm using Asymptotic analysis
CO5	design solutions for various types of problems in different disciplines like information security, optimization, mathematical analysis

2.	**Syllabus**	
	MATHEMATICAL LOGIC AND PROGRAM VERIFICATION	**(10 Hours)**
	Propositions, logical operators and propositional algebra, Predicates and quantifiers, Interaction of quantifiers with logical operators, Logical interference & proof techniques, Formal verification of computer programs (elements of Hoare logic).	
	GRAPH THEORY	**(10 Hours)**
	Graphs, Definition and basic concepts of finite and infinite graph, Incidence and Degree, Isomorphism, Subgraph, Walk, Path & Circuits, Operations on graphs, Connected Graph, disconnected graph and Components, Complete graph, Regular graph, Bipartite graph, Euler's graph, Hamiltonian paths and Circuits, Weighted graphs, Applications, Directed & Undirected graphs, Connectivity of graphs.	
	TREES	**(06 Hours)**
	Definition & properties of trees, Pendent vertices in a tree, Distance between two vertices, Centre, Radius and diameter of a tree, Rooted and binary trees, Representation of Algebraic structure by Binary trees, Binary search trees, Spanning trees and fundamental circuits.	
	LATTICES	**(06 Hours)**
	Definition and properties of lattice, Sublattice, Distributive and modular lattices, Complemented and bounded lattices, Complete lattices.	

	BOOLEAN ALGEBRA	**(06 Hours)**
	Introduction, Definition, Properties of Boolean algebra, Boolean variables, Boolean expression, Boolean function, Min term, Max term, Canonical forms, Switching network from Boolean expression, Karnaugh map method.	
	ASYMPTOTIC ANALYSIS	**(07 Hours)**
	Complexity analysis, Time and storage analysis, Big-oh, Big-Omega, Big–Theta notation, Illustration and application to real problems.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**

(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)

3.	**Tutorials**
1	Tutorial on Mathematical Logic and Verification
2	Tutorial on Graph Theory
3	Tutorial on Trees
4	Tutorial on Lattices
5	Tutorial on Boolean Algebra
6	Tutorial on Asymptotic Analysis

4.	**Books Recommended:**
1	K. H. Rosen, Discrete Mathematics and its Applications, 6th Edition, McGraw-Hill, 2006.
2	B. Kolman, R. C. Busby, and S. Ross, Discrete Mathematical Structure, 5th Edition, Prentice Hall Inc., 2003.
3	J. P. Tremblay and R. Manohar, Discrete Mathematical Structure with Applications to Computer Science, McGraw Hill Book Co., 1999.
4	N. Deo, Graph Theory with Applications to Engineering & Computer Science, Prentice Hall of India Pvt. Ltd., 2000.
5	D. F. Stanat and D. F. McAllister, Discrete Mathematics in Computer Science, Prentice-Hall, Englewood Cliffs, New Jersey, 1977.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Second Year of Five Years of Integrated M.Sc. (Physics) M.Sc.-II, Semester-IV Mathematical Methods in Physics PH202	Scheme	L	T	P	Credit
		3	1	0	4

1.	Course Outcomes: At the end of the semester students will be able to
CO1	Define groups, rings, vector spaces, similar matrices, row space, column space, null space, linear functional and dual space.
CO2	Show that the eigenvalues for a Hermitian matrix is always real, Legendre polynomials forms a complete basis set.
CO3	Extend the concept of vectors to tensors and classify the tensors according to their rank, dimension and transformation law.
CO4	Explain the Frobenius method for solving the second order ordinary differential equations.
CO5	Solve the second order ODE including Bessel, Hermite, Legendre, hypergeometric and confluent hypergeometric equations.
CO6	Apply the tensors and metric connections in the problems related to special theory of relativity, general theory of relativity and curved spaces.

2.	Syllabus:	
	VECTOR SPACES & LINEAR TRANSFORMATION	(12 Hours)
	Binary operations and relations, Introduction to Groups, Rings, Fields, Subspaces, Vector Spaces and Subspaces, Basis and dimension, Linear independence of vectors, Coordinates, Homomorphism and Isomorphism of Vector Spaces, Change of basis Linear transformation, Algebra of linear transformations, Non-singular transformations, Representation of linear transformations by matrices, Row space, Column space, Null space, Rank-nullity theorem, Duality and transpose, Linear functional and dual space	
	EIGEN VALUES & EIGEN VECTORS	(11 Hours)
	Eigen values and Eigen vectors of a matrix, Properties of Eigen-values and Eigen vectors of orthogonal, Hermitian and unitary matrices, Echelon form and rank of matrix, Minimal & characteristic polynomials, Similar matrices, Diagonalization and function of matrices, Cayley-Hamilton theorem and inverse of a matrix.	
	TENSOR ANALYSIS	(08 Hours)
	Vectors and indices: Transformation properties of vectors, Covariant and contravariant vectors; From vectors to tensors: Algebraic properties of tensors, Metric tensor: Index raising and lowering, Index contraction, Differentiation of tensors: Covariant derivative, Christoffel symbol and metric connection, Vector identities using tensors.	
	FROBENIUS METHOD & SPECIAL FUNCTIONS	(14 Hours)
	Series solution to ordinary differential equations (ODE), Singular points and their classification, Frobenius method for second order ODE, Solution to Bessel, Hermite, Legendre, Hypergeometric	

	and confluent hypergeometric differential equations. Generating function and recurrence relations for Legendre polynomials, Associated Legendre functions, Spherical harmonics, Legendre functions of the second kind, Vector spherical harmonics, Bessel function of the first kind, Neumann functions, Modified Bessel's functions, Asymptotic form of Bessel and Neumann functions, Spherical Bessel's function.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials:**
1.	Problems based on the concepts of groups, fields, rings and subspace.
2.	Problems to the understand difference between the basis, dimension, and coordinates.
3.	Some quantum mechanical and classical mechanical problems based on linear transformation and matrix algebra.
4.	Proof of rank-nullity theorem, problem based on the properties of eigen values of Hermitian matrix.
5.	Problems based on minimal polynomial, characteristic polynomial, and diagonalization of a matrix.
6.	Problems based on the Cayley-Hamilton theorem and its application to find the inverse of matrix.
7.	Problem based on the transformation law and algebraic properties of covariant and contravariant tensor.
8.	Problems based on metric tensor and metric connection of curved spaces.
9.	Problems based on the concept of singularity and classification of singularities in ordinary differential equation.
10.	Problems based on Bessel function, Legendre function, and spherical harmonics, and recurrence relations.

4.	**Books Recommended**
1.	Starkovich S. P., The structures of mathematical physics: An introduction, Springer, 2022
2.	Schobeiri M. T., Tensor analysis for engineers and physicists - with application to continuum mechanics, turbulence, and Einstein's special and general theory of relativity, Springer, 2021
3.	Balakrishnan V., Mathematical physics: Applications and problems, Springer, 2020
4.	Limaye B.V., Functional analysis, New Age International Publishers, 2014
5.	Grinfeld P., Introduction to tensor analysis and the calculus of moving surfaces, New York: Springer, 2013.
6.	Riley K. F., Hobson M. P., and Bence S. J., Mathematical methods for physics and engineering: a comprehensive guide. Cambridge university press, 2006.
7.	Hoffman K. and Kunze R., Linear algebra, PHI, 1991.
8.	Kreyszig E., Introductory functional analysis with applications, John-Wiley & Sons, 1989.
9.	Lang S., Introduction to linear algebra (Undergraduate text in Mathematics), Springer, 1986.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Second Year of Five Years of Integrated M.Sc. (Physics) M.Sc. - II, Semester - IV QUANTUM MECHANICS-I PH204*	Scheme	L	T	P	Credit
		3	1	0	4

*Pending approval of Senate on swapping with 'Classical Mechanics (PH204)' (Ref. Res. 3 of 47th DAAC of DoP dtd. 15.01.24 [DoP/1276 dtd. 22.01.24])

1.	**Course Outcomes:** **At the end of the semester students will be able to**
CO1	Remembering the origin of quantum theory and interpret the wave function properties
CO2	Interpret the Fourier transform and delta functions and their uses in quantum mechanics
CO3	Explain the central potential and utilize it to describe the energy spectrum of hydrogen atom
CO4	Identify symmetries in quantum mechanics and interpret the angular momentum and spin in general
CO5	Apply the Schrödinger's time-independent equation in solving various quantum models
CO6	Apply various quantum mechanical methods for solving many-body problem using time-independent Schrödinger equation.

2.	**Syllabus:**	
	ORIGINS OF QUANTUM THEORY & APPLICATIONS	**(10 Hours)**
	The conceptual aspect, The state vectors, Bra-Ket notation, Hilbert space, Operators, Eigenfunctions, Eigenvalues, Commutation relations, Fourier transform, Kronecker and Dirac delta functions, Interpretation of the wave function, The postulates of quantum mechanics.	
	SCHRÖDINGER EQUATION AND RELATED PROBLEMS	**(10 Hours)**
	Equation of motion, Hamiltonian, Time dependent Schrödinger equation (TDSE), Time-independent Schrödinger equation (TISE), TISE for solving particle in Infinite potential box, Step potential, Potential well, Rectangular potential barrier, Simple Harmonic Oscillator (SHO), etc.	
	CENTRAL POTENTIALS, ANGULAR MOMENTUM AND RADIAL SCHRÖDINGER EQUATION	**(10 Hours)**
	Spherically symmetric potentials, Angular momentum and its components in Spherical coordinate system, Eigenvalues of angular momentum, Spherical harmonics, Atomic orbitals, Reduced Radial Schrödinger Equation, Effective potential, Radial probability density distributions.	
	HYDROGEN ATOM PROBLEM	**(05 Hours)**
	The two-body problem, Solution of Hydrogen atom problem, Energy eigenvalue and eigenfunction, Energy spectrum of Hydrogen atom.	
	IDENTICAL PARTICLES, SPIN AND PAULI EXCLUSION PRINCIPLE	**(04 Hours)**
	The identity of particle, Quantum numbers, Spins and Statistics, Pauli's exclusion principle.	
	QUANTUM MECHANICAL METHODS FOR SOLVING MANY-BODY SYSTEM	**(06 Hours)**
	The Variational principle, 1st and 2nd order time-independent perturbation theory, The WKB approximation.	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials:**
1.	Numerical exercise on various pre-quantum principles and quantum postulates.
2.	Problems related to Braket algebra, Eigenstates and eigenvalues, Operators, The postulates of quantum mechanics, Operators, Commutation relations, Fourier transform, Kronecker and Dirac delta functions.
3.	Numerical exercise on the applications of various quantum models.
4.	Problems based on the angular momentum operators, radial Schrödinger equation, effective potential, etc.
5.	Numerical exercise related to Hydrogen atom problem and applications.
6.	Problem based on Identical Particles, Spin and Pauli Exclusion Principle.
7.	Numerical exercise related to applications of Variational principle.
8.	Numerical exercise related to applications of time-independent perturbation theories.
9.	Problems related to the WKB approximation.

4.	**BOOKS RECOMMENDED:**
1.	Schiff L.I., Quantum Mechanics, McGraw Hill Education, 4th Edition, 2017.
2.	Ghatak A.K. and Loknathan S., Quantum Mechanics: Theory and Applications, Laxmi Publications, 2015.
3.	Zettili N., Quantum Mechanics: Concepts and Applications; Wiley; 3rd Edition, 2022.
4.	Bransden B. H. and Joachain C. J., Quantum Mechanics, Pearson Education; 2nd Edition, 2004.
5.	Mathews P.M. and Venkateshan K., A Text book of Quantum Mechanics; McGraw Hill Education, 2nd Edition, 2017.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Second Year of Five Years of Integrated M.Sc. (Physics) M.Sc. - II, Semester - IV Electromagnetic Theory II PH206	Scheme	L	T	P	Credit
		3	0	2	4

1.	Course Outcomes: At the end of the semester students will be able to
CO1	Build the concept of Maxwell's equations and make use of them to determine the boundary conditions.
CO2	Explain the conservation laws in electrodynamics.
CO3	Demonstrate the propagation characteristics of electromagnetic waves in bounded and unbounded mediums.
CO4	Simplify the Maxwell's equations by writing them in terms of potentials and find out its solutions.
CO5	Analyze the various sources of electromagnetic radiations.
CO6	Summarize the various aspects of electrodynamics from the perspective of relativity.

2.	Syllabus:	
	ELECTRODYNAMICS	**(07 Hours)**
	Electromotive force and motional emf, Faraday's law of electromagnetic induction and energy in the magnetic fields, Maxwell's equations, Maxwell's correction in ampere's law, Maxwell's equations in matter, Boundary conditions.	
	CONSERVATION LAWS IN ELECTRODYNAMICS	**(06 Hours)**
	The continuity equation, Poynting's theorem, Newton's third law in electrodynamics, Maxwell's stress tensor, Conservation of momentum and angular momentum	
	ELECTROMAGNETIC WAVES	**(10 Hours)**
	Waves in one dimension, Electromagnetic waves in vacuum and in matter, Absorption and dispersion in matter, Guided waves	
	POTENTIALS AND FIELDS	**(08 Hours)**
	Scalar and vector potentials, Gauge transformations, Coulomb gauge and Lorentz gauge, Retarded potentials, Jefimenko's equations, Lienard-Wiechert potentials, The fields of a moving point charge	
	RADIATION	**(07 Hours)**
	Electric and magnetic dipole radiation, Radiation from an arbitrary source, Power radiated by a point charge, Radiation reaction.	
	ELECTRODYNAMICS AND RELATIVITY	**(07 Hours)**

	Special theory of relativity and relativistic mechanics, Relativistic electrodynamics, Field tensor, Electrodynamics in tensor notation.	
	Practicals will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1.	To determine the reduction factor of the given tangent galvanometer and also to find out the horizontal component of earth's magnetic field.
2.	To study the variation of magnetic field with distance along the axis of a circular coil carrying current.
3.	Hysteresis or BH curve experiment (Magnetic material characterization).
4.	To determine the magnetic susceptibility of a para magnetic material by Quincke's method.
5.	To find the temperature coefficient of resistance of a given coil.
6.	To determine the magnetic moment of a bar and horizontal intensity of earth's magnetic field using a deflection magnetometer.
7.	To determine the reduction factor of the given galvanometer.
8.	To determine the self inductance of the coil using Anderson's bridge.
9.	To experimentally demonstrate the concept of quantization of energy levels according to Bohr's model of atom (Frank- Hertz experiment). **Or** To determine e/m by helical method.
10.	To calculate/determine the permittivity and the permeability of the AIR.

4.	**BOOKS RECOMMENDED:**
1.	David J. Griffiths, Introduction to Electrodynamics, 3rd Edition, Pearson Education, 2008.
2.	John David Jackson, Classical Electrodynamics, 3rd Edition, Wiley, 2018.
3.	Matthew N. O. Sadiku, Elements of Electromagnetics, 6th Edition, Oxford university press, 2014.
4.	L. D. Landau, E. M. Lifshitz, The Classical Theory of Fields, Course of Theoretical Physics: Vol. 2, 3rd Edition, Pergamon Press, 1967.
5.	David K. Cheng, Field and Wave Electromagnetics, 2nd Edition, Pearson Education, 2001.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Second Year of Five Years of Integrated M.Sc. (Physics) M.Sc. - II, Semester - IV Laser and Photonics PH208	Scheme	L	T	P	Credit
		3	1	0	4

1.	Course Outcomes: At the end of the semester students will be able to
CO1	Explain laser cavities and calculate cavity modes.
CO2	Explain electro-optics and acousto-optic effects and design modulators based on them.
CO3	Identify various light sensing detectors and analyse noise characteristics in measurements.
CO4	Interpret the various non-linear optical effects in materials.
CO5	Analyse various photonic materials and their peculiar properties.
CO6	Analyse various loss mechanisms in optical fiber based light transmissions.

2.	Syllabus:	
	PHYSICS OF LASERS	**(08 Hours)**
	Fundamentals of light-matter interactions, Einstein's coefficients, Laser rate equations, Laser system and its components, Laser modes, Laser beam-parameters and characteristics, Line broadening mechanisms, Cavity modes, Quality factor, Mode selection, Q-switching, Mode locking in lasers, Various types of lasers.	
	LASER MODULATORS	**(07 Hours)**
	Electro-optics (EO) effects, Manifestation of EO effects in KDP, $LiNbO_3$ and $LiTaO_3$, Acousto-optic effect, General considerations on modulator design, Acousto-optics modulators, Raman-Nath and Bragg diffraction, Deflectors, Tunable filters.	
	LIGHT DETECTION AND MEASUREMENTS	**(07 Hours)**
	Detection of optical radiation, Photomultiplier tubes, Semiconductor photodiodes, Avalanche photodiodes, Single photon detectors, Dark current, Thermal noise, Shot noise. Measurement systems, Spectroscopy (Spectral and Temporal measurement systems), CCD, Monochromater, Pulse width measurement.	
	NON-LINEAR OPTICAL EFFECTS	**(08 Hours)**
	Second harmonic generation, Sum and difference frequency generation, Optical parametric amplification, Chirped pulse amplifier, Self-phase modulation, Stimulated Raman scattering, Stimulated Brillouin scattering.	
	PHOTONIC MATERIALS AND DEVICES	**(08 Hours)**
	Optical properties of anisotropic media, Wave refractive index, Liquid crystals, Magneto-optics, Photo refractive materials, Self-focusing and Kerr effect, Basics of holography.	
	OPTICAL FIBER	**(07Hours)**
	Total Internal Reflection and optical fibers, Fiber components, Step index and graded index optical	

	fibers, Light transmission in optical fibers, Losses, Attenuation, Dispersion.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1.	Calculations based on laser rate equations and threshold pump conditions.
2.	Problem based on laser cavity design and modes.
3.	Modulators design problems.
4.	Laser power calculations and problems based on optical power measurements.
5.	Problems based on spectroscopic measurements and noise analysis.
6.	Numerical questions based on the aspects covered in the section of non-linear optics.
7.	Problems based on photonic materials.

4.	**Books Recommended**
1.	Yariv A. and Yeh P., Photonics, 6th Ed., Oxford University Press, 2007.
2.	Ghatak A. and Thyagarajan K., Optical Electronics, Cambridge University Press, 2009.
3.	Saleh B.E.A. and Teich M.C., Fundamentals of Photonics, 2nd Ed., Wiley, 2007.
4.	Silfvast W. T., Laser Fundamentals, 2nd Ed., Cambridge University Press, 2004.
5.	Boyd R.W., Nonlinear Optics, 3rd Ed., Academic Press, 2007.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Second Year of Five Years of Integrated M.Sc. (Physics) M.Sc. II, Semester – IV DATA STRUCTURES CS102	Scheme	L	T	P	Credit
		3	1	2	5

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Recognize the need of different data structures and understand its characteristics.
CO2	Apply different data structures for given problems.
CO3	Design and analyze different data structures, sorting and searching techniques.
CO4	Evaluate data structure operations theoretically and experimentally.
CO5	Solve for complex engineering problems.

2.	Syllabus	
	BASICS OF DATA STRUCTURES	**(02 Hours)**
	Review of Concepts: Information and Meaning, Abstract Data Types, Internal Representation of Primitive Data Structures, Arrays, Strings, Structures, Pointers.	
	LINEAR LISTS	**(06 Hours)**
	Sequential and Linked Representations of Linear Lists, Comparison of Insertion, Deletion and Search Operations for Sequential and Linked Lists, Doubly Linked Lists, Circular Lists, Lists in Standard Template Library (STL), Applications of Lists.	
	STACKS	**(06 Hours)**
	Sequential and Linked Implementations, Representative Applications such as Recursion, Expression Evaluation Viz., Infix, Prefix and Postfix, Parenthesis Matching, Towers of Hanoi, Wire Routing in a Circuit, Finding Path in a Maze.	
	QUEUES	**(06 Hours)**
	Operations of Queues, Circular Queue, Priority Queue, Dequeue, Applications of Queues, Simulation of Time Sharing Operating Systems, Continuous Network Monitoring System Etc.	
	SORTING AND SEARCHING	**(04 Hours)**
	Sorting Methods, Bubble Sort, Selection Sort, Quick Sort, Radix Sort, Bucket Sort, Dictionaries, Hashing, Analysis of Collision Resolution Techniques, Searching Methods, Linear Search, Binary Search, Character Strings and Different String Operations.	
	TREES	**(08 Hours)**
	Binary Trees and Their Properties, Terminology, Sequential and Linked Implementations, Tree Traversal Methods and Algorithms, Complete Binary Trees, General Trees, AVL Trees, Threaded Trees, Arithmetic Expression Evaluation, Infix-Prefix-Postfix Notation Conversion, Heaps as Priority Queues, Heap Implementation, Insertion and Deletion Operations, Heapsort, Heaps in Huffman Coding, Tournament Trees, Bin Packing.	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	MULTIWAY TREES	**(04 Hours)**
	Issues in Large Dictionaries, M-Way Search Trees, B Trees, Search, Insert and Delete Operations, Height of B-Tree, 2-3 Trees, Sets and Multisets in STL.	
	GRAPHS	**(06 Hours)**
	Definition, Terminology, Directed and Undirected Graphs, Properties, Connectivity in Graphs, Applications, Adjacency Matrix and Linked Adjacency Chains, Graph Traversal, Breadth First and Depth First Traversal, Spanning Trees, Shortest Path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths.	
	Tutorials will be based on the coverage of the above topics separately.	**(14 Hours)**
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 14 Hours + 30 Hours = 89 Hours)	

3.	**Tutorials**
1	Problems on Array
2	Problems on Stack and Queue
3	Problems on Linked List
4	Problems on Trees
5	Problems on Graph

4.	**Practicals**
1	Implementation of Array and its applications
2	Implementation of Stack and its applications
3	Implementation of Queue and its applications
4	Implementation of Link List and its applications
5	Implementation of Trees and its applications
6	Implementation of Graph and its applications
7	Implementation of Hashing function and collision resolution techniques
8	Mini Project (Implementation using above Data Structure

5.	**Books Recommended**
1.	Trembley and Sorenson, An Introduction to Data Structures with Applications, 2nd Edition, Tata McGraw Hill, 1991
2.	Tanenbaum and Augenstein, Data Structures using C and C++, 2nd Edition, Pearson, 2007.
3.	Horowitz and Sahani, Fundamentals of Data Structures in C, 2nd Edition, Silicon Press, 2007.
4.	T. H. Cormen, C. E. Leiserson, and R. L. Rivest, Introduction to Algorithms, 3rd Edition, MIT Press, 2009.
5.	Robert L. Kruse, C. L. Tondo and Brence Leung, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2001.

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Indian Institute of Technology Mandi
Kamand, Himachal Pradesh - 175075

भारतीय प्रौद्योगिकी संस्थान मण्डी
कमांद, हिमाचल प्रदेश - 175075

IIT Mandi/ Academics/ MoU-JDP(IIT Mandi-SVNIT)/ 2024/6334 Dated: 12th March, 2024

Annexure 66.33
of 66th meeting of the IAAC

To
Associate Dean (Academics),
Sardar Vallabhbhai National Institute of Technology (SVNIT),
Surat-395007, Gujarat, INDIA

Subject: Regarding list of students(s) admitted under Ph.D. Joint Degree Programme between IIT Mandi and SVNIT, Surat Academic Year : 2023-2024.

Ref: Memorandum of Understanding between SVNIT, Surat and IIT Mandi.

Dear Sir/Madam,

With reference to our agreement, the following students have been admitted in both the Institutes for the Academic Year 2023-2024 in different projects.

The details of admission are mentioned below:

Home Institution	Host Institution	Number of students admitted
IIT Mandi	SVNIT, Surat	01
SVNIT, Surat	IIT Mandi	03

Further the approval from Chairman Senate/ Director IIT Mandi has been accorded for admission as per the agreement. The scanned copy of the approval is enclosed for your reference and kind perusal.

You are requested to accord approval from Chairman, Senate, SVNIT Surat, after approval, scanned copy of the same may kindly be shared with us for records.

Thank You,

Regards

Amit Jaiswal 13/3/2024

(Dr. Amit Jaiswal)
Associate Dean (Research)
IIT Mandi -Himachal Pradesh

Associate Dean (Research)
Indian Institute of Technology Mandi
Mandi-175001, Himachal Pradesh, India.

दैनन्दिनी संख्या Diary No.

भारतीय प्रौद्योगिकी संस्थान मण्डी
Indian Institute of Technology Mandi

पृष्ठ संख्या Page No.

पंजिका संख्या / File No. ....

कार्यालय टिप्पणी

NOTESHEET

F.No. IIT Mandi/Academics/JDP/2024/ **Dated: 14th February, 2024**

Subject: Regarding Admissions in Joint Degree Programme between IIT Mandi and Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat.

This is to submit that IIT Mandi and SVNIT Surat has signed MoU to start Joint Ph.D. Programme on 21st March, 2023.

Subsequently, the students have been admitted in the both the Instititutes for the Academic Year 2023-24 in different projects. The details of the students admitted to SVNIT Surat has been received and placed in the file for ready reference. Following is the number of admissions:

Home Institution	**Host Institution**	**Number of students admitted**
IIT Mandi	SVNIT, Surat	01
SVNIT, Surat	IIT Mandi	03

The details of the students joined in both the Institutes (IIT Mandi and SVNIT, Surat) are placed in the file at Annexure A. If considered, the details shall be shared with SVNIT Surat for approval of their Chairman Sernate.

Submitted for consideration and approval please.

14/2/2024

JS(Academics)

DR (Academics)

14/2/24

Associate Dean (Research) 15/2/24

Dean (Academics) 15/2/2024

Chairman Senate/Director 19/2/24

List of students under Joint Degree Programme between IIT Mandi and IIT Jammu for AY 2023-24

Annexure A

Home Institute: IIT Mandi

S.No	Roll No	Name of Student	School / Centre	Gender	Category	DOJ	Project Title	Home Supervisor	Host Supervisor	Funding	Current Status	Remarks if any
1	D23215	Rajat Dhiman	SCENE	Male	OBC(NCL)	18.01.2024	Biogeochemical investigations of rivers Beas and Tawi and implications for downstream water quality	Dr. Harshad V. Kulkarni	Dr. Vinay Chembolu	HTRA	Current	-

Home Institute: IIT Jammu

S.No	Roll No	Name of Student	School / Centre	Gender	Category	DOJ	Project Title	Home Supervisor	Host Supervisor	Funding	Current Status	Remarks if any
1	2023RCY2037	MOHD NAWEED	Chemistry	Male	ST	03-Jan-24	Asymmetric Synthesis of Functional Molecules for Applications as Organocatalysts and Advanced Molecular Motors	Dr Pankaj Chauhan	Dr. Abhimanew Dhir	Institute	Active	-
2	2023REE2038	AADIL AHMAD KHAN	Electrical Engineering	Male	GENERAL	03-Jan-24	Reconfigurable Intelligent Surfaces for Defence Applications	Dr. Kushmanda Saurav	Dr. Anirban Sarkar	Institute	Active	-
3	2023RME2040	LAKSHMI YADAV	Department of Mechanical Engineering	Female	OBC-NCL	03-Jan-24	Fabrication of Components by Additive Manufacturing Techniques for Defense applications	Dr. Shiva Sekar	Dr. Prateek Saxena	Institute	Active	-
4	2023RCE2036	RAMESH BIRADAR PATIL	Department of Civil Engineering	Male	GENERAL	03-Jan-24	Seismic vulnerability of tunnels in himalayan region	Dr Sivakumar G	Dr Prasanna R	Institute	Active	-
5	2023RME2039	LOKESH SARKAR	Department of Mechanical Engineering,	Male	SC	03-Jan-24	Self-Lubricating Composite for Bearing Application	Dr. Arvind Kumar Rajput	Dr Himanshu Pathak	Institute	Withdrawn	Withdrawn from programme
6	2023REE1022	MOHD ILYAS KHAN	Electrical Engineering	Male	GENERAL	04-Aug-23	UAV-assisted wireless networks. deployment and path planning	Dr. Ajay Singh & Dr. Karan Nathwani	Dr. Siddhartha Sarma	Institute	Active	Converted from reg Ph.D. to Joint Ph.D programme

Annexure 66.34
Of the 66th meeting of the IAAC

Grade Sheet format and course code for NPTEL/SWAYAM Courses (Applicable from A.Y. 2024-25)

Grade sheet

DD	CD	CC	BC	BB	AB	AA
40-45	46-50	51-60	61-70	71-80	81-90	91-100

Score Type of Certificate

≥ 90	Elite + Gold
75 – 89	Elite + Silver
≥ 60 -74	Elite
40 – 59	Successfully Completed
< 40	Fail

Sr. No.	Subject Code	Subject Name	Duration	Credits
1	NPT401	NPTEL – 1	12 Week or Above	4
2	NPT402	NPTEL – 2	12 Week or Above	4
3	NPT403	NPTEL – 3	12 Week or Above	4
4	NPT404	NPTEL – 4	12 Week or Above	4
5	NPT301	NPTEL – 5	8 to 11 Week	3
6	NPT302	NPTEL – 6	8 to 11 Week	3
7	NPT303	NPTEL – 7	8 to 11 Week	3
8	NPT304	NPTEL – 8	8 to 11 Week	3
9	NPT201	NPTEL – 9	4 to 7 Week	2
10	NPT202	NPTEL – 10	4 to 7 Week	2
11	NPT203	NPTEL – 11	4 to 7 Week	2
12	NPT204	NPTEL – 12	4 to 7 Week	2
13	NPT205	NPTEL – 13	4 to 7 Week	2
14	NPT206	NPTEL – 14	4 to 7 Week	2

Subject Code	Subject Name	Duration	Credits
SWM401	SWAYAM-1	12 Week or Above	4
SWM 402	SWAYAM-2	12 Week or Above	4
SWM 403	SWAYAM-3	12 Week or Above	4
SWM 404	SWAYAM-4	12 Week or Above	4
SWM 301	SWAYAM-5	8 to 11 Week	3
SWM 302	SWAYAM-6	8 to 11 Week	3
SWM 303	SWAYAM-7	8 to 11 Week	3
SWM 304	SWAYAM-8	8 to 11 Week	3
SWM 201	SWAYAM-9	4 to 7 Week	2
SWM 202	SWAYAM-10	4 to 7 Week	2
SWM 203	SWAYAM-11	4 to 7 Week	2
SWM 204	SWAYAM-12	4 to 7 Week	2
SWM 205	SWAYAM-13	4 to 7 Week	2
SWM 206	SWAYAM-14	4 to 7 Week	2

DEAN (ACADEMIC)

Annexure 66.35
of the 66th meeting of the IAAC

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	First Semester (1st year of UG)				
1	Stoichiometry, Solutions, and Gases	CY101	3-1-2	5	100
2	Atomic Structure and Chemical Bonding	CY103	3-0-2	4	85
3	Qualitative and Quantitative Analysis	CY105	3-0-2	4	85
4	Mathematics for Chemistry	MA121	3-1-0	4	70
5	Indian Value System and Social Consciousness	HS120	2-0-0	2	35
6	Energy and Environment in Chemical Engineering	EG111	3-1-0	4	70
			Total	**23**	**445**
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	ICV01 / ICP01	0-0-10	5	200 (20 x 10)
	Second Semester (1st year of UG)				
1	Fundamentals of Organic Chemistry	CY102	3-1-2	5	100
2	Basic Industrial Chemistry	CY104	3-0-2	4	85
3	Engineering Drawing	ME110	2-0-4	4	55
4	Fundamentals of Computer and Programming	CS110	3-0-2	4	85
5	English and Professional Communication	HS110	3-1-0	4	70
6	Numerical Methods in Chemical Engineering	CH106	3-1-0	4	70
			Total	**25**	**465**
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	ICV02 / ICP02	0-0-10	5	200 (20 x 10)
	Third Semester (2nd year of UG)				
1	Industrial Organic Chemistry	IC201	3-0-2	4	85
2	Hetero Functional Groups and Heterocycles	CY203	3-0-2	4	85
3	State and Properties of Matter	CY205	3-0-2	4	85
4	Mechanical Operations	CH201	3-1-2	5	100
5	Heat and mass transfer	CH209	3-1-0	4	70
			Total	**21**	**425**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	ICV03 / ICP03	0-0-10	5	200 (20 x 10)
Sr.	**Subject**	**Code**	**Scheme**	**Credits**	**Notional**

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B.Tech. (Industrial Chemistry)

No.			L-T-P	(Min.)	hours of Learning (Approx.)
	Fourth Semester (2nd year of UG)				
1	Computational Chemistry	IC202	3-0-4	4	85
2	Chemical Reaction Engineering	CH208	3-1-2	5	100
3	Fluid mechanics	ME202	3-1-2	5	100
4	Organic reaction mechanism	CY204	3-1-2	5	100
5	Departmental Elective - I	IC2AA	3-0-0	3	55
			Total	**22**	**440**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	ICV04 / ICP04	0-0-10	5	200 (20 x 10)
	Fifth Semester (3rd year of UG)				
1	General Chemical Technologies	CH301	4-0-2	5	100
2	Pericyclic Reactions and Photochemistry	CY303	3-0-4	5	100
3	Analytical Chemistry	CY305	3-0-4	5	100
4	Introduction to AI	AI375	3-0-2	4	85
5	Departmental Elective - II	IC3AA	3-0-0	3	55
6	Specialization Elective - I	IC3BB	3-0-0	3	55
			Total	**25**	**495**
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	ICV05 / ICP05	0-0-10	5	200 (20 x 10)
	Sixth Semester (3rd year of UG)				
1	Interpretative Molecular Spectroscopy	CY302	3-1-0	4	85
2	Polymer Chemistry	CY306	3-0-4	5	100
3	Chemistry in Industries	CY308	3-0-0	3	55
4	Instrumentation and process control	CH302	3-1-2	5	100
5	Chemical engineering plant design and economics	CH306	3-0-0	3	55
6	Departmental Elective - III	IC3CC/ CY453	3-0-0	3	55
7	Specialization Elective - II	IC3DD	3-0-0	3	55
			Total	**26**	**505**
8	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	ICV06 / ICP06	0-0-10	5	200 (20 x 10)
	Seventh Semester (4th year of UG)				
1	Machine Learning in Chemistry	IC401	3-0-0	3	55
2	Chemical Engineering Thermodynamics	CH407	3-0-0	3	55
3	Industry Lecture Series	IC304	1-0-0	1	35
4	Separation Technologies	IC403	3-0-0	3	55

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

5	Innovation Incubation and Entrepreneurship	MG110	3-1-0	4	70
6	Specialization Elective - III	IC4AA	3-0-0	3	55
7	Specialization Elective - IV	IC4BB/CH401	3-0-0	3	55
			Total	**20**	**380**
8	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	ICV07 / ICP07	0-0-10	5	200 (20 x 10)
	Eighth Semester (4th year of UG)				
1	Industrial Internship/ Project	ICP08	0-0-40	20	800 (20 x 40)
			Total	**20**	**800**

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	Departmental Elective - I				
1	Industrial Safety and Hazardous Management	IC252	3-0-0	3	55
2	Quality Control and Assurance in Chemical Industries	IC254	3-0-0	3	55
	Departmental Elective - II				
1	Dyes, Pigments, and Paints	IC351	3-0-0	3	55
2	Chemistry of Pesticides and Fertilizers	IC353	3-0-0	3	55
	Departmental Elective – III				
1	Synthetic Dyes for Textile Processing	IC352	3-0-0	3	55
2	Green chemical Processing	CY453	3-0-0	3	55
	Specialization Elective - I				
1	Medicinal Chemistry and Drug Discovery	IC355	3-0-0	3	55
2	Fuel, Petroleum, and Petrochemicals	IC357	3-0-0	3	55
	Specialization Elective – II				
1	Pharmaceuticals	IC354	3-0-0	3	55
2	Plastics and Polymer Industries	IC356	3-0-0	3	55
	Specialization Elective – III				
1	Industrial Chemistry	IC452	3-0-0	3	55
2	Advanced Polymer Coating Technology	IC454	3-0-0	3	55
	Specialization Elective – IV				
1	Advance Industrial Chemistry	IC456	3-0-0	3	55
2	Process Modeling and Simulation	CH401	3-0-0	3	55

Total credit: 182
Total Credit with Vocational Training = 217

Total Notional hours: 4420
Total notional hours with Vocational Training: 5820

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B. Tech. (Industrial Chemistry)

Annexure - II

B.Tech. - I (Industrial Chem), Semester – I	Scheme	L	T	P	Credit
STOICHIOMETRY, SOLUTIONS AND GASES CY101		3	1	2	05

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Acquire the knowledge of stoichiometric in chemical reactions.
CO2	Memorize the basic theoretical knowledge of solutions and gases.
CO3	Learn the fundamentals of solutions and gases along with their thermodynamics.
CO4	Perform the experiments related to preparation of various solutions of different concentrations and estimation of concentrations using titrations.
CO5	Develop expertise in handling of laboratory solutions and glasswares.

2.	Syllabus	
	CHEMICAL REACTIONS & STOICHOMETRY	**(10 Hours)**
	Chemical reaction and chemical equation, balanced chemical equations, law of conservation of mass, law of constant composition/definite proportion, law of multiple proportions, Law of reciprocal proportions, Gay-Lussac's law of gaseous volumes, stoichiometry and its significance, mole ratio method, chemical equivalence - metathesis and redox, chemical formula from percentage composition, molecular formula from empirical formula, limiting reagent, reaction yield, stoichiometry and titrations. Numerical problems.	
	SOLUTIONS	**(10 Hours)**
	Solution composition, ways of expressing concentration, molarity, molality, normality, mole fraction, solutions of gases in gases, Henry's law, solutions of liquids in liquids, solubility of completely miscible liquids, solubility of partially miscible liquids, phenol-water system, nicotine-water system, vapour pressures of liquid-liquid mixtures, azeotropes, theory of fractional distillation, steam distillation, solutions of solids in liquids, solubility-equilibrium concept, determination of solubility, solubility of solids in solids.	
	GASES	**(10 Hours)**
	States of a gas, equation of state, perfect gas law, kinetic model of gases, mixture of gases, partial pressures, Dalton's law, real gases, molecular interactions in gases, compression factor, virial equation of state, Boyle's temperature, critical states, critical constants, liquefication of gases, van der Waal's equation and limitations, interpretation of deviations from van der Waal's equation, law of the corresponding states. The kinetic model of gases, Maxwell distribution of speeds, collisions with walls and surfaces, rate of effusion, transport properties of a perfect gas.	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	THERMODYNAMICS OF GASES	**(09 Hours)**
	First law of thermodynamics and gases – internal energy, enthalpy, work function, heat changes, second law of thermodynamics and gases, Helmholtz and Gibb's energies, Maxwell's relations, criteria of reversibility, van't Hoff isotherm, van't Hoff isochore, carnot cycle, entropy, entropy changes, Nernst heat theorem, third law of thermodynamics and imperfections	
	KINETICS AND THERMODYNAMICS OF SOLUTIONS	**(06 Hours)**
	Molecular motion in liquids, methods to detect motion in liquids, electrolyte solutions, Arrhenius theory and Ghosh theory of electrolytes, activity and activity coefficient, conductivity, specific conductivity, equivalent conductivity, molar conductivity, Kohlrausch's law, mobilities of ions, Grotthuss mechanism.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

3.	**Tutorials**
1	Numericals based on application of stoichiometry to chemical reactions.
2	Calculations based on limiting reagents, reaction yields and titrations.
3	Determination and conversion of concentration terms.
4	Diagrams and calculations based on partially immiscible liquids.
5	Calculations based on solubility –equilibrium concept.
6	Numericals based on compressibility factor and virial equation of state.
7	Graphs and calculations based on liquefaction of gases, critical states and critical values.
8	Solving problems related to Maxwell distribution of speeds.
9	Calculation based on internal energy, enthalpy, work function and free energy changes during gaseous reactions.
10	Applications of Maxwell's relation in thermodynamics.
11	Entropy changes in gases.
12	Conductivities of solutions.
13	Effect of dilution and temperature on conductivities.
14	Ionic mobility and abnormally high ionic conductances.

4.	**Practical**
1	Preparation of primary and secondary standards along with the standardization of secondary solutions.
2	Estimation of a weak acid, CH3COOH with a standardized NaOH solution.
3	Determination of Na2CO3 and NaOH in a mixture with standardized HCl solution.

4	Estimation of boric acid with standardized NaOH solution.
5	Estimation of CH_3COOH and HCl in a mixture by titrating with a strong base, NaOH.
6	Preparation of $KMnO_4$ and estimation of H_2O_2 using standardized $KMnO_4$.
7	Estimation of iodine concentration using standardized sodium thiosulphate.
8	To study the kinetics of ester hydrolysis in acidic media.
9	Demonstration: To find out the dissociation constant of acetic acid by potentiometric titration.
10	Demonstration: To titrate 'X'N H_2SO_4 by titrating it against 0.1N NaOH solution potentiometrically and find out the endpoint, normality and strength of H_2SO_4 solution.

5.	**Books Recommended**
1	B. R. Puri, L. R. Sharma, M.S. Pathania, Principles of Physical Chemistry, 47th edition, Vishal Publications, New Delhi, 2017.
2	G. Raj, Advanced Physical Chemistry, 4th edition, Goel Publishing House, Meerut, 1990.
3	P. Atkins, J. de Paula, J. Keeler Atkins' Physical Chemistry, 11th edition, Oxford Publishing House, 2018.
4	A. Bhal, B. S. Bahl, G. D. Tuli, Essential of Physical Chemistry, 28th edition, S.C. Chand, 2020.
5	A. K. Nad, B. Mahapatra, A. Ghoshal, An Advanced Course in Practical Chemistry, New Central Book Agency P Ltd, 2022.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B. Tech. (Industrial Chemistry)

B.Tech. - I (Industrial Chem), Semester – I	Scheme	L	T	P	Credit
ATOMIC STRUCTURE AND CHEMICAL BONDING CY103		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Gain knowledge of basic chemistry of elements.
CO2	Apply the concept of lattice energy using Born-Landé equation.
CO3	Understand the importance and application of chemical bonds, inter-molecular and intramolecular weak chemical forces.
CO4	Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model.
CO5	Describe the plausible structures and geometries of molecules using Radius Ratio Rules, VSEPR theory and MO diagrams.

2.	Syllabus	
	PERIODIC TABLE AND ATOMIC PROPERTIES	**(13 Hours)**
	Periodicity of Elements: Brief discussion of the properties of the elements: Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in the periodic table, Atomic and ionic radii, Ionization enthalpy, Successive ionization enthalpies, and factors affecting ionization enthalpy and trends in groups and periods, Electron gain enthalpy and trends in groups and periods, Electronegativity, Pauling's/ Allred Rochow's scales. Variation of electronegativity with bond order, partial charge, hybridization, and group electronegativity.	
	CHEMICAL BONDING AND MOLECULAR STRUCTURE	**(16 Hours)**
	Atomic models, de Broglie principle, postulates of quantum mechanics, quantum numbers Schrödinger wave equation: The significance of Ψ^2 , Schrodinger wave equation for H-atom, angular and radial wave function, Valence Band Theory, Valence Shell Electron Pair Repulsion theory, hybridization, geometry and shape of molecules, Molecular Orbital Theory, molecular orbital diagrams of diatomic and simple polyatomic molecules: N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl, BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given).	
	IONIC SOLIDS	**(16 Hours)**
	Ionic structure, radius ratio effect, and coordination number, calculation of limiting radius ratio values for Coordination numbers, limitations of radius ratio rule, lattice defects, semi-conductors, lattice energy, Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule, metallic bond: free electron, valence bond and band theories; weak interactions: hydrogen bonding, Van der Waals interactions. covalent bond, coordinate bond, hydrogen bond, dipole moment. Metallic Bond: The qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids, effects of weak chemical forces, melting and boiling points, solubility, and energetics of the dissolution process	

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	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practical**
1	Estimation of Cu(II) ions iodometrically using $Na_2S_2O_3$.
2	Estimation of oxalic acid using $KMnO_4$ by redox titration.
3	Estimation of oxalic acid and sodium oxalate in a mixture.
4	Estimation of Fe(II) with $K_2Cr_2O_7$ using an internal indicator (diphenylamine, N-phenylanthranilic acid) and discussion of the external indicator.
5	Estimation of Fe(II) using standardized $KMnO_4$ solution.
6	Determination of strength of potassium dichromate solution iodometrically using sodium thiosulphate.
7	Preparation of ammonium Cu(II) sulphate tetrahydrate complex.
8	Preparation of ferrous ammonium sulphate.
9	Preparation of potassium trioxalatochromate(III).
10	Preparation of sodium ferrioxalate(sodium trioxalatoferrate(III).

4.	**Books Recommended**
1	Lee, J. D. (1998). Concise Inorganic Chemistry (5th ed.). United Kingdom: Recommended Books have been reviewed 12 Wiley/Oxford Publications.
2	Puri, B.R., Sharma, L.R. &. Kalia, K.C. (2017). Principles of Inorganic Chemistry (33rd ed.). India: Vishal Publications.
3	Cotton, F. A., & Wilkinson, G. (1994). Basic Inorganic Chemistry (3rd ed.). United Kingdom: John Wiley Publications.
4	Bhagchandani, P. (2017). Inorganic Chemistry. India: SahityaBhawan Publications. 5. Malik, W. U., Tuli, G.D., & Madan, R. D.(2010).
5	Atkins, P.; Paula, J. D., Atkin's Physical Chemistry, Oxford (Indian Edition), Oxford University Press, 2012.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B. Tech. (Industrial Chemistry)

B.Tech. - I (Industrial Chem), Semester – I QUALITATIVE AND QUANTITATIVE ANALYSIS CY105	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Acquaint with the purpose and applicability of Basic Analytical Chemistry Tools
CO2	Adapt various mathematical tools in chemistry to gain knowledge about fundamental qualitative approaches.
CO3	Adapt reactions within the solution using fundamental theoretical principles.
CO4	Understand the use of gravimetric and titrimetric methods in analysing various methods.
CO5	Understand the applicability of Quality control and Quality assurance relevant to pharmaceutical, environmental and petrochemical industry.

2.	Syllabus	
	BASIC TOOLS OF ANALYTICAL CHEMISTRY	**(15 Hours)**
	Fundamental Units of Measure, Significant Figures, Units for Expressing Concentration, Stoichiometric Calculations, Accuracy, Precision, Sensitivity, Selectivity, Robustness and Ruggedness, Error and Uncertainty, Propagation of Uncertainty: Uncertainty When Adding or Subtracting, Uncertainty When Multiplying or Dividing, Uncertainty for Mixed Operations, Uncertainty for Other Mathematical Functions, Statistical Methods for Normal Distributions, Calibrations, Standardizations and Blank Corrections.	
	FUNDAMENTAL THEORETICAL PRINCIPLES OF REACTIONS IN SOLUTION	**(10 Hours)**
	Chemical equilibrium, The law of mass action, Factors affecting chemical reactions in solution, Electrolytic dissociation, Activity and activity coefficient, Solubility product, Quantitative effects of a common ion , Fractional precipitation, Effect of acids on the solubility of a precipitate, Effect of temperature on the solubility of a precipitate, Effect of the solvent on the solubility of a precipitate Acid-base equilibria in water, Strengths of acids and bases, Dissociation of polyprotic acids, Common-ion effect, The ionic product of water, The hydrogen ion exponent, The hydrolysis of salts Hydrolysis constant and degree of hydrolysis, Buffer solutions, Metal ion buffers, Electrode potentials, Concentration cells Calculation of the e.m.f. of a voltaic cell, Oxidation-reduction cells, Calculation of the standard reduction potential, Equilibrium constants of oxidation-reduction reactions.	
	GRAVIMETRY AND TITRIMETRIC METHODS OF ANALYSIS	**(10 Hours)**
	Introduction to gravimetric analysis, Types of Gravimetric Methods, Conservation of Mass, Precipitation Gravimetry, Volatilization Gravimetry, Titrations Based on Acid–Base Reactions, Titrations Based on Complexation Reactions, Titrations Based on Redox Reactions, Precipitation Titrations, Supersaturation and precipitate formation, The purity of the precipitate: Co-precipitation, Conditions of precipitation, Precipitation from homogeneous solution, Washing the precipitate.	

	QUALITY ASSURANCE	**(10 Hours)**
	Quality Control, Quality Assessment: Internal Methods of Quality Assessment, External Methods of Quality Assessment, Evaluating Quality Assurance Data: Prescriptive Approach, Performance-Based Approach	
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practical**
1	Calibration—Volumetric glassware (burets, pipets, and volumetric flasks)
2	Standardization—External standards, standard additions, and internal standards
3	Effect of Ionic Strength on an Equilibrium Constant
4	Equilibrium Constants for Calcium Iodate Solubility and Iodic Acid Dissociation.
5	The effect of pH on the solubility of $Ca(IO_3)_2$
6	The Solubility of Silver Acetate.
7	Determination of the Thermodynamic Solubility Product, Ksp, of PbI2
8	Determination of Ammonia in Household Cleaners,
9	Acid Rain Analysis by Standard Addition Titration
10	Titration of Chromate–Dichromate Mixtures.

4.	**Books Recommended**
1	Harvey, David, 'Modern Analytical Chemistry' McGraw-Hill Companies, 1st Edition 2006.
2	Harvey, David, Analytical chemistry. -- Seventh edition, Wiley.
3	W. Fifield and David Kealey, Principles and Practice of Analytical Chemistry, 5th Edition University Press, 2012.
4	Vogel A. I. and Mendham J., 'Vogel's Textbook of Quantitative Chemical Analysis Hall, 6th Edition, 2002.
5	D. A. Skoog, F. J. Holler, T. A. Nieman, "Principles of Instrumental Analysis", sixth edition, 2006.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B. Tech. (Industrial Chemistry)

B.Tech. - I (Industrial Chem), Semester – I MATHEMATICS FOR CHEMISTRY MA121	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Solve successive differentiations with its applications to different series expansions.
CO2	Apply partial differentiation to find series expansion with error approximations, extremals andjacobians.
CO3	Trace curves in Cartesian, polar, and parametric forms.
CO4	Solve first-order ordinary differential equations with its applications to real world problems.
CO5	Analyse the Linear systems of algebraic equation with different approach.

2.	**Syllabus**	
	DIFFERENTIAL CALCULUS	**(10 Hours)**
	Differentiation of Hyperbolic and Inverse Hyperbolic functions. Successive Differentiation, standard forms, Leibnitz's theorem and applications, Power series, Expansion of functions, Taylor's and Maclaurin's series. Curvature, Radius of curvature for Cartesian curve with application.	
	PARTIAL DIFFERENTIATION	**(10 Hours)**
	Partial differentiation, Euler's theorem for homogeneous function, Modified Euler's theorem, Taylor's and Maclaurin's series for two variables. Tangent plane and Normal line, Error and Approximation, Jacobians with properties, Extreme values of function of two variables, Lagrange's methods of undetermined multipliers.	
	CURVE TRACING	**(05 Hours)**
	Cartesian, polar and parametric for of standard curves.	
	ORDINARY DIFFERENTIAL EQUATION	**(08 Hours)**
	Reorientation of the differential equation first order first degree, exact differential equation and Integrating factors, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient	
	APPLICATION OF DIFFERENTIAL EQUATION (MATHEMATICAL MODELLING)	**(07 Hours)**
	Modelling of Real-world problems, particularly Chemical Systems, the spread of epidemic (SI, SIS, SIR), Newton's Law of cooling, Single compartment modelling, Bending of beam models.	
	SYSTEM OF LINEAR ALGEBRAIC EQUATION	**(05 Hours)**
	Linear systems, Elementary row, and column transformation, the rank of a matrix, consistency of the linear system of equations, Linear Independence and Dependence of vectors, Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method.	

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	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Differential calculus -I
2	Differential calculus -II
3	Differential calculus -III
4	Partial differentiation-I
5	Partial differentiation-II
6	Curve tracing-I
7	Curve tracing-II
8	Ordinary differential equation-I
9	Ordinary differential equation-II
10	Ordinary differential equation-III
11	Application of differential equation-I
12	Application of differential equation-II
13	System of linear algebraic equation-I
14	System of linear algebraic equation-II

4.	**Books Recommended**
1	J. Stewart, "Calculus," Thomson Asia, Singapore, 1 January 2012.
2	P. O'Neil, "Advanced Engineering Mathematics," Thompson, Singapore, Ind. Ed. 2002.
3	B. Kreyszing, "Advanced Engineering Mathematics," John Wiley & Sons, Singapore, Int. Student Ed. 2015.
4	Wiley C. R., “Advanced Engineering Mathematics”, McGraw Hill Inc., New York Ed. 1993.
5	Bali and Iyengar. Engg. Mathematics, Laxmi Publications, New Delhi, 2004.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B. Tech. (Industrial Chemistry)

B.Tech. - I (Industrial Chem), Semester – I INDIAN VALUE SYSTEM AND SOCIAL CONSCIOUSNESS HS120	Scheme	L	T	P	Credit
		2	0	0	02

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	interpret the important values that need to be cultivated
CO2	analyse the cultures depicted in Ramayana, Mahabharata, Jainism and Buddhism
CO3	review the structure of Indian knowledge system
CO4	discuss the significance of constitution of India
CO5	demonstrate social responsibility

2.	Syllabus	
	HUMAN VALUES AND CONSCIOUSNESS	**(08 Hours)**
	Human Values Definition and Classification of Values; The Problem of Hierarchy of Values and their Choice; Self-Exploration; 'Basic Human Aspirations; Right understanding, Relationship and Physical Facility; fulfilment of aspirations; Understanding Happiness and Prosperity, Harmony at various levels. What Is Consciousness? ; Can We Build A Conscious Machine?; Levels Of Consciousness; Mind, Matter And Beyond; Holistic Lifestyle; Dealing With Anxiety; Connecting Mind To Brain; Minds, Brains, And Programs.	
	INDIAN CULTURE AND HERITAGE	**(07 Hours)**
	Culture and its salient features: The Vedic – Upanishadic Culture and society, Human aspirations in those societies; Culture in Ramayana and Mahabharata: The Ideal Man and Woman, Concepts Maitri, Karuna, Seela, Vinaya, Kshama, Santi, Anuraga – as exemplified in the stories and anecdotes of the Epics; The Culture of Jainism: Jaina conception of Soul, Karma and liberation, Buddhism as a Humanistic culture; The four Noble truths of Buddhism; Vedanta and Indian Culture;	
	INDIAN KNOWLEDGE SYSTEM	**(08 Hours)**
	Indian knowledge as a unique system, Place of Indian knowledge in mankind's evolution, Relevance of Indian knowledge to present day and future of mankind, Nature of Indian Knowledge; Structure of Indian Knowledge: Types of knowledge (para, apara), The scientific and the unscientific, Instruments for gaining and verifying knowledge, Knowledge traditions: Lineages, Instruments - debate, epistemology and pedagogy, The inverted tree – axiomatic, deductive, empirical knowledge, and evolution of knowledge; Disciplines of Study: A brief outline of the subjects, the major contributions and theories along with timelines where	

	relevant: Mathematics; Astronomy; Physical Sciences; Cosmogony; Language studies; Astrology; Moral studies/righteousness; Statecraft and political philosophy	
	INDIAN CONSTITUTION	**(04 hours)**
	History of Making of the Indian Constitution; Philosophy of the Indian Constitution: Preamble; Salient Features; Contours of Constitutional Rights & Duties; Organs of Governance: Parliament; Composition; Qualifications and Disqualifications; Powers and Functions	
	SOCIAL RESPONSIBILITY	**(03 Hours)**
	Social Responsibility: Meaning and Importance, Different Approaches of Social Responsibility. Social Responsibility of Business towards different Stakeholders. Evolution and Legislation of CSR in India.	
	(Total Contact Time: 30 Hours)	

3.	**Books Recommended**
1	D. K. Chaturvedi, Professional Ethics Values and Consciousness, Ane Books Pvt. Ltd., 2023.
2	R.R. Gaur, R Sangal, G. P.Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010.
3	A.N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
4	P R Rao, Indian Heritage and Culture, Sterling Publishers Pvt. Ltd, 1988.
5	D. Singh, Indian Heritage and Culture, APH Publishing Corporation, 1998.
6	Sri Prashant Pole, Treasure Trove of Indian knowledge, PrabhatPrakashan, 2021.
7	Sri Suresh Soni, Sources of our cultural heritage, PrabhatPrakashan, 2018.
8	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

B.Tech. - I (Industrial Chem), Semester – I **ENERGY AND ENVIRONMENTAL IN CHEMICAL ENGINEERING** **EG111**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Explain the components of ecosystems, various biogeochemical cycles and importance of different urban network services
CO2	Differentiate between various types of environmental pollution along with their impacts and regulatory standards
CO3	Examine various global environmental issues and their management
CO4	Discuss the fundamental principles of energy, including classification, conservation and related policy frameworks and regulations.
CO5	Get acquainted with the concept of energy systems and their components

2.	**Syllabus**	
	ENVIRONMENT AND ECOSYSTEMS	**(10 Hours)**
	Introduction: Concept of an ecosystem - structure and functions of ecosystem; Components of ecosystem - producers, consumers, decomposers; Food chains, food webs, ecological pyramids, energy flowing ecosystem; Bio-geochemical cycles, hydrologic cycle Components of environment and their relationship, impact of technology on environment, environmental degradation, environmental planning of urban network services such as water supply, sewerage, solid waste management; closed loop cycle, concepts of sustainability	
	ENVIRONMENTAL POLLUTION	**(10 Hours)**
	Water, air, soil, noise, thermal and radioactive, marine pollution - sources, effects, and engineering control strategies; Centralized and decentralized treatment system, Drinking water quality and standards, ambient air and noise standards	
	GLOBAL ENVIRONMENTAL ISSUES AND ITS MANAGEMENT	**(10 Hours)**
	Engineering aspects of climate change, concept of carbon credit, CO_2 sequestration, concepts of environmental impact assessment and environmental audit, lifecycle assessment	
	BASICS OF ENERGY AND ITS CONSERVATION	**(07 Hours)**
	Classification of energy sources, Global and national energy scenario, Fossil and alternate	

	fuels and its characterization. General aspects of energy conservation and management; Energy conservation act, Energy policy of company; Need for energy standards and labelling; Energy building codes.	
	INTRODUCTION TO ENERGY CONVERSION SYSTEMS	**(08 Hours)**
	Energy conversion systems: Working principle, Basic components, General functioning and normal rating specifications of various energy conversion systems like Power plant, Pump, Refrigerator, Air-conditioner, Internal combustion engine, Solar PV cell, Solar water heating system, Biogas plant. Wind turbine, Fuel cells.	
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practical**
1	Performance Test on a computerised single cylinder diesel engine
2	Performance Test on Three-cylinder petrol engine
3	Determination of COP of vapor compression refrigeration system
4	Study of General Motors Cruze Vehicle Automotive System
5	Study of MG Hector Vehicle Automotive Systems
6	Measurement of direct and diffused Solar radiation using pyranometer
7	Determination of I-V Characteristics of solar PV Panel
8	Study of electricity and or gas bill
9	Study of pollutants from diesel Engine
10	Study of pollutants from petrol Engine

4.	**Books Recommended**
1	Daniel B Botkin &EdwardA Keller, Environmental Sciences, John Wiley & Sons, 2010
2	R.Rajagopalan, Environmental Studies, Oxford University Press, 2015
3	Benny Joseph, Environmental Studies, McGraw Hill publishers, 2017
4	B. H. Khan, Nonconventional Energy resources, Second Edition, Tata McGraw Hill publishers, 2009
5	P. V. Bhale, National Mission Project on pedagogy main phase course on Energy Management and Energy Audit, 2018
6	C S Rao, Environmental Pollution Control Engineering, New Age International Publishers, 2018

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B. Tech. (Industrial Chemistry)

B.Tech. - I (Industrial Chem), Semester – II FUNDAMENTALS OF ORGANIC CHEMISTRY CY102	Scheme	L	T	P	Credit
		3	1	2	05

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Impart knowledge in fundamental aspects of organic chemistry.
CO2	Understand and apply concepts of organic chemical structure.
CO3	Predict products, including stereochemistry, in the reactions of alkanes, alkenes, dienes, and cycloalkanes.
CO4	Identify chiral carbons as (R) or (S), identify relationships between pairs of molecules as enantiomers, diastereomers, or equivalent, and identify when a solution is racemic versus optically active
CO5	Know about the types of reactions and mechanisms by realizing the various factors which are affecting the reactions.

2.	**Syllabus**	
	GENERAL INTRODUCTION	**(06 Hours)**
	Classification of organic compounds and functional groups, Tetra-valency of Carbon, Structural representations of organic compounds. Physical properties of organic compounds: Solubility, Polarity, organic Acid and bases, pKa and pH, Lewis acid and base (hard/soft), dipole moment and substituent effects, types of intramolecular and intermolecular reaction.	
	METHODS OF PURIFICATION OF ORGANIC COMPOUNDS	**(04 Hours)**
	Sublimation, Crystallisation, Distillation (Simple, Fractional, Vacuum and Steam), Differential Extraction.	
	CONCEPTS IN ORGANIC REACTION MECHANISMS	**(09 Hours)**
	Fission of a covalent bond, Nucleophiles and Electrophiles, Electron Movement in Organic Reactions, Electron Displacement Effects in Covalent Bonds, Inductive Effect, Resonance Structure, Resonance Effect, Electromeric Effect, Hyperconjugation and Types of Organic Reactions and Mechanisms (aliphatic and aromatic compounds).	
	STEREOCHEMISTRY OF ORGANIC COMPOUNDS	**(09 Hours)**
	Conformations and configurations of alkanes; molecular chirality, enantiomers, diastereomers, threo- and erythro- diastereomers, meso compounds, resolution of enantiomers, retention and racemization. Relative and absolute configuration, sequence rules, D and L systems of nomenclature and R and S systems of nomenclature. Determination of composition of enantiomers and diastereomers. Geometric isomerism: determination of configuration of geometric isomers E and Z systems of nomenclature, geometric isomers of oximes and alicylic compounds.	
	ORGANIC COMPOUNDS AND REACTIONS	**(09 Hours)**
	Structure and properties, relationship between shapes and properties of organic molecules:	

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	reactive intermediates, electrophiles and nucleophiles, free radical, carbonium ion and carbanion, carbenes, nitrenes, and arynes, types of organic reactions: stepwise, ionic and free radical mechanisms, single step concerted mechanism, addition, substitution, elimination and rearrangement, method of determining mechanisms (identification of product, isotope effects and determination of reaction intermediates).	
	HYDROCARBONS	**(08 Hours)**
	Structure, preparation and reactions of: alkanes, alkenes and alkynes. Dienes: Nomenclature, classification, methods of formation of butadiene, chemical reactions, conjugated and isolated dienes, resonance stabilization, 1,2- versus 1,4- addition. Cycloalkanes:Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations, theory of strainless ring. Reactions and stereochemistry of substituted cyclohexane.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

3.	**Tutorials**
1	Drawing various mechanisms with curly arrow step-by-step.
2	Relative strengths of organic acids and bases.
3	Relative stability of reaction intermediates.
4	Systematic nomenclature of organic compounds
5	Structure and reactivity relationship of organic reactions.
6	Method of determining mechanisms of organic reactions.
7	Nomenclature of cycloalkanes
8	Conformational isomers of alkanes and cycloalkanes
9	Molecular chirality, enantiomers, diastereomers.
10	Meso compounds, racemic mixture. resolution of enantiomers
11	Threo- and erythro- D and L systems of nomenclature and R and S systems of nomenclature.
12	Determination of configuration of geometric isomers E and Z systems
13	Determination of composition of enantiomers and diastereomers.
14	Reactions and stereochemistry of substituted cyclohexane.

4.	**Practical**
1	Filtration, melting point and mixed melting point
2	Demonstration: Purification of liquid organic compounds
3	Simple Distillation (Methanol and water)
4	Determination of boiling point using distillation (Methanol and water)
5	Distillation at reduced pressure (Methanol)
6	Demonstration: Purification of solid organic compounds
7	Crystallization (Benzoic acid)
8	Crystallization (Acetanilide)

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

9	Fractional recrystallization (Cinnamic acid and benzoic acid)
10	Sublimation (benzoic acid and sugar)

5.	**Books Recommended**
1	Clayden, J., Greeves, N., & Warren, S. (2012). Organic Chemistry (2nd ed.) Oxford University Press.
2	Carey, Francis A., and Robert M. Giuliano. Organic Chemistry, (10th ed.). New York, McGraw-Hill, 2016.
3	M. B. Smith, Jerry March, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, sixth edition, Wiley-Interscience, 2012.
4	H. Maskill (Ed.), The Investigations of Organic Reactions and Their Mechanisms, first edition, Blackwell Publishing Ltd. Oxford, 2006.
5	V. K. Yadav, Steric and Stereoelectronic Effects in Organic Chemistry, Springer, first edition, 2016

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B. Tech. (Industrial Chemistry)

B.Tech. - I (Industrial Chem), Semester – II BASIC INDUSTRIAL CHEMISTRY CY104	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Impart knowledge in fundamental aspects of industrial chemistry.
CO2	Acquire knowledge on material and energy balance.
CO3	Describe the composition of different types of glasses.
CO4	Understand different types of ceramics and their uses.
CO5	Describe the steps involved in the manufacturing of cement

2.	Syllabus	
	BASIC CONCEPT	**(10 Hours)**
	Unit operations and unit processes, preparation of flow diagrams, concepts of material balance and energy balance.	
	GLASS	**(09 Hours)**
	Properties and classification silicate and non-silicate glasses. Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, safety glass, borosilicate glass, fluorosilicate, colored glass, photosensitive glass.	
	CERAMICS	**(09 Hours)**
	Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications.	
	CEMENT	**(08 Hours)**
	Classification of cement, ingredients and their role, manufacture of cement and the setting process, quick setting cements	
	EXPLOSIVES	**(09 Hours)**
	Properties and classification of explosives, preparation and explosive properties of nitro-cellulose, TNT, PETN, cyclonite (RDX). Introduction of rocket propellant.	
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	Practical
1	To determine the loss on igniting the cement sample.
2	To determination the total insoluble residue in the cement sample.
3	To determine the total silica in the given sample.
4	To determine the total oxides (Sesquioxides $Fe_2O_3 + Al_2O_3$) in the given sample.
5	To determine the amount of lime (CaO) in the given sample.
6	To determine the amount of Magnesia (MgO) in the given sample.

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

7	To determine the amount of Iron as Fe_2O_3 in the given sample.
8	Preparation of nitro-cellulose.
9	Synthesis using different unit processes.
10	Synthesis using different unit processes

4.	**Books Recommended**
1	Process calculations (Stoichiommetry) K.A. Ghavane (NiraliPrakashan).
2	Basic Principles & Calculations in Chemical Engineering, David M. Himmelblau (Prentice Hall).
3	J. A. Kent: Riegelís Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
4	O. P. Vermani, A. K. Narula: Industrial Chemistry, Galgotia Publications Pvt. Ltd., New Delhi.
5	S. C. Bhatia: Chemical Process Industries, Vol. I & II, CBS Publishers, New Delhi

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B. Tech. (Industrial Chemistry)

B.Tech. - I (Industrial Chem.), Semester – II **ENGINEERING DRAWING** **ME110**	**Scheme**	**L**	**T**	**P**	**Credit**
		2	**0**	**4**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	To read, understand and apply the knowledge of orthographic projections (production-related features and instructions) in the manufacturing industry, process industry and other allied engineering applications.
CO2	To communicate with globally recognized engineers of different disciplines of engineering for research and development activities.
CO3	To get knowledge of projections and sections of different solid objects
CO4	To perceive the idea of sectional view and its advantages of it.
CO5	To apply the concept of intersections of solids for various engineering applications
CO6	To create the image of three-dimensional figures with the help of isometric projections

2.	**Syllabus**	
	INTRODUCTION	**(01 Hours)**
	Introduction: Importance of Engineering Drawing, drawing instruments and materials, B.I.S. and IS Conventions, First angle and third angle projection method.	
	ENGINEERING CURVES	**(03 Hours)**
	Classification of engineering curves, construction of conics, cycloidal, Involutes and spirals curves.	
	PROJECTION OF POINTS, LINES AND PLANES	**(04Hours)**
	Introduction to principal planes of projection, Projections of the points located in the same and different quadrants, projection of lines with its inclination to the reference planes, true length of the lines and its inclination with reference planes, projection of planes with its inclination with two reference planes, concept of an auxiliary plane method for projection of planes.	
	PROJECTION AND SECTION OF SOLIDS	**(03 Hours)**
	Classification of the solids, projections of the solids like cylinder, cone, pyramid and prism with its inclination to two reference planes, Section of such solids and true shape of the section	
	DEVELOPMENT OF THE LATERAL SURFACES	**(03 Hours)**

	Method of development, parallel line development, radial line development, developments of cylinder, cone, prism, pyramid, true length of edges – oblique surface.	
	PENETRATION CURVE	**(04 Hours)**
	Classification, line of interaction, line/generator method and section plane method; intersection of two prisms, two cylinders, interaction of cone and cylinder, pyramid with prism, surface development.	
	ORTHOGRAPHIC PROJECTIONS	**(04 Hours)**
	Projections from a pictorial view of the object on the principal planes for view from front, top, and side using a first and third angle of the projection method	
	ISOMETRIC PROJECTIONS	**(04 Hours)**
	Terminology, isometric scale, construction of isometric view and isometric projection, isometric axes, and lines	
	INTRODUCTION TO COMPUTER-AIDED DRAFTING	**(04 Hours)**
	Introduction of the drafting and modeling software and demonstration of its application on the latest machines.	
		(Total Contact Time: 30 Hours)

3.	**Practical: Practice with drawing sheets**
1	Orthographic views
2	Isometric views
3	Engineering curves
4	Projection of points and planes
5	Projection of solids
6	Section of solids
7	Penetration curve and surface development
8	Demonstration of computer-aided drafting and demonstration of its application in the latest machines.
9	Determination of cloud point and pour point of biodiesel and its comparison with diesel

4.	**Books Recommended**
1	Bhatt, N.D.,2023. Engineering Drawing. Charotar Publishing House Pvt. Limited
2	Shah P. J., 2013, Engineering Graphics, S. Chand and Company.
3	Basant Agrawal, C M Agrawal, 2019, Engineering Drawing, McGraw Hill Education (India) Private Limited
4	S.R. Singhal, O. P. Saxena, 2014, Engineering Drawing, Asian Publisher
5	R. K. Dhawan, 2019, A Textbook of Engineering Drawing, S Chand Publishing

B.Tech. - I (Industrial Chem.), Semester – II FUNDAMENTALS OF COMPUTER AND PROGRAMMING CS110	Scheme	L	T	P	Credit
		3	0	2	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Acquire knowledge about computer architecture, network and software development.
CO2	Install an operating system and configure the network along with programming skills to solve the given problem.
CO3	Debug network and operating system related issues and analyse the given problem.
CO4	Evaluate programming solutions with different aspects.
CO5	Design and develop solution for given problems.

2.	Syllabus	
	INTRODUCTION TO COMPUTER AND ITS ARCHITECTURE	**(02 Hours)**
	Introduction and Characteristics, Computer Architecture, Generations, Classifications, Applications, Central Processing Unit and Memory, Communication between various Units, Processor Speed, Multiprocessor System, Peripheral Buses, Motherboard Demonstration.	
	MEMORY AND VARIOUS INPUT AND OUTPUT DEVICES	**(02 Hours)**
	Introduction to Memory, Input and Output Devices, Memory Hierarchy, Primary Memory and its Types, Secondary Memory, Classification of Secondary Memory, Various Secondary Storage Devices and their Functioning.	
	NUMBER SYSTEMS	**(01 Hour)**
	Introduction and type of Number System, Conversion between Number System, Arithmetic Operations in different Number System, Signed and Unsigned Number System.	
	INTRODUCTION TO SYSTEM SOFTWARES AND PROGRAMMING LANGUAGES	**(04 Hours)**
	Classification of Computer Languages, Introduction of Operating System, Evolution, Type and Function of OS, Unix Commands, Evolution and Classification of programming Language, Feature and Selection of good Programming Language, Development of Program, Algorithm and Flowchart, Program Testing and Debugging, Program Documentation and Paradigms, Characteristics of good Program.	
	WINDOWS OPERATING SYSTEM AND ITS ENVIRONMENT	**(02 Hours)**
	Introduction to GUI based OS, Configuration, Setup, Services, Network Configuration.	
	LINUX OPERATING SYSTEM AND ITS ENVIRONMENT	**(02 Hours)**
	Introduction to Unix based OS, Configuration, Setup, Services, Scripting, Network Configuration.	
	DEBUGGING TOOLS AND COMPILER OPTION	**(04 Hours)**
	Different Debugging tools, Commands, Memory dump, Register and Variable Tracking, Instruction and Function level debugging, Compiler Options, Profile Generation.	

	DATA COMMUNICATION, COMPUTER NETWORK AND INTERNET BASICS	**(02 Hours)**
	Data Communication and Transmission media, Multiplexing and Switching, Computer Network and Network Topology, Communication Protocols and Network Devices, Evolution and Basic Internet Term, Getting Connected to Internet and Internet Application, Email and its working, Searching the Web, Languages of Internet, Internet and Viruses.	
	PROGRAMMING USING 'C' LANGUAGE – INTRODUCTION	**(06 Hours)**
	Characteristics of C Language, Identifiers and Keywords, Data Types Constants and Variables, Declarations and Statements, Representation of Expressions, Classification of Operators and Library Functions for Data Input and Output Statements, Formatted Input and Output Statements.	
	PROGRAMMING USING 'C' LANGUAGE – CONTROL STATEMENTS, STRUCTURES, ARRAYS, POINTERS	**(12 Hours)**
	Conditional Control Statements, Loop Control Statements, One Dimensional Array of Numbers and Characters, Two-Dimensional Array, Introduction and Development of User Defined Functions, Different Types of Variables and Parameters, Structure and Union, Introduction to Pointers, Pointer Arithmetic, Array of Pointers, Pointers and Functions, Pointers and structures, File Handling Operations.	
	PROGRAMMING USING 'C' LANGUAGE – FUNCTIONS	**(06 Hours)**
	Functions, Passing the arguments, Return values from functions, Recursion, Header Files Design, File handling operations, Read and Write to Secondary Devices, Read and Write to Input and Output Ports.	
	PROGRAMMING USING 'C' LANGUAGE – GRAPHICS, DEBUGGING	**(02 Hours)**
	Include Graphics Library, Debugging, Linking, Compilation Option for Optimization, Make file.	
	Practical will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practical**
1	Basic commands of Windows and Linux
2	Flow chart drawing and writing pseudo steps or algorithms steps
3	Programming for logic development using different control statements
4	Programming for familiarity with control statement, array, pointers
5	Programming using structures, pointers, programming using functions

4.	**Books Recommended**
1	"Introduction to Computer Science", Fourth Impression, Pearson Education, ITL Education Solutions Limited, 2009.
2	Gottfried B.S., "Programming with C Schaum's outline Series", Outline Series, 2^{nd} Edition, Tata McGraw-Hill, 2006.
3	Brian W. Kernighan, Dennis M. Ritchie, "The C Programming language", 2^{nd} Edition, Prentice Hall PTR publication, 1988.
4	E. Balagurusamy, "Programming in ANSI C", 6^{th} Edition, Tata Mc-Graw Hill, 2012.
5	PradipDey, "Programming in C", 2^{nd} Edition, Oxford University Press, 2012.

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Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B. Tech. (Industrial Chemistry)

B.Tech. - I (Industrial Chem.), Semester – II ENGLISH AND PROFESSIONAL COMMUNICATION HS110	Scheme	L	T	P	Credit
		3	1	0	04

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Show enhanced reception towards the use of English language.
CO2	Choose and employ appropriate words for professional communication.
CO3	Develop sentences and text in English coherently and formally.
CO4	Demonstrate overall improvement in oral communication.
CO5	Analyze and infer from written and oral messages.

2.	**Syllabus**	
	COMMUNICATION	**(05 Hours)**
	Introduction to Communication, Different forms of Communication, Barriers to Communication and some remedies, Non-Verbal Communication – Types, Non-Verbal Communication in Intercultural Context	
	VOCABULARY AND USAGE OF WORDS	**(05 Hours)**
	Common Errors, Synonyms, Antonyms, Homophones, and Homonyms; One Word Substitution; Misappropriations; Indianisms; Redundant Words.	
	LANGUAGE THROUGH LITERATURE	**(09 Hours)**
	Selected short stories, essays, and poems to discuss nuances of English language.	
	LISTENING AND READING SKILLS	**(06 Hours)**
	Types of listening, Modes of Listening-Active and Passive, Listening and note taking practice, Practice and activities Reading Comprehension (unseen passage- literary /scientific / technical) Skimming and scanning, fact vs opinion, Comprehension practice	
	SPEAKINGSKILLS	**(10 Hours)**
	Effective Speaking, JAM, Presentation Skills- types, preparation and practice. Interviews-types, preparation and mock interview; Group Discussion- types, preparation and practice	
	WRITING SKILLS	**(10 Hours)**
	Prerequisites of effective writing, Memo-types, Letter Writing- types, Email etiquette and Netiquette, Résumé-types, Report Writing and its types, Editing.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Letter and Resume

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

2	Group Discussion
3	Presentation Skills (Individual)
4	Role Play on Nonverbal communication
5	Group Presentation
6	Debate
7	Body language and intercultural communication
8	Listening Activities
9	Editing
10	Report Writing
11	Mock interviews
12	JAM

4.	**Books Recommended**
1	Kumar, Sanjay and Pushp, Lata. *Communication Skills*, 2nd Edition, OUP, New Delhi, 2015.
2	Raman, Meenakshi& Sharma Sangeeta. *Technical Communication Principles and Practice*, 3rd Edition, OUP, New Delhi, 2015.
3	Raymond V. Lesikar and Marie E Flatley. *Basic Business Communication skills for Empowering the Internet generation.* Tata McGraw Hill publishing company limited. New Delhi 2005.
4	Courtland L. Bovee, John V. Thill, and MukeshChaturvedi. “Business Communication Today.” Ninth Edition. Pearson, 2009.
5	Mike Markel. “Practical Strategies for Technical Communication,” Bedford/ St. Martin's Second Edition, 2016
6	Laura J. Gurak and John M. Lannon. “Strategies for Technical Communication in the Workplace,” Pearson, 2013.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Chemistry
B. Tech. (Industrial Chemistry)

B.Tech. - I (Industrial Chem.), Semester – II NUMERICAL METHODS IN CHEMICAL ENGINEERING CH106	Scheme	L	T	P	Credit
		3	1	0	04

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Apply curve fitting techniques to approximate a function in interpolating and extrapolating a given data.
CO2	Analyze the different samples of data at different level of significance using various hypothesis testing.
CO3	Solve system of linear and non-linear equations using direct and iterative methods.
CO4	Compare various numerical methods for solving ordinary and partial differential equations.
CO5	Solve chemical processes and design problems.

2.	**Syllabus**	
	INTERPRETATION OF ENGINEERING DATA	**(08 Hours)**
	Curve fitting: Least square regression. Interpolation: Newton's Forward/Backward interpolation, Lagrange's interpolation and their applications.	
	ENGINEERING STATISTICS	**(10 Hours)**
	Errors and its propagation. Significance tests: Null hypothesis, alternative hypothesis, p-value, Type-I and Type-II error, confidence interval, central limit theorem. Z-test, t-test, f-test, chi square test, etc. Analysis of variance (ANOVA)	
	NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS	**(10 Hours)**
	Linear systems of equations, Solutions by Cramer's Rule, Matrix methods, Gauss-Jordan, Gauss Elimination, Gauss Jacobi, Gauss-Seidel and Relation methods. Non-linear equations: Bisection, Regula-falsi, Secant and Newton- Raphson methods.	
	NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS	**(10 Hours)**
	Initial value problems for ordinary differential equations: Euler's,Runge-Kuttaand Milne's predictor-corrector methods. Boundary value problems: Finite difference methods, Partial differential equations: Solutions of elliptic, parabolicand hyperbolic types of equations.	

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	FORMULATION OF PHYSICAL PROBLEMS	**(07 Hours)**
	Mathematical statement and representation of problems, Exponential growth and decay, Newton's law of cooling, Batch reaction kinetics, Radial heat transfer through a cylindrical conductor, salt accumulation in a stirred tank.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Tutorial is based using curve fitting methods.
2	Tutorial is based on interpolation methods.
3	Tutorial is related to tests of significance
4	Tutorial based on ANOVA.
5	Tutorial is based on finding solutions to linear equations by direct methods.
6	Tutorial is based on finding solutions to non-linear equations by iterative methods.
7	Tutorial is based on finding solutions to initial value problems.
8	Tutorial is based on finding solutions to boundary value problems.
9	Tutorial is based on formulation of physical problems.

4.	**Books Recommended**
1	S.S. Sastry, Introductory Methods of Numerical Analysis, 5th Edition, PHI Learning Private Limited, 2012.
2	M. K. Jain, S.R.K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computations, 8th Edition, New Age International publications, 2022.
3	Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers, 8th Edition, Mc. Graw Hill, 2021
4	Pradeep Ahuja, Introduction to Numerical Methods in Chemical Engineering, 2nd Edition, PHI Learning Private Limited, 2019.
5	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., Probability and Statistics for Engineers andScientists, 9thEdition, Pearson Education, Asia, 2011.
6	Norman W. Loney, Applied Mathematical Methods for Chemical Engineers, 3rd Edition, CRC Press, 2015.

Annexure 66.36
of 66th meeting of the IAAC

SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY (SVNIT) SURAT

Reschedule of Academic Activities (Due to Parliamentary Election 2024 & NBA Visit)

SPRING SEMESTER (EVEN SEMESTER): A. Y. 2023-24

Ref. 1: Dean (Academic)/1803 dated 06.03.2024

In continuation of earlier Notice (vide Ref. 1), some modifications have been made as follows:

Sr. No.	Activity	Original Schedule	Revised Schedule
1	XX Grade Submission	19 April, 2024	4 April, 2024
2	Make up tests and Practical Examination	22 - 26 April, 2024	1 - 7 April, 2024
3	**Last Day of Teaching**	26 April, 2024	**13 April, 2024**
4	**End Semester Examination**	29 April - 3 May, 2024	**15 - 20 April, 2024**
5	End – Minor Regular Common Subjects	6 - 8 May, 2024	22 - 27 April, 2024
6	**Project/Internship (UG) Exam**	6 - 10 May, 2024	**9 - 15 May, 2024**

Teaching Schedule to be followed

Sl. No.	Date	Time table to be followed
1	12.04.2024	Time table of Friday (in lieu of 15.03.2024)
2	13.04.2024	Time table of Monday

21.03.24

DEAN (ACADEMIC)

अनुमत 21/3/24

DIRECTOR

DEAN ACADEMIC
S.V.N.I.T., SURAT-7
INWARD No. ....
OUTWARD No. 1877
Date 21-03-2024