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

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	Third Semester (2nd year of UG)				
1	Digital Signal Processing	VL201	3-0-2	4	85
2	Analog Circuits	EC201	3-0-2	4	85
3	Microprocessors and Microcontrollers	EC205	3-0-2	4	85
4	Control Systems	EE258	3-1-0	4	70
5	Professional Ethics, Economics, and Business Management	MG210	3-1-0	4	70
			Total	**20**	**395**
6	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	ECV03 / ECP03	0-0-8	4	160 (20 x 8)
	Fourth Semester (2nd year of UG)				
1	Data Structure and Algorithms	VL202	3-0-2	4	85
2	Electromagnetic Waves	VL204	3-1-0	4	70
3	Analog and Digital Communication	VL206	3-0-2	4	85
4	Linear IC Applications	EC204	3-0-2	4	85
5	Digital Integrated Circuits	EC208	3-0-2	4	85
			Total	**20**	**410**
6	Minor / Honor (M/H#1)	EC2AA	3-0-2	4	70/85
7	Vocational Training / Professional Experience (Optional) (Mandatory for Exit)	ECV04 / ECP04	0-0-8	4	160 (20 x 8)

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B.Tech. III (VL) Semester V DIGITAL SIGNAL PROCESSING VL201	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	Define continuous and Discrete Time Signal, Discrete time System
CO2	Apply the various discrete time system and digital systems in frequency domain.
CO3	Analyze Z-transform, DTFT and FFT
CO4	Design FIR and IIR Filter
CO5	Evaluate various Realizations of filter structure and finite word length effect

2. Syllabus:

REVIEW OF DISCRETE TIME SIGNAL AND SYSTEMS **(08 Hours)**

Continuous-Time and Discrete- Time Signals, Signal classification, Discrete-time system & analysis of Discrete-time linear time invariant systems. Correlation of Discrete-time signals.

Z-Transforms **(07 Hours)**

Definition of the Z-Transform, Properties of Z-transform, Evaluation of Inverse Z-transform. Analysis of Linear Time invariant System in Z Domain, One sided Z-transform.

COMPUTATION OF THE DISCRETE FOURIER TRANSFORM **(08 Hours)**

DTFT, Direct evaluation of DFT, DFT symmetry relation, Fast Fourier Transform, Goertzel algorithm, Decimation-in-Time algorithm, Decimation-in-Frequency algorithm, Approaches to design radix-m algorithm. Implementation of DFT using convolution algorithm, Correlation

FIR FILTER DESIGN **(08 Hours)**

Introduction, Magnitude and Phase response of Digital Filters, Frequency response of linear Phase FIR filters, Location of zeros of linear phase FIR filters, The Fourier Series method of designing FIR Filters, Frequency sampling method, Design of FIR filter using different Windowing techniques, Digital differentiator, Hilbert transform, Various approach to design Optimum linear phase FIR filters.

IIR FILTER DESIGN **(08 Hours)**

Introduction, IIR Filter Design by approximation derivatives, IIR Filter design by Impulse invariant method, IIR filter design by Bilinear transformation, Butterworth filter, Chebyshev Filter, Inverse Chebyshev filters, Elliptic Filters, Frequency Transformation

REALIZATION OF DIGITAL LINEAR SYSTEMS **(06 Hours)**

Basic realization block diagram and Signal flow-flow graph, Basic structure for IIR and FIR systems. Finite-word length effect.

PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY **(30 Hours)**

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

3.	**List of Practical:**
	1. Classification discrete time signal and systems 2. Analyse the properties of LTI systems 3. Analysis of Z-transform and its properties 4. Implementation of DTFT & DFT algorithms 5. Implementation of FFT with decimation in time and decimation in frequency 6. Finding liner convolution and circular convolution for given signal. 7. Design FIR Filter for given specifications. 8. Design IIR Filter for given specification 9. Implementation of digital system and analysis finite word length effect for system. 10. Study of DSP Processor &Implement FIR Filter.
4.	**Books Recommended:**
	1. Shalivahan S., Vallavaraj A. and Gnanapriya C., "Digital Signal Processing", 4th Ed., Tata McGraw-Hill, 2019. 2. Proakis J. G. and Manolakis D. G., "Digital Signal Processing: Principles, Algorithms And Applications", 4th Ed., Pearson Education, 2014. 3. Babu Ramesh P., "Digital Signal Processing", 4th Ed., SciTech Publication, 2008. 4. MitraSanjit K., "Digital Signal Processing: A Computer Based Approach", 4th Ed., Tata McGraw-Hill, 2013. 5. Oppenhein A. V. and Shafer R. W., "Discrete-Time Signal Processing", 3rd Ed., PHI, 2014.
5.	**Reference Books:**
	1. Padmanabhan K.,"A Practical Approach to Digital Signal Processing", 1st Ed., New Age International, 2001.

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B.Tech. II (VL) Semester III ANALOG CIRCUITS EC201	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	Describe single-stage / multistage amplifiers and their frequency response characteristics.
CO2	Apply the concept of current sources/sinks in the differential amplifiers.
CO3	Analyze different amplifier configurations by deploying negative feedback therein.
CO4	Evaluate the criterion for the stability of analog circuits.
CO5	Design ssolid-statepower amplifiers.

2. Syllabus:

- **HIGH FREQUENCY AMPLIFIERS** **(12 Hours)**

Classification of Amplifiers, Distortion in Amplifiers, Frequency Response of An Amplifier, Bode Plots, Step Response of Amplifiers, CE Short Circuit Current Gain, High-Frequency Response of a CE Stage, Gain Bandwidth Product, Emitter Follower at High Frequencies, Common Source and Common Drain Amplifier at High Frequencies. Analysis of Multistage Amplifier, Design of Two-Stage Amplifier, Frequency Response of Multistage Amplifier, Two Pole Analysis.

- **FEEDBACK AMPLIFIERS** **(12 Hours)**

Representation of Amplifiers, Feedback Concept, Transfer Gain with Feedback, Characteristics of Negative Feedback Amplifiers. I/O Impedance in Feedback Amplifiers, Analysis of Amplifiers having Voltage Series, Current Series, Current Shunt and Voltage Shunt Feedback, General Analysis of Multistage Feedback Amplifiers, Effect of Negative Feedback on Bandwidth, Frequency Response of Feedback Amplifiers, frequency compensation.

- **POWER AMPLIFIERS** **(09 Hours)**

Class A, B, AB, and C Power Amplifiers, Transformer Coupled Push–Pull and Complementary Symmetry Push-Pull Amplifier, Heat Sinks, Power Output, Efficiency, Crossover Distortion and Harmonic Distortion, Tuned Amplifiers, High Fidelity Design, Tuned Amplifiers

- **DIFFERENTIAL AMPLIFIERS** **(12 Hours)**

Differential amplifiers, AC/DC Analysis of Various Differential Amplifiers using BJT/MOSFET, CMRR and I/O Resistances, Output Offset Voltages, Active Load Differential Amplifiers, Current Mirrors using MOSFET, Widlar Current Source, Cascaded Differential Amplifier Stages and Level Translator, Operational Amplifier Design.

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

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

3.	**List of Practical:**	
	Practicals are to be performed using breadboard and SPICE Simulators.	
	1. Study and design a single-stage RC coupled amplifier and obtain its high-frequency response curve. 2. Study and design a double-stage RC coupled amplifier and obtain its high-frequency response curve. 3. Study and design a differential amplifier and measure its differential and common mode output voltages. 4. Study and design a Voltage Series Feedback amplifier and obtain its frequency response characteristics with and without feedback. 5. Study and design a Current Series Feedback amplifier and obtain its frequency response characteristics with and without feedback. 6. Study and design a Voltage Shunt Feedback amplifier and obtain its frequency response characteristics with and without feedback. 7. Study & Design a Class Power Amplifier and obtain its efficiency. 8. Study and design a Push-Pull Amplifier and obtain its efficiency. 9. Design a Current Mirror Circuit using BJT/MOSFET 10. Design of Differential Amplifier 11. SPICE Simulation for Analog Circuits 12. Mini Project.	
4.	**Books Recommended:**	
	1. Millman Jacob, Halkias Christos C., and Parikh C., "Integrated Electronics", 2nd Edition, McGraw-Hill, 2017. 2. A. Sedra and K. C. Smith, "Microelectronic Circuits", 5th Edition, Oxford University Press, 2005. 3. Donald Neamen, “Electronic Circuits: Analysis & Design”, 3rd Edition, McGraw Hill, 2006. 4. B. Razavi, “Fundamental of Microelectronics”, 3rd Edition, Wiley India, 2021. 5. Robert Boylestad and Louis Nashlesky, "Electronics Device & Circuits and Theory", PHI, 10th Edition, 2009.	

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B.Tech. II (VL) Semester III MICROPROCESSORS AND MICROCONTROLLERS EC205	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	Classify microprocessor and microcontroller with RISC & CISC architectures. Overview of 8/16/32 microcontrollers
CO2	Describe 8-bit microprocessor 8085 architecture, bus system, Memory and I/O interfacing
CO3	Analyze the merits of ARM controllers along with architectural features and instructions
CO4	Elevate the knowledge gained for Programming ARM Cortex M0+ for different applications
CO5	Design an embedded system with various peripheral interfacing using Embedded C and Assembly language

2. Syllabus:

- **INTRODUCTION TO MICROPROCESSORS AND MICROCONTROLLER** **(06 Hours)**

Microprocessor architectures basics, 8085 as Von Neumann CISC CPU. Bus system and its operation. 8085 Memory and peripheral interfacing. Advanced Microprocessors, Von Neumann vs Harvard, CISC vs RISC architecture, Overview and features of 8051 microcontrollers, Overview of the various commercially available 8-bit/16-bit Microcontrollers

- **ARM 32-BIT MICROCONTROLLER** **(12 Hours)**

The architecture of ARM Cortex M0+, Various Units in the architecture, Thumb-2 technology, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence. Other Cortex series processors

- **ARM CORTEX M0+ INSTRUCTION SETS AND PROGRAMMING** **(13 Hours)**

Arm & Thumb Instruction Set: Data Processing Instruction, Branch Instruction, Load Store Instruction, Special instructions, Bit-band operations and CMSIS, Assembly and C Language Programming

- **EMBEDDED SYSTEM COMPONENTS** **(14 Hours)**

Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. The core of an Embedded System includes all types of processors/controllers, Peripheral interfacing such as timers, ADC, DAC, Sensors, Actuators, LED/LCD display, Push button switches, Communication Interface standards (onboard and external), Embedded firmware, Other system components, RTOS based embedded system

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

3.	**List of Practicals:**	
	(The practical set is based on ARM Cortex-M Kit)	
	1. Introduce Keil ARM – MDK development flow 2. Assembly language programming set 1: (a) 2's complement of 64-bit number (b) add data items of an array 3. Assembly language programming set 2: (a) packed BCD to binary conversion (b) sorting of an array in ascending/ descending order 4. Assembly language programming set 3: (a) multiplication with shift and add method (b) compute square root of a 32-bit number 5. Write an program to flash simple LEDs (D0, D1, ..., D7) connected to Ports in various patterns 6. Write code to show up/down BCD count on Multiplexed 7-segment LED display updated every second. Use two keys (up & down) to change the direction of counting. 7. Write a program to display "Welcome to SVNIT" as a welcome message on the LCD interface. 8. Interface the 4x4 keypad and pressed the display key on the LCD 9. Establish full duplex ASCII communication between kit and PC using UART 10. Generate Sine wave/Triangle/Square wave using SPI-based DAC and observe on CRO. Increase or Decrease frequency using Keys in decades. 11. Using the internal PWM module of the ARM controller generate PWM and vary its duty cycle 12. Interface DC and stepper motor and demonstrate its operation 13. Demonstrate the use of an external interrupt to toggle an LED ON/OFF 14. Display digital output for given analog input using internal ADC	
4.	**Books Recommended:**	
	1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M0/M0+ processors, 2nd Ed., Newnes, (Elsevier), 2015. 2. A.N.Sloss, D.Symes and C. Wright, "ARM System Developer's Guide: Designing and Optimizing System Software", Elsevier, 2008 3. ARM Cortex M0 Technical Reference Manual. Available at:http://infocenter.arm.com/help/topic/com.arm.doc.ddi0432c/DDI0432C_cortex_m0_r0p0_trm.pdf 4. Gaonkar R. S., "Microprocessor Architecture, Programming and Applications with 8085", 6th Ed., Penram International, Indian, 2013 5. Ram B., "Fundamental of Microprocessor & Microcomputers", 9th Ed., Dhanpat Rai Publications, 2022	
5.	**Reference Book:**	
	1. Shibu K V, "Introduction to Embedded Systems", 2nd Ed., Tata McGraw Hill, 2017	

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B.Tech. II (VL) Semester III CONTROL SYSTEMS EE258	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	Describe various types of control systems and to impart knowledge of mathematical modelling of physical systems
CO2	Explain the response of various control systems in the time domain.
CO3	Analyze the response and stability of control systems using frequency domain techniques
CO4	Design of PD, PI, and PID controllers.
CO5	Demonstrate various control systems applications with laboratory experiments

2. Syllabus:

- **INTRODUCTION TO CONTROL SYSTEMS** **(03 Hours)**

Open loop control and close loop control; illustrative examples of control systems.

- **MATHEMATICAL MODELS OF PHYSICAL SYSTEMS** **(10 Hours)**

Linear and non-linear systems; equations and transfer functions for linear mechanical translational systems and linear electrical network; Force-Voltage and Force-Current analogy; Block diagram representation of control systems; Block diagram reduction; ; Signal flow graph and Mason's gain formula, Transfer functions of armature-controlled and field-controlled DC motors.

- **TIME DOMAIN ANALYSIS OF CONTROL SYSTEMS** **(06 Hours)**

Typical test signals; Response of first-order systems; Transient response of a second-order system due to step input; Time domain specifications of a second-order system; Steady-state errors; Static error coefficients.

- **CONCEPTS OF STABILITY** **(12 Hours)**

Introduction to stability, definition through impulse response function, asymptotic stability and relative stability, Routh-Hurwitz stability criterion. Basic Properties of Root Loci, Construction of Root Loci, Effects of Adding Poles and Zeros.

- **FREQUENCY DOMAIN ANALYSIS OF CONTROL SYSTEMS** **(10 Hours)**

Steady-state response of a system due to sinusoidal input; Frequency response; Logarithmic plots or Bode diagrams; Log-magnitude versus phase plots; Polar plots; conformal mapping, principal of argument, Nyquist stability criterion, Stability analysis; Relative stability; Gain margin and phase margin; Closed loop frequency response.

- **INTRODUCTION TO COMPENSATORS AND CONTROLLERS** **(04 Hours)**

Introduction to phase lag, phase lead and phase lag-lead compensators and their applications. P, PI, PID Controllers

	• **TUTORIAL**	**(15 Hours)**
	Based on mathematical models of physical systems, time domain analysis of control systems, concepts of stability, frequency domain analysis of control systems	
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	
3.	**Books Recommended:**	
	1. I.J. Nagrath, M. Gopal, “Control system engineering”, New Age International Publishers, 7th Ed., 2021. 2. K. Ogata, “Modern control system engineering”, Pearson Education Asia, 5th Ed., 2015. 3. B.C. Kuo, “Automatic control system”, Prentice Hall of India, 7th Ed., 1995 4. R.C. Dorf, R.H. Bishop, “Modern control system”, Pearson Education Asia. 8th Ed., 2004. 5. N. S. Nice, “Control System Engineering”, John willey& sons, 4th Ed., 2004	

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

1. Course Outcomes (COs):

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

CO1	Develop knowledge regarding Professional ethics and knowledge of Economics in engineering
CO2	Develop managerial skills to become future engineering managers
CO3	Develop skills related to various functional areas of management (Marketing Management, Financial Management, Operations Management, Personnel Management, etc.)
CO4	Build knowledge about modern management concepts
CO5	Develop experiential learning through Assignments, Management games, Case study discussions, Group discussions, Group presentations, etc.

2. Syllabus:

- **PROFESSIONAL ETHICS** **(06 Hours)**

Introduction, Meaning of Ethics, Approaches to Ethics, Major attributes of Ethics, Business Ethics, Factors influencing Ethics, Importance of Ethics, Ethics in Management, Organizational Ethics, Ethical aspects in Marketing, Mass communication and Ethics - Television, Whistle blowing, Education – Ethics and New Professional, Intellectual Properties and Ethics, Introduction to Professional Ethics, Engineering Ethics

- **ECONOMICS** **(08 Hours)**

Introduction To Economics, Applications & Scopes of Economics, Micro & Macro Economics, Demand Analysis, Demand Forecasting, Factors of Production, Types of Cost, Market Structures, Break Even Analysis

- **MANAGEMENT** **(15 Hours)**

Introduction to Management, Features of Management, Nature of Management, Development of Management Thoughts – Scientific Management by Taylor & Contribution of Henry Fayol, Coordination & Functions Of Management, Centralization & Decentralization, Decision Making; Fundamentals of Planning; Objectives & MBO; Types of Business Organizations: Private Sector, Public Sector & Joint Sector; Organizational Behaviour: Theories of Motivation, Theories of Leadership

- **FUNCTIONAL MANAGEMENT** **(14 Hours)**

Marketing Management: Core Concepts of Marketing, Marketing Mix (4p), Segmentation – Targeting – Positioning, Marketing Research, Marketing Information System, Concept of International Marketing, Difference Between Domestic Marketing & International Marketing; Operations Management: Introduction to Operations Management, Types of Operation Systems, Types of Layouts, Material Handling, Purchasing & Store System, Inventory Management; Personnel Management: Roles & Functions of Personnel Manager, Recruitment, Selection, Training; Financial Management: Goal of Financial Management, Key Activities In Financial Management, Organization of Financial Management, Financial Institutions, Financial Instruments, Sources of Finance

- **MODERN MANAGEMENT ASPECTS** **(02 Hours)**

	Introduction To ERP, e – CRM, SCM, RE – Engineering, WTO, IPR Etc.	
	• **TUTORIAL**	**(15 Hours)**
	Case Study Discussion, Group Discussion, Management games and Assignments / Mini projects & presentation on related Topics	
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	
3.	**Books Recommended:**	
	1. Balachandran V. and Chandrasekaran, Corporate Governance, Ethics and Social Responsibility, PHI, 2nd Edition, 2011 2. Prasad L.M., Principles & Practice of Management, Sultan Chand & Sons, 8th Edition,2015 3. Banga T. R. & Sharma S.C., Industrial Organisation & Engineering Economics, Khanna Publishers, 25th Edition, 2015 4. Everett E. Adam, Ronald J. Ebert, Production and Operations Management, Prentice Hall of India, 5th edition, 2012 5. Kotler P., Keller K. L, Koshi A.& Jha M., Marketing Management – A South Asian Perspective, Pearson, 14th Edition, 2014 6. Tripathi P.C., Personnel Management & Industrial Relations, Sultan Chand & sons, 21st Edition, 2013 7. Chandra P., Financial Management, Tata McGraw Hill, 9th Edition, 2015	
5.	**Reference Book:**	
	1. Crane A. & Matten D., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Oxford University, 2010 2. Fritzsche D. J., Business Ethics: a Global and Managerial Perspectives, McGraw Hill Irwin, Singapore, 2004 3. Mandal S. K., Ethics in Business and Corporate Governance, Tata McGraw Hill, 2011	

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B.Tech. II (VL) Semester III DATA STRUCTURE AND ALGORITHMS VL202	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	Describe the concept of dynamic memory management, data types, algorithms,
CO2	Big-O notation, arrays, linked lists, stacks and queues.
CO3	Apply the hash function and concepts of collision and its resolution methods.
CO4	Analyze problems involving graphs, trees and heaps.
CO5	Evaluate algorithms for solving problems like sorting, searching, insertion and deletion

2. Syllabus:

- **INTRODUCTION** **(04 Hours)**

Algorithms as opposed to programs, Four Fundamental Data Structure, Complexity of Algorithms, Big Oh Notation, Complexity of Mergesort, Role of constant. Big Omega and Big Theta Notions, Time versus space complexity, Worst versus average complexity, Concrete measures for performance, Big-O notation for complexity class, Formal definition of complexity classes.

- **TYPE OF LIST** **(04 Hours)**

Implementation of Lists, Array Implementation, loops and Iteration Pointer Implementation, Double Linked List Implementation, Stack, Queues, Circular array Implementation, Double linked list, Buddy System Memory Allocation

SEARCHING ALGORITHMS

Requirements for searching, Specification of the search problem, A simple algorithm: Linear Search, A more efficient algorithm: Binary Search.

- **DICTIONARIES& HASH TABLES** **(06 Hours)**

Various Sets of Dictionary, Implantation of Dictionaries, Hash Tables, Closing of Hashing, Analysis of Closed Hashing, Skip Lists, Analysis of Skip Lists.

- **BINARY TREES** **(06 Hours)**

Definition, Quad trees, Preorder, Inorder, Postorder, Data structures for tree representation, Binary Trees, Binary Trees for Huffman Code construction, Binary Search Tree, Splay Trees, Search, Insert, Delete in Bottom-up Splay, Amortized Algorithm Analysis.

- **BALANCED TREES** **(04 Hours)**

AVL Trees, Maximum Height of an AVL Tree, Insertions and Deletions, Red-Black Trees, 2-3 Trees, B-Trees, Variants of B-Trees

	● **PRIORITY QUEUES AND HEAP TREES**	**(04 Hours)**
	Binary Heaps, Creating heap, Implementation of Binary heap, Binomial Queues, Binomial Queue Operations, Binomial Amortized Analysis, Lazy Binomial Queues, Fibonacci heaps, heap time complexity comparison.	
	● **DIRECTED GRAPHS**	**(07 Hours)**
	Data Structures for Graph Representation, Shortest path Problem, Single shortest paths problems, Dynamic programming Algorithms, Warshall's Algorithms, Depth First Search and breadth search, Directed Acyclic Graphs.	
	● **UNDIRECTED GRAPHS**	**(04 Hours)**
	Some Definitions, Breadth-first search of undirected graphs, Minimum-Cost Spanning, MST Property, Prim's Algorithm, Kruskal's Algorithm, Traveling Salesman Problem using greedy algorithm.	
	● **SORTING METHODS**	**(06 Hours)**
	Bubble Sort, Insertion Sort, Selection Sort, Shellsort, Heap Sort, Quick Sort, Algorithm for Partitioning, Average Case Analysis, Order Statistics, Lower Bound on Complexity for Sorting Methods, Lower Bound on Worst Case Complexity, Lower Bound on Average Case Complexity, Radix Sorting, Merge Sort, Heap Sort and Quicksort, Mergesort	
	● **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY**	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	
3.	**List of Practicals:**	
	1. Write a program to perform Insertion and Deletion in an unsorted Array when the number and the positions are given. 2. Write a program to search an element in a sorted array using binary search and search the same element in the same array using linear search. 3. Perform Insertion and Deletion in a Linked List when the number and the positions are given. 4. Given two linked lists List1 = {A1, A2…….,An} and List2 = {B1,B2,……Bm} with data (both lists) in ascending order. Write a program to merge the given lists so that the merged list will be: {A1,B1,A2,B2,……..Am,Bm,Am+1,……..An} if n >= m {A1,B1,A2,B2,……..An,Bn,Bn+1,……..Bm} if m >= n 5. Write the programs to perform a stack's push, pop, top and is Empty functions. 6. Write a program to find the height of a binary tree. 7. Write a program to insert and delete an element in a binary search tree. 8. Given a sorted doubly linked list, write a program to convert it into a balanced binary search tree. 9. Write a program to find the shortest path in a weighted graph using the Dijkstra algorithm. 10. Write a program to sort an array using mergesort algorithm. 11. Write a program to implement a separate chaining collision resolution technique. 12. Write the enqueue and deque functions for a queue implemented using a linked list. 13. Write a program to implement heap sort algorithm. 14. Write a program to solve the traveling salesman problem using greedy algorithm.	

4.	**Books Recommended:**	
	1. Narasimha Karumanchi, “Data Structures and Algorithms Made Easy”, CareerMonk Publications, 2021. 2. Mark A. Weiss, “Data Structures and Algorithm Analysis in C++”, 4th Ed., Published by Pearson (June 13th 2013). 3. Gilles Brassard, “Fundamentals of Algorithms”, Pearson Education 2015. 4. E. Horowitz, S. Sahni and S. Rajasekaran, “Computer Algorithms/C++”, Second Edition, University Press, 2007. 5. A. V. Aho, J. E. Hopcroft, and J. D. Ullman. Data Structures and Algorithms. Addison-Wesley, Reading, Massachusetts, 1983. 6. Anany Levitin “Introduction to the Design and Analysis of Algorithms” Pearson Education, 2015.	
5.	**Reference Books:**	
	1. Richard F. Gilberg, Behrouz A. Forouzan, “Data Structures – A Pseudocode Approach with C++”, Thomson Brooks / COLE, 1998.	

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. II (VL) Semester IV ELECTROMAGNETIC WAVES VL204	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	Describe the basic concepts and theorems of electromagnetic theory and its applications.
CO2	Apply the principles of electromagnetic theory and wave propagation to model transmission line and radiating systems.
CO3	Analyze the theoretical concepts based on Maxwell's equation, transmission line theory and antennas.
CO4	Evaluate the wave propagation behaviour between two mediums.
CO5	Formulate the aspects of electromagnetic theory for different applications.

2. Syllabus:

- **ELECTROMAGNETIC THEOREM and MAXWELL'S EQUATIONS** **(12 Hours)**

Divergence and Stoke's Theorem, Coulomb's law, Gauss's law and Applications, Electric Potential, Poisson's and Laplace Equations, Biot-Savart's law, Faraday's law and Ampere's Work law in the Differential Vector form , Flux rule for Motional EMF, Magnetic Vector Potential, Introduction to The Equation of Continuity For Time Varying Fields, Inconsistency of Ampere's Law, Maxwell's Equation, Condition at a Boundary Surface, Poynting Theorem.

- **ELECTROMAGNETIC WAVES** **(10 Hours)**

Solution for Free Space Conditions, Uniform Plane Waves and Propagation, The Wave Equations for a Conducting Medium, Sinusoidal Time Variations, Conductors and Dielectrics, Polarization, Reflection by a Perfect Conductor: Normal Incidence and Oblique Incidence, Reflection by a Perfect Dielectric: Normal Incidence and Oblique Incidence, Reflection at the Surface of a Conductive Medium.

- **RADIATION** **(10 Hours)**

Potential functions and the Electromagnetic field, Oscillating Electric Dipole derivations for E and H field components in spherical coordinate systems, Power Radiated by a Current Element, Application to Antennas, Radiation from Half wave Dipoles, Derivation for Radiation Resistance, Application of Reciprocity Theorem to Antennas, Equality of Directional Patterns and Effective Lengths of Transmitting and Receiving Antennas, Directional Properties of Dipole Antennas, Antenna Parameters and Definitions.

- **TRANSMISSION LINE ANALYSIS** **(08 Hours)**

Transmission Line Equations, Voltage and Current Waves, Solutions for Different Terminations, Transmission-line Loading, Impedance Transformation and Matching, Smith Chart, Quarter-wave and Half-wave Transformers.

- **ATMOSPHERIC WAVE PROPAGATION** **(05 Hours)**

Plane Earth Reflection, Spherical Earth Propagation, Tropospheric Waves. The Ionosphere, Reflection and Refraction Waves by the Ionosphere, Regular and Irregular Variations of the Ionosphere.

	• **TUTORIAL**	**(15 Hours)**
	Based on electromagnetic theorem and maxwell's equations, electromagnetic waves, radiation, transmission line analysis, atmospheric wave propagation	
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	
3.	**Books Recommended:**	
	1. E.C. Jordan & G. Balmain, “Electromagnetic Waves and Radiating Systems”, 2nd Ed., PHI, Reprint 2011. 2. R. K. Shevgaonkar, “Electromagnetic Waves”, 1st Ed., Tata McGraw Hill, 2006. 3. M.N.O. Sadiku, “Principles of Electromagnetics”, 4th Ed., Oxford University Press, 2011. 4. W.H. Hayt, “Engineering Electromagnetics”, 7th Ed., McGraw Hill, 2006. 5. Roger F. Harrington, “Time-Harmonic Electromagnetic Fields”, Wiley-IEEE Press, 2001.	

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B.Tech. II (VL) Semester IV ANALOG AND DIGITAL COMMUNICATION VL206	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	Define the principles of analog and digital modulation techniques
CO2	Apply the principles of multicarrier modulation, particularly Orthogonal Frequency Division Multiplexing, to analyze and solve problems related to bandwidth efficiency, signal-to-noise ratio, and interference mitigation in wireless communication systems.
CO3	Analyse and compare the performance characteristics (e.g., probability of error, bandwidth efficiency, power efficiency) of different digital modulation and spread-spectrum techniques under various channel conditions (e.g., AWGN, bandlimited).
CO4	Design a basic digital communication system, selecting appropriate modulation, coding, and synchronization techniques to meet specific performance requirements for a given channel model.
CO5	Evaluate the trade-offs between different design choices in digital communication systems, considering factors such as complexity, cost, power consumption, and performance in the presence of noise and interference.

2. Syllabus:

PROBABILITY THEORY AND RANDOM PROCESS	**(08 Hours)**
Review of probability theory, Random variables and Random processes, Autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems.	
ANALOG COMMUNICATIONS	**(10 Hours)**
Amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers, circuits for analog communications; noise analysis, Information theory: entropy, mutual information and channel capacity theorem.	
PULSE MODULATION TECHNIQUES	**(07 Hours)**
Sampling and A to D conversion, Quantization techniques—Uniform and Non-uniform, A-law and μ-law, Pulse Code Modulation, Pulse Amplitude Modulation, Pulse Position Modulation, Pulse Width Modulation, TDM, DPCM and ADPCM, Delta Modulation	
DIGITAL COMMUNICATIONS	**(12 Hours)**
Digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, matched filter receiver, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error correction, Hamming codes; Timing and frequency synchronization, inter-symbol interference and its mitigation; Basics of TDMA, FDMA and CDMA	
SOURCE AND ERROR CONTROL CODING	**(08 Hours)**
Entropy, Source Encoding Theorem, Shannon Fano Coding, Huffman Coding, Mutual Information, Channel Capacity, Error Control Coding, Linear Block Codes, Cyclic Codes – ARQ Techniques Simulation of error control coding schemes.	
(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**List of Practical:**
	1. Amplitude Modulation and Demodulation. 2. Angle Modulation and Demodulation. 3. Implement ASK modulation and demodulation using a function generator and oscilloscope. Analyze the impact of noise on signal recovery. 4. Implement FSK and observe the frequency changes representing data bits. Compare error rates of ASK and FSK under varying noise conditions. 5. Implement basic Binary Phase Shift Keying and investigate the phase shifts associated with data bits. 6. Implement PAM and observe the effect of varying pulse amplitudes on signal quality. Analyze the impact of noise on different PAM levels. 7. Simulate a bandlimited channel and transmit a digital signal. Observe the effects of ISI on the received signal. 8. Implement an equalization technique to mitigate Inter symbol Interference 9. Implementation error correction coding technique. 10. Realization of TDMA, FDMA and CDMA modulation
4.	**Books Recommended:**
	1. John G. Proakis, Digital Communication, 5th Edition, McGraw Hill, 2014. 2. S. Haykin, Digital Communication systems, an Indian Adaption, John Wiley & Sons, 2021. 3. Taub and Schilling, “Principles of Communication Systems”, Second Edition, Tata McGraw Hill, 2017 4. B. Sklar, Digital Communications: Fundamentals and Applications” Second Edition, Pearson education, 2009 5. Probability - Random Variables and Stochastic Processes, 4th Edition, Tata McGraw Hill, 2017
5.	**Reference Books:**
	1. Lathi B.P, and Ding Zhu, “Modern Digital and Analog Communication Systems”, Fourth edition, Oxford University press, 2011.

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

B.Tech. II (VL) Semester IV LINEAR IC APPLICATIONS EC204	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	Describe an op-amp fundamentals and its specifications.
CO2	Analyze and design active filters and oscillators using op-amp and functional ICs.
CO3	Classify the working principle of data converters and select appropriate D/A and A/D converters for signal processing applications.
CO4	Compare the working of multivibrators using special application IC 555 and general-purpose op-amp.
CO5	Design the linear and nonlinear applications of an op-amp using IC 741.

2. Syllabus:

- **OPERATIONAL AMPLIFIER FUNDAMENTALS** **(10 Hours)**

Operational Amplifier, Basic Op-Amp Configuration, An Op-Amp with Negative Feedback, Voltage Series and Voltage Shunt Configurations, Difference Amplifiers, Instrumentation Amplifier, Specification of an Op-Amp, Offset Voltages and Currents, CMRR, Slew Rate, PSRR, Input Bias and Offset Currents, Frequency Response, GBW Product, Compensated Op-amp and Non-Compensated Op-Amp.

- **GENERAL LINEAR APPLICATIONS** **(06 Hours)**

Summing, Scaling, and Averaging Amplifiers, Concept of Negative Resistance, Voltage to Current Converter with Floating and Grounded Load, Current to Voltage Converter, Integrator and Differentiator, Gyrator, Frequency-dependent negative resistance circuit.

- **ACTIVE FILTERS AND OSCILLATORS** **(10 Hours)**

First Order Active Filters, Second-Order Active Filters, Multiple Feedback Filters (Band Pass and Band Reject Filters), All-Pass Filter, Cascade design of filters, Magnitude, and Frequency scaling concepts, Oscillators, Phase Shift and Wien Bridge Oscillators, Square, Triangular and Saw Tooth Wave Generators.

- **NON-LINEAR CIRCUITS** **(05 Hours)**

Schmitt Trigger, Voltage Comparator, Voltage Limiters and Window Detector, Concept of Clippers and Clampers Circuit using passive component, Clippers and Clampers using Op Amp, Precision Rectifiers.

- **MULTI-VIBRATOR CIRCUIT** **(07 Hours)**

Concept of Multi-vibrator Circuit using passive component, the 555 Timer, Astable Mode operation, Monostable Mode operations, Applications of 555 Timer Circuit.

- **D/A AND A/D CONVERTERS** **(07 Hours)**

Introduction, D/A Converters, Performance Parameters of D/A Converter, Basic D/A Conversion Techniques, Sources of Errors in D/A Converters, D/A Converter IC, A/D Converters, Performance parameters of A/D Converter, Counter Type A/D converter,

	Successive approximation Conversion, Flash A/D converter, Single and Dual Slope A/D converter, A/D Converter IC.	
	• **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY**	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	
3.	**List of Practicals:**	
	1. Design and implement Zero Crossing Detector, Positive Level Detector, and Negative Level Detector or inverting and non-inverting configuration using IC 741. 2. To study the effect of Loading and input impedance for Inverting and Non-inverting negative feedback amplifiers using IC 741. 3. Design and implement circuits for testing specifications of IC 741. 4. Design and implement Inverting and Non-inverting negative feedback amplifiers for given gain using IC 741. Also, analyze the frequency response. 5. Design and implement Summing, Averaging, and Scaling amplifiers. Also, implement 4 input Subtractors using IC 741. 6. Design and implement a Practical Integrator for a given cut-off frequency using IC 741. Also, analyze the frequency response. 7. Design and implement a Practical Differentiator for a given cut-off frequency using IC 741. Also, analyze the frequency response. 8. Design and implement 1st and 2nd order Low-pass filters for a given cut-off frequency using IC 741. Also, analyze the frequency response. 9. Design and implement 1st and 2nd order High-pass filter for a given cut-off frequency using IC 741. Also, analyze the frequency response. 10. Design and implement a Notch filter for a given notch frequency using IC 741. Also, analyze the frequency response. 11. Design and implement an All-pass filter for a given phase difference using IC 741. 12. Design and implement RC Phase shift and Wein bridge oscillator using IC 741. 13. Design and implement a square wave Generator using IC 741. 14. Design and implement a Monostable and Astable Multivibrator using a 555 timer. 15. Design and implement a Voltage Regulator using IC 7805. Also, perform Load and Line Regulation.	
4.	**Books Recommended:**	
	1. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Ed., McGraw-Hill, Published: 2016. 2. Coughlin and Driscol, "Op-Amps and Linear Integrated Circuits", 6th Ed., PHI, 2003 3. Gayakwad Ramakant, "Op-Amps and Linear Integrated Circuits", 4th Ed., PHI, 2003. 4. Salivahanan S., "Linear Integrated Circuits", 4th Reprint, McGraw-Hill, 2010. 5. Roy Choudary D. and Shail B. Jain, Linear Integrated circuits, 4th Ed., New Age International Publishers, 2010.	
5.	**Reference Book:**	
	1. William D. Stanley, “Operational Amplifiers with Linear Integrated Circuits”, 4th Ed., Old Dominion University, Pearson Education, 2002.	

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

B.Tech. II (VL) Semester IV DIGITAL INTEGRATED CIRCUITS EC208	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 operation of MOS transistors, scaling trends and fabrication process flow.
CO2	Recognize the fundamental concepts of various logic families with their comparative analysis.
CO3	Analyse the design of an inverter using CMOS logic and estimate the switching parameters, power dissipation and CMOS-TTL interfacing.
CO4	Evaluate the performance of different sequential and combinational circuits using CMOS logic.
CO5	Design the sequential and combinational circuits using CMOS with layout and stick diagrams.

2. Syllabus:

- **MOS TRANSISTORS** **(10 Hours)**

Fundamental of MOSFET operation and MOSFET capacitances, MOSFET I-V Characteristics, MOSFET Model, Modeling of MOS Transistor using Spice, Scaling and Small Geometry Effects, Fabrication Process Flow, CMOS N-Well Process and Twin Tub Process.

- **OVERVIEW OF HIGH-SPEED LOGIC FAMILIES** **(10 Hours)**

BJT Inverter, DC Switching Characteristic, Introduction to RTL, DTL, DCTL, HTL,TTL, Schottky TTL, and ECL Logic Family, Concept of Noise margin, Fan Out and Propagation Delay, NMOS, PMOS, CMOS, Bi- CMOS Circuits

- **NMOS AND CMOS LOGIC DESIGN** **(10 Hours)**

Various NMOS Inverters, Determination of VTC, Calculation of VTC Critical Points, CMOS Inverter Technology, VTC, Static Characteristics, Dynamic Behaviour, Static and Dynamic Power Dissipation, Power-Delay Product, TTL-CMOS Interfacing.

- **CMOS COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUITS** **(15 Hours)**

CMOS Logic Circuits, Complex Logic Circuits, Pass transistor and Transmission gate, Behavior of MOS Logic Elements. The Bistability Principle, SR Latch Circuit, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop. Layout Design Rules, Full-Custom Mask Layout Design and Stick Diagram

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

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

3.	**List of Practicals:**	
	1. Introduction to SPICE circuit simulator 2. Realization of MOSFET characteristics using circuit simulator characteristics and BSIM models. 3. Realization of NOR gate using RTL logic. Obtain & plot its transfer characteristics and determine noise margins, fan-out and propagation delay. 4. Realization of NAND gate using TTL logic. Obtain & plot Its transfer characteristics and determine noise margins, fan-out and propagation delay 5. Implementation of CMOS inverter, obtain & plot its transfer characteristics, determine noise margins and measure propagation delay 6. Realization of inverter gate using BiCMOS logic, obtain & plot its transfer characteristics, determine noise margins 7. Design and implementation of TTL-CMOS & CMOS-TTL interfacing. 8. Design and implementation of pass transistor and transmission gate-based logic circuits. 9. Design and implement of JK & SR flip-flop using CMOS. 10. Layout of CMOS inverter and parasitic extraction and obtain VTC of extracted net list. 11. Design and implementation of inverter and NAND gate circuits using the DTL logic family 12. Design and implementation of inverter and NAND gate circuits using the ECL logic family	
4.	**Books Recommended:**	
	1. Taub H. and Schilling D., "Digital Integrated Electronics", International Ed., McGraw-Hill, 2008 2. R P Jain, “Modern Digital Electronics”, 4th Ed. Tata McGraw-Hill New Delhi. 3. Kang and Leblebici,“CMOS Digital Integrated Circuits: Analysis and Design”, Tata McGraw-Hill, 4th Edition, 2019 4. Rabaey Jan M., Chandrakasan Anantha and Borivoje Nikolic, "Digital Integrated Circuits (Design Perspective)", 2nd Ed., Prentice Hall of India, 2016 (Reprint). 5. Hodges D. A. and Jackson H. G. "Analysis And Design Of Digital Integrated Circuits", 3rd Ed., McGraw-Hill, 2004. 6. Baker R. J., Li H. W. and Boyce D. E., "CMOS Circuits Design Layout and Simulation", 2nd Ed., PHI 2005.	