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	**23**	**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

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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)				
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	Institute Elective**	CS3BB	3-X-X	3/4	55/70/85
6	MOOC Course*	Φ	-	3/4	70/80
	*MOOC Course may be registered either in Fifth or Sixth Semester		**Total**	**18/21-20/24**	**350/420-410/490**
7	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	Institute Elective**	CS3EE	3-X-X	3/4	55/70/85
6	MOOC Course*	Φ	-	3/4	70/80
	*MOOC Course may be registered either in Fifth or Sixth Semester		**Total**	**18/21-20/24**	**350/420-410/490**
7	Minor / Honor (M/H#3)	CS3FF	3-X-X	4	70/85
8	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**

** to be offered to the UG students of other departments

Sr. No.	Optional Core	Code	Scheme L-T-P
1	Artificial Intelligence	CS232	3-0-2
2	Information Security	CS233	3-0-2

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3	Machine Learning	CS331	3-0-2
4	Distributed Computing	CS332	3-0-2
5	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
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	3-0-0
16	System Analysis and Simulation	CS455	3-0-2
17	Security in the Internet of Things *	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
23	Introduction of Large Language Models*	CS441	3-0-2

Sr. No.	Institute Elective	Code	Scheme L-T-P
	Fifth Semester (3rd year of UG)		
1	Object Oriented Programming	CS231	3-0-2
2	Soft Computing	CS365	3-0-2
	Sixth Semester (3rd year of UG)		
1	Ethical Hacking	CS364	3-0-2
2	Computer Vision and Image Processing	CS368	3-0-2
3	Applied Machine Learning	CS372	3-0-2

	B.Tech. I Semester – I/II (For other disciplines)

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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

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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)**

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	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)	

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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", 2/E, Pearson Education, ITL Education Solutions Limited, 2011.
2	Nell Dale and John Lewis, "Computer Science Illuminated", 8/E, Jones and Bartlett Publishers, 2023.
3	Robert Sedgewick and Kevin Wayne, "Computer Science: An Interdisciplinary Approach", Addison-Wesley, 2016.
4	Ashok N. Kamthane, Raj Kamal. "Computer Programming and IT", Pearson, 2012.
5	Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Oxford University Press, 2013.

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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)**

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	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.	

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	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”, 8/E, Mc-Graw Hill, 2019.

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2	Brian W. Kernighan / Dennis Ritchie,"The C Programming Language", 2/E, Pearson, 2021.
3	Yashavant Kanetkar, "Let us C",19/E, BPB Publications, 2022.
4	Samuel P. Harbison and Guy L. Steele, "C: A Reference Manual". 5/E, Pearson, 2002.
5	Byron S Gottfried, "Programming with C", 4/E, Tata McGraw-Hill, 2018.

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**

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), $As per

*As per, MoM of committee dated 17th July, 2025, 28th Nov 2025, , 71st IAAC, Dated 5th December 2025,

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", 6thEdition, TMH, 2006.
2	Van Valkenburg M E, "Network Analysis", 3rdEdition, PHI, 2002.
3	Samarjit Ghosh, "Network Theory, Analysis & Synthesis",3rd Edition, PHI, 2005.
4	C.L.Wadhwa, "Network Analysis & Synthesis", Revised 3rdEdition, New Age International Publishers, 2007.
5	Kothari and Nagrath, "Basic Electrical Engineering", 2ndedition, Tata McGraw-Hill Education, 2007.

ADDITIONAL REFERENCE BOOKS	
1	V. N. Mittle & Arvind Mittal, "Basic Electrical Engineering", 2nd 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.	

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), $As per

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	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.

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), $As per

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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.

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)**

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), $As per

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	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

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), $As per

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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	

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), $As per

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	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.

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), $As per

*As per, MoM of committee dated 17th July, 2025, 28th Nov 2025, , 71st IAAC, Dated 5th December 2025,

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	M. L. Young," The Complete reference of Internet", Tata Mc Graw Hill, 2/E, 2002.
2	W. G. Lehnert, "Internet 101, 1/E, Person Education, 2001.
3	B. Underdahle and K. Underdahle, "Internet and Web Page/ Website design", 2/E, IDG Books India (P) Ltd., 2001.
4	D. Comer, "The Internet Books," Prentice Hall of India, 5/E, 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 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.	

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), $As per

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	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

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), $As per

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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", 3rd Ed., McGraw-Hill, 2014.
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.

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), $As per

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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	

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	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, April 2015.
3	Benny Joseph, Environmental Studies, TMH Publishers,2018.
4	Dr. Suresh K. Dhameja, Environmental Studies, S. K. Kataria & Sons, 2014.

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5	U. K. Khare, Basics of Environmental Studies, Tata McGraw Hill, 2014.

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

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, July 2020.
2	Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., Ed 2006.
3	Gilbert Strang, "Introduction to Linear Algebra", Wellesley Cambridge Press, sixth Ed., 2023.
4	David C. Lay, "Linear Algebra and its applications", fifth Ed., Pearson, 2016.
5	A. Papoulis and S. U. Pillai, "Probability, Random Variables and Stochastic Processes", 4th Ed., Mc-Graw Hill, 2002.

ADDITIONAL REFERENCE BOOKS

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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	

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	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", 2/E, Pearson Education, ITL Education Solutions Limited, 2011.
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
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

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)**

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	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.

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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;	

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	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, 2020.
4	P R Rao, Indian Heritage and Culture, Sterling Publishers Pvt. Ltd, 1988.
5	D. Singh, Indian Heritage and Culture, APH Publishing Corporation, 2014.
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, 2019.

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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 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.	

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	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.

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), $As per

*As per, MoM of committee dated 17th July, 2025, 28th Nov 2025, , 71st IAAC, Dated 5th December 2025,

4.	**Books Recommended**
1	John L. Hannessy, David A. Patterson, "Computer organization and Design", 5/E, Morgan Kaufmaan, reprint -2014.
2	Andrew S. Tanenbaum, "Structured Computer Organization", 6/E, PHI EEE, reprint 1995.
3	William Stallings, "Computer Organization & Architecture: Designing For Performance", 11/E, PHI, 2019.
4	Carl Hamacher, Zvonko Vranesic, Safwat Zaky,Naraig Manjikian "Computer Organization and Embedded Systems", 6/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 Computer Science and Engineering
B.Tech. Computer Science and Engineering

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)**

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

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	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

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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", 7/E, TMH, 2019.
2	Jeffrey A. Hoffer, V. Ramesh, Heikki Topi, "Modern Database Management",12/E, Pearson Education Limited 2016
3	C.J Date, "An Introduction to Database Systems", Publisher: Addison, Wesley, 8/E, 2004.
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, 2006.

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 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	

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)

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	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", 4/E, MIT Press, 2022.
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.

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

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

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)

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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 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)**

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

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	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", 7/E, MGH, 2012.
2	Liu C.L., "Elements of Discrete Mathematics", (Sie)3E, 2008.

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

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3	Deo Narsingh., "Graph theory with applications to Engineering & Computer Science", Dover Publication, 2017.
4	J. A.Bondy and U. S. R.Murty, “Graph Theory”, 1/E, Springer, 2010.
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 Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. II (CSE) Semester – III B.Tech. III (CSE) Semester - V (INSTITUTE ELECTIVE) 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.	
	DYNAMIC MEMORY MANAGEMENT	**(04 Hours)**
	Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.	
	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,	

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	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.	
	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.

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4.	**Books Recommended**
1	E. Balagurusamy, "Object Oriented Programming with C++",8/E McGraw Hill Education (India),2020.
2	E. Balagurusamy, "Programming with JAVA", 7/E , McGraw Hill, 2023.
3	Yashwant Kanetkar, "Object Oriented Programming using C++", BPB, 2004.
4	R. Lafore, "Object Oriented Programming using C++",4/E SAMS Publications, 2005.
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 Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. III (CSE) Semester - V (INSTITUTE ELECTIVE) SOFT COMPUTING CS365	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 human intelligence, artificial Intelligence and the knowledge about the soft computing approaches.
CO2	Apply different soft computing techniques like fuzzy logic, genetic algorithm, neural network and bio-inspired techniques, Evolutionary approaches for problem solving.
CO3	Analyse the learning methods for optimizing the solution.
CO4	Evaluate performance of different soft computing techniques.
CO5	Design and innovate solution for real life example using bio-inspired techniques which mimic human brain abilities.

2.	Syllabus	
	INTRODUCTION	**(06 Hours)**
	Concepts of Artificial Intelligence, Need of Machine Learning, Learning Methods, Soft Computing Approach, Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Applications.	
	NEURAL NETWORK	**(13 Hours)**
	Model of Artificial Neuron, Neural Network Architectures, Weights, Activation Functions, Learning Models, Learning Rate, Bias, McCulloch Pitts Neuron, Single Layer Neural Network, Multi Layers Neural Networks, Training Algorithms, Back Propagation Method, Supervised Learning, Unsupervised Learning, Radial Basis Functions, Auto-associative Memory, Bi-directional Hetero-associative Memory, Hopfiled Network, Kohonen Self-organizing Network, Learning Vector Quantization, Simulated Annealing Network, Boltzmann Machine, Applications.	
	FUZZY SET THEORY	**(08 Hours)**
	Fuzzy Sets, Membership, Fuzzy Operations, Properties, Fuzzy Relation, Fuzzy Systems, Fuzzy Logic, Fuzzification, Fuzzy Inference, Decision Making, Fuzzy Rule based System, De-fuzzification, Applications.	

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	GENETIC ALGORITHMS	**(08 Hours)**
	Fundamentals of Genetic Algorithms, Chromosomes, Encoding, Selection Operator, Mutation Probability, Mutation Operator, Crossover Probability, Crossover Operator, Fitness Function, Different Variants of Genetic Algorithms, Applications.	
	NATURE INSPIRED TECHNIQUES AND HYBRID SYSTEM	**(10 Hours)**
	Ant Colony, Particle Swarm Optimization, Integrating Neural Networks, Fuzzy Logic, and Genetic Algorithms, GA based Back Propagation Networks, Fuzzy Back Propagation Networks, 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	Simulate a simple linear neural network model. Calculate the output of neural net using both binary and bipolar sigmoidal function.
2	Generate AND/NOT/XOR function using McCulloch-Pitts neural net.
3	Write a program to implement Hebb's rule.
4	Write a program to implement of delta rule. II
5	Write a program for Back Propagation Algorithm
6	Write a program for ACO Algorithm and demonstrate with an example.
7	Write a program for Hopfield Network and explain how energy analysis can be done.
8	Simulate an environment for Multi robot target searching using fuzzy logic and neural networks.
9	Write a program to demonstrate the fuzzy operators with examples.

4.	**Books Recommended**
1	Timothy J. rd Ross, "Fuzzy Logic with Engineering Applications", 3rd Ed., Willey, 2010.
2	B. Yagnanarayana, "Artificial Neural Networks", 1st Ed., PHI, 2009.
3	Simon O. Haykin, "Neural Networks and Learning Machines", 3/E, 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)

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

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4	S. Rajasekaran, G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", PHI, 2007.
5	David E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", 1st Ed., Addison-Wesley Professional, 2006.

ADDITIONAL REFERENCE BOOKS	
1	S. N. Sivanandam, S. N. Deepa, “Principles of Soft Computing”, Wiley India Edition, 2010.
2	Hoffmann F., Koeppen M., Klawonn F., Roy R, “Soft Computing: Methodologies and Applications”, Springer, 2005.
3	Rafik Aziz Aliev, Rashad Rafig Aliyev, “Soft Computing and Its Applications”, World Scientific, 2001.
4	F. Martin, Mc Neill, and Ellen Thro, “Fuzzy Logic: A Practical approach”, AP Professional, 2000.

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 – 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)**

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)

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	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, 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)**

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	(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, Satish Shah, “Microprocessors and Interfacing” , Oxford University Press, 2012.
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", 3/E, TMH, 2012.

ADDITIONAL REFERENCE BOOKS

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

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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 Computer Science and Engineering
B.Tech. Computer Science and Engineering

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)**

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	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 system 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.

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)

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B.Tech. Computer Science and Engineering

4.	**Books Recommended**
1	William Stalling, "Data and Computer Communication", 10/E, Pearson India, 2017.
2	B. Forouzan, "Data Communication and Networking", 6/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.

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	Acquires knowledge of the basis of theory of computation, different computational problems and the importance of automata as a modelling tool of computational problems.
CO2	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 form 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 EXPRESSION	**(12 Hours)**

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	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.

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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.

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.	

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

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	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)**

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	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, and Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed., 2009.
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.

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

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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 – 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	

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

*As per, MoM of committee dated 17th July, 2025, 28th Nov 2025, , 71st IAAC, Dated 5th December 2025,

	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)**

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

3.	**Books Recommended**
1	William Stallings, Cryptography and Network Security – Principles and Practice, 8th Edition, Pearson Education, 2022.
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, 4th Edition, CRC Press, 2018.
5	William Stallings, Network Security Essentials: Applications and Standards, 6th Edition, Pearson Education, 2018.

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
Department of Computer Science and Engineering
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.	

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

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	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.

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

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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., 2018.
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)**

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), $As per

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	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.

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ADDITIONAL REFERENCE BOOKS	
1	Ranjjan Shinghal, "Pattern Recognition Techniques and Application", 1st Edition, Oxford university press, 2006.

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 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,	

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)

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	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.

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), $As per

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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 Theory and Practice, Tata McGraw Hill, 11th Edition, 2022.

ADDITIONAL REFERENCE BOOKS	
1	Crane A. & Matten D., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Oxford University, 4th edition, 2016.
2	Fritzsche D. J., Business Ethics: a Global and Managerial Perspectives, McGraw Hill Irwin, Singapore, 2005.
3	Mandal S. K., Ethics in Business and Corporate Governance, Tata McGraw Hill, 2011.

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

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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 – 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,	

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)

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	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.

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), $As per

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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", 6/E, McGraw Hill, 2014.
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.

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 – 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)**

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), $As per

*As per, MoM of committee dated 17th July, 2025, 28th Nov 2025, , 71st IAAC, Dated 5th December 2025,

	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**

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), $As per

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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”, 4th Edition, Pearson Education. Inc 2023.
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”, Third Edition E, Pearson Education, 2003.
5	Colouris, Dollimore, Kindberg, "Distributed Systems Concepts & Design", 5th Edition, Pearson Ed. 2011.

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 – 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.	

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	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.

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

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

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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 - VI (INSTITUTE ELECTIVE) ETHICAL HACKING CS364	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 core concepts related to ethical hacking and information security.
CO2	Utilize tools and techniques to identify and exploit vulnerabilities ethically.
CO3	Analyze and mitigate threats to system and network security.
CO4	Apply principles of ethical hacking in professional environments with a focus on legal and ethical compliance.
CO5	Conduct penetration testing and propose solutions for secure systems.

2.	Syllabus	
	INTRODUCTION: ETHICAL HACKING, FOOTPRINTING AND RECONNAISSANCE	**(08 Hours)**
	Ethical Hacking: Information Security Overview, Threats, Hacking Concepts, Ethical Hacking Principles, Penetration Testing Basics, Laws and Standards Footprinting Techniques, Who is Lookup, DNS Enumeration, Network Footprinting, Tools and Countermeasures.	
	SCANNING, ENUMERATION AND MALWARE ANALYSIS	**(08 Hours)**
	Network Scanning Tools and Techniques, Banner Grabbing, Vulnerability Scanning, Enumeration Methods, Countermeasures, Steganography, System Hacking and Malware Threats: Password Cracking, Privilege Escalation, Malware Analysis, Trojan and Virus Concepts, Anti-Malware Strategies.	
	SNIFFING, SOCIAL ENGINEERING AND WEB APPLICATION AND DATABASE HACKING	**(08 Hours)**
	Sniffing Techniques (ARP Poisoning, DHCP Attacks), Social Engineering Tactics, Countermeasures and Penetration Testing, Web Application and Database Hacking: SQL Injection, Cross-Site Scripting, Web Application Vulnerabilities, Tools and Testing Methods.	
	WIRELESS AND MOBILE HACKING	**(05 Hours)**
	Wireless Network Attacks, Bluetooth Hacking, Mobile OS Vulnerabilities, OWASP top 10 Vulnerabilities, Countermeasures.	

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	REMOTE EXPLOITATION	**(08 Hours)**
	Attacking Remote Services: Brute Force Attacks: Traditional brute force, Dictionary and hybrid attacks, Common target protocols: SSH, RDP, SQL, Tools of the trade: THC Hydra, Medusa, Ncrack, Practical examples: Cracking SSH with Medusa, Attacking SMTP services, Metasploit Framework: History and key features, Interfaces: MSFConsole, MSFcli, MSFVenom, Reconnaissance and database integration: Port scanning and vulnerability assessment, Storing Nmap data in Metasploit, Exploitation examples: Compromising a Windows host, Using db_autopwn.	
	CLIENT-SIDE EXPLOITATION, POST-EXPLOITATION AND PRIVILEGE ESCALATION	**(08 Hours)**
	Client-Side Exploitation: Attack scenarios: Emails with malicious attachments/links, USB-based malware attacks, PDF hacking and browser exploits, Tools: Social Engineering Toolkit (SET), Evilgrade, PDF reconnaissance with tools like PDFINFO and PDFTK, Real-world examples and defense mechanisms, Post-Exploitation and Privilege Escalation, Situation awareness: Enumerating Windows/Linux systems, Identifying processes and interacting with the system, Privilege escalation: Techniques for bypassing user access control, Token impersonation, Maintaining access: Installing backdoors, Persistence with MSFVenom, Hash cracking: Dumping and cracking hashes, Tools: John the Ripper, Rainbow Crack.	
	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	Installation of Kali Linux and Virtual Lab Setup.
2	MAC Address changer using python
3	Network Scanner Programming.
4	ARP Spoofing Implementation
5	Packet Sniffing and Spoofing
6	DNS Spoofing Demonstration.
7	Reverse Engineering Demonstration.
8	Mobile and Bluetooth Hacking Demonstartion
9	Creating and Analyzing Malware
10	Web Application Penetration Testing.
11	Writing a Vulnerability Scanner using Python

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4.	**Books Recommended**
1	Michael Gregg, "Certified Ethical Hacker (CEH) Cert Guide", 2nd Edition, Pearson India, 2014.
2	Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, 2nd Edition, CRC Press, 2017.
3	Jon Erickson “HACKING: The art of Exploitation”, 2nd Edition, William Pollock No Starch Press, 2008.
4	Allen Harper, Shome Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, Terron Villiams “Gray Hat Hacking The Ethical Hakers Handbook”, 3rd Edition, TMH, 2011.
5	Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, 2nd Edition, Elsevier, 2013.

ADDITIONAL REFERENCE BOOKS	
1	Dafydd, Stuttard, and Pinto Marcus. "The Web Application Hacker’s Handbook: Finding and Exploiting Security Flaws." (2011).
2	Shimonski, Robert. *Cyber reconnaissance, surveillance and defense*. Syngress, 2014.
3	Online ethical hacking platforms for practice e.g., Hack The Box, TryHackMe.
4	Kendall, Kris, and Chad McMillan. "Practical malware analysis." Black Hat Conference, USA. Vol. 10. 2007.

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 - VI (INSTITUTE ELECTIVE) COMPUTER VISION AND IMAGE PROCESSING CS368	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 fundamentals of image processing and computer vision and image analyzing techniques.
CO2	Apply various image processing operations for analyzing images and vision related techniques for segmentation, visualization of depth and camera calibration.
CO3	Analyze the problem and effectively use appropriate technique for image processing and vision related problem solving.
CO4	Evaluate critically the solutions developed for image processing and vision problems.
CO5	Build new applications using advanced image processing and computer vision techniques.

2.	Syllabus	
	INTRODUCTION TO COMPUTER VISION	**(06 Hours)**
	Introduction to Human Visual Perception and Geometric Vision, Photometric Image Formation, The digital camera, Image Model, Image Sensing and Acquisition, Sampling and Quantization, Mathematical Tool for Digital Image Processing, Types of Digital Images, Image File Formats, Colour Fundamentals and Models.	
	IMAGE PROCESSING BASICS	**(08 Hours)**
	Point Operations: Histogram Equalization, Log and Power-Law Transformations; Spatial Filtering: Smoothing (Gaussian), Sharpening (Laplacian, Unsharp Masking); Sampling and Fourier transform, DFT, Smoothing and sharpening in frequency domain; Edge Detection: Sobel, Prewitt, Canny Morphological Operations: Erosion, Dilation, Opening, Closing.	
	IMAGE FEATURES AND MATCHING	**(06 Hours)**
	Keypoint Detection: Harris Corner, SIFT, SURF; Feature Matching: SSD, NCC, RANSAC; Descriptor Representations: BRIEF, ORB Applications: Object Tracking, Image Registration.	
	MOTION AND DEPTH ESTIMATION	**(06 Hours)**
	Optical Flow: Lucas-Kanade, Horn-Schunck; Stereo Vision: Epipolar Geometry, Depth Estimation; Structure from Motion (SfM).	
	OBJECT DETECTION AND RECOGNITION	**(06 Hours)**
	Template Matching, Object Detection Frameworks: Sliding Window, YOLO, SSD; Recognition Methods: Bag of Visual Words, HOG , SVM, Deep Learning-Based Approaches.	
	ADVANCED TOPICS IN VISION	**(06 Hours)**

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

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	Introduction to Deep Learning for Vision: CNN Architectures (AlexNet, VGG, ResNet); Semantic Segmentation: UNet, SegNet, Generative Models: GANs for Image Synthesis and Style Transfer; Vision Transformers (ViT).	
	REAL-WORLD APPLICATIONS	**(06 Hours)**
	Case Studies: Autonomous Driving, Face Recognition, Medical Image Analysis, , Biometrics, Surveillance, Augmented Reality, Vision for Robots; Ethics and Challenges in Computer Vision.	
	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	Implementation of low level, mid-level, and high-level image processing algorithms.
2	Implementation of various filters and transformation techniques for frequency domain operations.
3	Implementation of camera calibration and estimation of internal and external parameters.
4	Implementation of depth using optical flow, stereo and motion.
5	Implementation of application-based mini-project.
6.	Implementation of image restoration techniques.
7.	Implementation of basic morphological operations.
8.	Implementation of image segmentation algorithms.

4.	**Books Recommended**
1	Rafael C. Gonzales and Richard E. Woods, "Digital Image Processing", 4th edition Education, Reprint 2018.
2	Anil K. Jain, "Fundamentals of Digital Image Processing", PHI, EEE, 4th reprint 2002.
3	David A. Forsyth and Jean Ponce, "Computer Vision: A Modern Approach", Prentice -Hall, 2004.
4	Robert M. Haralick and Linda G. Shapiro, "Computer and Robot Vision ", Addison Wesley, 1992.
5	J. R. Parker, " Algorithms for Image Processing and Computer Vision", 2nd edition, Wiley, 2010.

ADDITIONAL REFERENCE BOOKS	
1	Milan Sonka, Vaclav Hlavac, Roger Boyal, “Image Processing Analysis and Machine Vision” 3rd Ed. PWS / Thomson Publishing, 2007.

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2	Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.

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 - VI (INSTITUTE ELECTIVE) APPLIED MACHINE LEARNING CS372	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 machine learning techniques and formulation of problem in diverse field.
CO2	Apply these techniques of the algorithms to the hard machine learning problems.
CO3	Perform data analysis, data clustering and data transformation techniques for better usage and enhancement of available data.
CO4	Evaluate and compare the appropriateness and complexity of various machine learning techniques for real life problems.
CO5	Design the solution for the real life problems using machine learning approaches.

2.	Syllabus	
	INTRODUCTION	**(04 Hours)**
	Towards Intelligent Machines, Machine Learning Problems, Applications of machine learning in Diverse Fields, Data Representation, Domain knowledge, Forms of Learning, Fundamentals of Artificial Intelligence, Machine Learning, Deep Learning, Data Analytics, Big Data, IoT and Cloud Technologies.	
	MACHINE LEARNING TECHNIQUES	**(10 Hours)**
	Supervised Learning, Unsupervised Learning, Statistical Learning, Support Vector Machine, Neural Networks, Decision Tree Learning, Tree Based Ensembles.	
	DATA CLUSTERING AND TRANSFORMATION TECHNIQUES	**(04 Hours)**
	Data Analysis, Cluster Analysis, standard Clustering Techniques, Classification, Data Enhancement, standard transformation Techniques, Feature Selection, Feature Extraction.	
	BUSINESS INTELLIGENCE AND DATA MINING: TECHNIQUES AND APPLICATIONS	**(07 Hours)**
	Data Warehousing and Online Analytical Processing, Mining Frequent Patterns and Association Rules, Intelligent Information Retrieval Systems, Data Mining Applications and Trends.	
	MACHINE LEARNING APPLICATIONS	**(20 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)

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

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	Overview, Design cycle, Machine Learning Applications like Mobility: Robotics, Action Learning, Automatic Driving; Imaging: Object / Face Detection, Recognition, Tracking; Interfaces: Brainwaves (for the disable), Handwriting &Speech Recognition; Security: Spam / Virus Filtering, Virus Troubleshooting; Banking: Identify Good Customers, Minimize Credit Risk, Market Analysis; Gaming: Intelligent Player/Agent, Object Tracking, 3D Modelling; Medicine: Screening, Diagnosis of Drug Discovery; Security: Face, Signature, Iris Recognition; Bioinformatics: Disease Classification, Gene Detection, Protein Folding Prediction.	
	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 linear regression to predict house price.
2	Demonstrate the working of the decision tree based ID3 algorithm.
3	Implement Naïve Bayes theorem to classify the English text.
4	Implement the finite words classification system using Back-propagation algorithm.
5	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
6	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7	Mini Project for real world problem solving using ML.

4.	**Books Recommended**
1	M Gopal, Applied Machine Learning, Mc-Grow Hill, 2019.
2	Andreas Muller, Introduction to Machine Learning with Python: A Guide for Data Scientists, O'reilly, 2016.
3	Davy Cielen, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Dreamtech Press, 2016.
4	Ian Goodfellow , Deep Learning (Adaptive Computation and Machine Learning series), MIT Press, 2016.
5	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'reilly, 2022.

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

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)

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

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)**

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	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	Andr´e Platzer: Logical foundations of cyber-physical systems, Springer International Publishing, 2018.
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.

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) 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 -	

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	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	Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", 6/E, Cengage Learning, 2019.

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B.Tech. Computer Science and Engineering

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.	

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	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, 2003.
2	Stephen R. Schach: "Software Engineering with JAVA", TMH, 1999.

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Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

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)**

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	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 Chosen Ciphertext 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", Third Edition, Publisher: Chapman & Hall/CRC, 2021.
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", 8th Edition, Upper Saddle River: Pearson, 2017.
5	Forouzan and Mukhopadhyay, "Cryptography and Network Security", 3/E, McGraw Hill, 2015.

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ADDITIONAL REFERENCE BOOKS	
1	Schneier, Bruce, "Applied cryptography: protocols, algorithms, and source code in C", 2nd Edition, john wiley & sons, 2007.

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)**

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	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, 3rd edition, 2021.

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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, 2nd edition, 2014.
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.

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)**

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

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	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

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), $As per

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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.

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) 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)**

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	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, 5th/E, Pearson, 2023.
2	John Vacca, Network and System Security, 2/E, Elsevier, 2013.
3	William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 6th edition, 2021.
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.

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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) 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.	

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	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; 2/E, 2018, ISBN: 978-1526437945.
5	John Scott, "Social Network Analysis: A Handbook", SAGE Publications Ltd; 3/E, 2017, ISBN: 978-1446297070.

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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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) 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	

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	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", 5th Edition, Morgan Kaufmann Publishers, 2017, ISBN 13: 978-0-12-383872-8.
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

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) 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)**

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	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.

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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.

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) 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	Understand the concept of the notion of configuration space, Probabilistic Roadmaps in planning for 2D and 3D systems.
CO2	Apply search algorithms to plan the shortest path from one point to another
CO3	Aanlyze filters (including Kalman, and particle filters) in order to localize moving objects whose locations are subject to noise.
CO4	Evaluate a SLAM algorithm for a robot moving in at least two dimensions
CO5	Design an efficient system robots using artificial intelligence.

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.	

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)

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	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 and RRT
7	Introduction to sensor and implementation
8	Reasoning Under Uncertainty using Bayesian Learning
9	Reinforcement Learning using Q-Learning

4.	**Books Recommended**
1	H.R Everett, "Sensors for Mobile Robots: Theory and Application", CRC Press.

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2	S.R Deb, Sankha Deb, “Robotics Technology and Flexible Automation”, McGraw Hill Education (India), 2/E, 2010.
3	Milan Sonka Vaclav Hlavac and Rger Boyle “Image Processing, Analysis and Machine Vision”, Springer, 1/E, ISBN 978-0-412-45570-4, 1993.
4	Robin R Murphy, "Introduction to AI robotics", MIT press, 2nd Edition, 2019.
5	Francis X. Govers, "Artificial Intelligence for Robotics", Packt Publishing, ISBN: 9781788835442, 2018.

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) 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	

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	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”, 4/E, Packt publishing, 2023.
2	Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, 2/E, O’Reilly, 2014.

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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.	

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	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 , 2nd Edition, O’reilly publishing house, 2022, ISBN: 9781492072942.
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.

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B.Tech. Computer Science and Engineering

B.Tech. III/IV (CSE) BIG DATA ANALYTICS CS452 (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	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	**(08 Hours)**
	Definition of Big Data, Source of Big Data, Convergence of Key Trends, Unstructured Data, Industry Examples of Big Data, Web Analytics, Fraud and Risk Associated with Big Data, Credit Risk Management, Big Data in Algorithmic Trading, Healthcare, Medicine, Marketing and Advertising, Big Data Technologies, Introduction to Hadoop and Spark, Open Source Technologies, Cloud, Mobile Business Intelligence, Crowd Sourcing Analytics, Inter and Trans Firewall Analytics. Data Collection, Sampling and preprocessing: Types of Data Sources Sampling, Types of Data Elements ,Visual Data Exploration and Exploratory Statistical Analysis, Missing Values, Outlier Detection and Treatment, Standardizing Data, Categorization, Weights of Evidence Coding, Variable Selection, Segmentation.	
	PREDICTIVE ANALYTICS, DESCRIPTIVE ANALYTICS & SURVIVAL ANALYSIS	**(08 Hours)**
	Predictive Analytics: Target Definition, Linear Regression, Logistic Regression, Decision Trees, Neural Networks, Support Vector Machines, Ensemble Methods, Multiclass Classification Techniques, Evaluating Predictive Models Descriptive Analytics: Association Rules, Sequence Rules, Segmentation Survival Analysis: Survival Analysis Measurements, Kaplan Meier Analysis, Parametric Survival Analysis, Proportional Hazards Regression, Extensions of Survival Analysis Models, Evaluating Survival Analysis Models.	
	DISTRIBUTED FILE SYSTEM HADOOP	**(08 Hours)**

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	Introduction, HDFS Daemons, Different Methods to HDFS Access, Hadoop, Features, Google File System Features, Phases involved in Map Reduce, Architecture, Execution of MapReduce Jobs, Monitoring the progress of job flows, Building Blocks of Hadoop MapReduce. Data format, Analyzing data with Hadoop, Scaling Out, Hadoop Streaming, Hadoop Pipes, Design of Hadoop Distributed File System, MapReduce, HDFS Concepts: Java Interface, Data Flow, Hadoop I/O, Data integrity, Compression, Serialization, Avro, File–based Data Structures, Mahout, Pig, Hive, HBase.	
	BIG DATA STORAGE MODELS	**(05 Hours)**
	HBase, Data Model and Implementations, HBase Clients, HBase Examples, Praxis, Cassandra, Cassandra data Model, Cassandra Examples, Cassandra Clients, Hadoop Integration, Hive, Data Types and File Formats, HiveQL Data Definition, HiveQL Data Manipulation, HiveQL Queries, Applications on Big Data Using Pig and Hive, Data Processing Operators in Pig, Fundamentals of ZooKeeper, K-Means Clustering, Decision Trees, Random Forests, Recommenders, Table in Spark, Higher Level Declarative Programming, Network Structure, Computing Graph Statistics.	
	ADVANCED TOPICS IN BIG DATA ANALYTICS	**(05 Hours)**
	Application of Big Data Analytics, Machine Learning for Big Data, Data Mining Techniques for Big Data, Running Big Data Applications on Public Cloud Platforms.	
	(Total Contact Time: 42 Hours)	

3.	**Books Recommended**
1	Ron Bekkerman, Mikhail Bilenko, John Langford, “Scaling up Machine Learning: Parallel and Distributed Approaches”, Cambridge University Press.
2	Bart Baesens , Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, ,Wiley, 2014.
3	Michael Minelli, Michele Chambers, Ambiga Dhiraj, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
4	Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer.
5	Tom White, “Hadoop: The Definitive Guide”, O’reilly Media.
6	Arshdeep Bahga, Vijay Madisetti, “Big Data Science & Analytics: A Hands on Approach “, VPT.

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	

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	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 , Marcus Birath , Nathan Clarke, “Fundamentals of Digital Forensics A Guide to Theory, Research and Applications”, Third Edition, Springer, 2024.
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.

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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

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Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. IV (CSE) SOFTWARE SECURITY CS454 (Elective)	Scheme	L	T	P	Credit
		3	0	0	03

Course Objectives	
1	To discuss and explain the fundamental concepts of software security and defensive programming.
2	To ANALYZE the vulnerabilities in a typical memory unsafe language and the potential attacks/exploits.
3	To ANALYZE & DESIGN counter mechanisms for preventing the security vulnerabilities from being exploited and those for ensuring secure programs.
4	To ANALYZE the limits of the applicability of the Static Analysis for Software Testing tools as well as the Dynamic Analysis for Software Testing tools.
5	To DESIGN a program free from the known vulnerabilities as well as to withstand the zero-day vulnerabilities.
6	To APPLY the skills learnt to generate secure programs.

INTRODUCTION	**02 Hours**
Introduction to the course. Review of Information Security concepts. Essential Terminologies. Proactive software security vis-à-vis the security software. The concept of Software Security. Security in Software Development Life Cycle. Security as a Software Quality attribute. The trinity of troubles viz. Connectivity, Extensibility and Complexity. Studies of various catastrophes due to Insecure software. Three Pillars of Software Security. The basic terminologies: a bug, an exploit, a threat, defects, vulnerabilities, risks, attacks.	
INTRODUCTION TO CODE REVIEWS & CODE ANALYSIS	**04 hours**
Introduction to Code reviews and Static Informal reviews, Formal inspections. Illustrations. Introduction to Code reviews and Static Analysis. Code Reviews. Static Code Analysis. Static and Dynamic Application Security Testing (SAST and DAST) tools. Using basic linting to detect security vulnerabilities in the code with the linuxfind(), grep(), awk(), splint() and the FlawFinder. A glance at Code Analyzer Tools.	
REVIEW of SECURITY ATTACKS.	**04 Hours**
Review of security attacks – Taxonomy of Security Attacks, Methods. Attacks in each phase of software life cycle. DoS, DDoS attacks on the TCP/IP protocol suite layers. Motivation for attackers, Methods for attacks: Malicious code, Hidden software mechanisms, Social Engineering attacks, Physical attacks. Non- malicious dangers to software. Attack Taxonomy in Internet of Things and Cyber Physical Systems. Review of Malwares,	
THE SYSTEM SECURITY VULNERABILITIES	**10 Hours**
The Software Vulnerabilities: Vulnerabilities in the Memory-safe and memory-unsafe languages. Introduction to the Program Stack Analysis. Hands-on on Stack Analysis using gcc compiler and gdb debugger tool. Methods of security attack exploiting the vulnerabilities in the code. Taxonomy of security vulnerabilities. Remote Code	

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Execution. Overview of C, C++, Java Security Vulnerabilities. The Buffer Overflow - Stack overflows, Heap Overflows, the Code and Command Injections. and the types: The Format String vulnerabilities, writing shellcode. The Seven Pernicious Kingdoms. The OWASP Top 25 vulnerabilities in the current year.

THE WEB SECURITY VULNERABILITIES	**10 Hours**

Introduction to Session Management in Web Applications. Session Management best practices. SQL injection, Cross-site scripting, Interpreter injection; The Hidden form fields, Weak session cookies. Fault injection & Fault monitoring, Fail open authentication The XSRF (Cross-site Request Forgery) Attack. Security vulnerabilities in Java. Application misconfiguration and Software Composition Analysis (SCA).

THREAT MODELING	**10 hours**

Finding Threats: Using STRIDE, Attack Patterns, Attack Trees, Misuse Patterns. Threat modelling with Attack Trees and Graphs. Anti-models. State transition diagrams. Review of Access control models. 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. 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. Specifying Secrecy, Authentication and Assertions. Graph based specifications, UML-based specifications. Formal Security specifications. Privacy Tools: Solove's Taxonomy of Privacy, Privacy Considerations for Internet Protocols, Privacy Impact Assessments (PIA).

DYNAMIC ANALYSIS SECURITY TESTING	**05 hours**

Basics, Approaches to DAST, DAST application analysis. DAST prerequisites. DAST job order, DAST run options. Tools, DAST Pros and Cons. DAST in DevOps practices. Interactive application security testing (IAST), Software composition analysis (SCA).

(Total Contact Time: 45 Hours)

BOOKS RECOMMENDED (LATEST EDITION)

The course will be taught through the research papers prescribed in the class. However, some of the reference books that would be used are listed as follows:

1. Izar Tarandach. Threat Modeling: A Practical Guide for Development Teams. O'reilly Pubclications. 1st Edition. 2020.
2. Gary McGraw. Software Security: Building Security In. Addison Wesley Software Security Series. 1st Edition. 2006.
3. John Viega, Gary McGraw. Building Secure Software: How to Avoid Security Problems the Right Way. Addison-wesley Professional Computing Series. 1st Edition. 2011.
4. Andrew Magnusson. Practical Vulnerability Management: A Strategic Approach to Managing Cyber Risk. No starch Press. 1st Edition. 2020.

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5. Malcolm McDonald. Web Security for Developers: Real Threats, Practical Defense. No starch Press. 1st Edition. 2020.
6. Theodor Richardson, Charles Thies. Secure Software Design. Jones and Bartlet Learning Publishers, 1st Edition. 2013

Course Outcomes **At the end of the course, students will**	
CO1	to understand the fundamental concepts of software security and defensive programming, as well as understand the difference between software security and security software.
CO2	to ANALYZE & DESIGN counter mechanisms for preventing the security vulnerabilities from being exploited and those for ensuring secure programs.
CO3	to ANALYZE the limits of the applicability of the Static Analysis for Software Testing tools as well as the Dynamic Analysis for Software Testing tools.
CO4	to ANALYZE the vulnerabilities in a typical memory unsafe language and the potential attacks/exploits.
CO5	to DESIGN a program free from the known vulnerabilities as well as to withstand the zero-day vulnerabilities.

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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)**

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)

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	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	John W. Satzinger, Robert B. Jackson, Stephen D. Burd, "Systems Analysis and Design in a Changing World", 7/E, Boston, USA: Thomson Course Technology, 2016.
2	Averill M. Law, "Simulation modelling and analysis (SIE)", 5/E, Tata McGraw Hill India, 2015.
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
Department of Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. III/IV (CSE) SECURITY IN THE INTERNET OF THINGS 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 be able to UNDERSTAND the concept of resource constrained devices, their characteristics, their applications and the constraints under which they operate.
CO2	To be able to UNDERSTAND the Wireless Sensor Networks, the typical configurations of the constituent components viz. sensor motes, typical applications, operating environments, programming languages.
CO3	To be able to UNDERSTAND the importance of the Security Issues & the Denial of Service attacks in the Internet of Things.
CO4	To be able to ANALYZE the design of a typical link layer security architecture for WSNs and the design of the light weight ciphers for the WSNs.
CO5	To be able to DESIGN the security mechanisms suitable for a security protocol for the IoT viz. the IV, MAC, replay protection algorithm, key deployment algorithm for the hop-by-hop as well as end-to-end (using the Partially Homomorphic Encryption Algorithms) for the Secure Data Aggregation protocols.
CO6	To be able to ANALYZE the security protocols and routing protocols for the Internet of Things viz. 6LoWPAN and RPL.

2.	Syllabus	
	INTRODUCTION TO SECURITY IN RESOURCE CONSTRAINED DEVICES	**04 Hours**
	Reviewing the basic Information Security concepts. Introduction to Embedded Security. Design Challenges in Security for Embedded Systems. The Ubiquitous computing and Pervasive Computing Paradigms. Introduction to Wireless Sensor Networks as the actors of the Internet of Things systems, the architecture, topologies of deployment of WSNs. Case studies of real-world deployment i.e. applications.	
	THE WIRELESS SENSOR NETWORK NODES ARCHITECTURE	**02 Hours**
	The Wireless sensor nodes, typical configurations, typical real-world motes and their configurations.	
	SECURITY ISSUES IN THE INTERNET OF THINGS	**04 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)

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	The motivation for the Security Issues in WSNs, Typical Attacks and Countermeasures. The Denial of Service Attacks in Wireless Sensor Networks and the Countermeasures.	
	DESIGN OF A LINK LAYER HOP-BY-HOP SECURITY ARCHITECTURE	**08 Hours**
	Secure Data Aggregation (SDA) in Wireless Sensor Networks. End-to-end and Hop-by-hop Secure Data Aggregation. The Design of a Hop-by-hop Link Layer Security protocol in Wireless Sensor Networks. Replay protection. Designing a flexibly configurable link layer security architecture for WSNs.	
	DESIGN OF AN END-TO-END SECURITY ARCHITECTURE	**08 hours**
	End-to-end security for Secure Data Aggregation in WSNs. Partially Homomorphic Encryption Algorithms for the WSNs. Privacy in SDA.	
	KEY MANAGEMENT IN WIRELESS SENSOR NETWORKS	**04 hours**
	Key Management Techniques in the Internet of Things. Public Key Infrastructure in Wireless Sensor Networks, The TinyPK protocol as a case study. Attribute Based Encryption and its motivation for Embedded Systems.	
	SECURITY ISSUES IN ROUTING PROTOCOLS FOR THE MOBILE ADHOC NETWORKS	**03 hours**
	Security Issues in routing protocols for the Mobile Adhoc Networks. (MA-NETS). Reactive and Proactive routing protocols for the MANETS. Analysis of the Blackhole attack on the AODV routing protocol in MANETs.	
	SECURITY IN ROUTING PROTOCOLS IN THE INTERENT OF THINGS	**06 hours**
	The Security and Privacy Issues in IoT Systems. Overview of the IoT Protocols. Protocols viz. ZigBee, Bluetooth, Routing in the IPv6 over Low-power Wireless Personal Area Networks (6LowPAN), Routing Protocol for Low-Power and Lossy Networks (RPL). The Constrained Access Protocol.	
	LIGHTWEIGHT CIPHERS	**06 hours**
	Case study of one or two candidate ciphers – representative ciphers (their Encryption, Decryption and Key Management Routines) from the list viz. TEA, XTEA, XXTEA, Skipjack, RC5, miniAES, KATAN32, SQUASH, PRESENT, HIGHT, DESL, SEA.	
	(Total Contact Time: 45 Hours)	
	INTRODUCTION TO SECURITY IN RESOURCE CONSTRAINED DEVICES	

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B.Tech. Computer Science and Engineering

3.	Books Recommended
1	The course will be taught through the research papers prescribed in the class.

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)**

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	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”, 4/E, Prentice Hall Series in Artificial Intelligence Pearson, 2022.
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”, 2nd Edition, O’reily, 2022.

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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	Understand the limitations of the conventional security software in the wake of machine learning based attacks on the security software
CO2	Apply the concepts machine learning based intrusion detection to analyze the IDSs.
CO3	Analyze the malware analysis and mitigation-based solutions for the probable threats therein.
CO4	Evaluate different machine learning techniques for malware analysis, network analysis.
CO5	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.	

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	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	

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	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

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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.

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4	Steven Bird, "Natural Language Processing with Python", 1st Edition, O'Reilly, 2009.
5	Jacob Perkins, "Python Text Processing with NLTK 3.0 Cookbook", 3rdEdition, Packt Publishing, 2014.

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)**

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	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", 2017.
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, 2021.
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 first Edition, 2012.

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)**

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	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", 4/E, 2006.

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2	Jim Richards, Churchill Livingstone, "Biomechanics in Clinic and Research", 2/E, 2018.
3	David A. Winter , "Biomechanics and Motor Control of Human Movement" 5/E, 2022.

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.	

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	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

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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 Computer Science and Engineering
B.Tech. Computer Science and Engineering

B.Tech. IV (CSE) Introduction of Large Language Models CS441 (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 foundational concepts behind large language models, including transformer architectures and tokenization.
CO2	Explore the training processes, data requirements, and scaling laws of LLMs.
CO3	Analyze key LLM capabilities such as in-context learning, few-shot prompting, and fine-tuning.
CO4	Evaluate ethical, societal, and safety challenges posed by LLMs in real-world applications.
CO5	Design, build, and deploy applications using LLMs through APIs and open-source tools like Hugging Face and LangChain.

2.	Syllabus	
	INTRODUCTION	**(06 Hours)**
	● Evolution of language models: From RNNs to Transformers ● Basic components: tokenization, embeddings, attention mechanisms ● Overview of state-of-the-art LLMs (GPT, BERT and its variants, PaLM, LLaMA) ● Key terminology and concepts (parameters, pretraining, autoregression, etc.)	
	TRAINING AND SCALING OF LLMS	**(08 Hours)**
	● Pretraining vs fine-tuning ● Dataset collection and preprocessing for LLMs ● Scaling laws and performance trade-offs ● Infrastructure, compute, and optimization challenges ● Instruction tuning and RLHF ● Proximal Policy Optimization (PPO), Direct Preference Optimization (DPO), Group Relative Policy Optimization (GRPO)	

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	LLM CAPABILITIES AND TECHNIQUES	**(10 Hours)**
	● Prompt engineering: zero-shot, one-shot, few-shot prompting ● In-context learning and reasoning abilities ● Chain-of-Thought (CoT) prompting, Retrieval-Augmented Generation (RAG) ● Fine-tuning and adapter-based methods (LoRA, PEFT) ● Evaluation metrics and benchmarks (MMLU, HELM, etc.)	
	TOOLS, LIBRARIES, AND FRAMEWORKS	**(09 Hours)**
	● Hugging Face Transformers, LangChain, OpenAI API ● Tokenizers, vector databases, and prompt templates ● Model serving and deployment (Gradio, Streamlit, FastAPI) ● Experiment tracking and model versioning	
	SAFETY, ETHICS, AND SOCIETAL IMPACT	**(06 Hours)**
	● Bias, fairness, and hallucination in LLMs ● Misuse potential and responsible AI practices ● Open vs closed models and alignment challenges ● Regulatory and ethical frameworks	
	APPLICATIONS AND PROJECTS	**(06 Hours)**
	● Applications in code generation, customer support, education, and healthcare ● Hands-on mini-projects using LLM APIs and open-source models ● Case studies from real-world deployments ● Capstone project: design and build an LLM-powered application	
	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	Prompt engineering and model exploration
2	Fine-tuning and adapter-based training

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3	Building conversational agents
4	Using LangChain for LLM orchestration
5	Evaluating model responses and safety measures

4.	**Books Recommended**
1.	Sowmya Vajjala et al., Practical Natural Language Processing, Wiley, 2024
2.	Tanmoy Chakraborty et al., "Introduction to Large Language Models", Wiley, 2024.
3.	Lewis Tunstall et al., "Natural Language Processing with Transformers", O'Reilly, 2022
4.	Jay Alammar, "The Illustrated Transformer"
5.	Hugging Face Documentation – https://huggingface.co/docs
6.	Speech and Language Processing, 3rd Edition, Dan Jurafsky and James H. Martin