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

Sr. No.	Subject	Code	Scheme L-T-P	Credits (Min.)	Notional hours of Learning (Approx.)
	Third Semester (2nd year of UG)				
1	Analog Circuits	EC201	3-0-2	4	85
2	Signals and Systems	EC203	3-1-0	4	70
3	Microprocessors and Microcontrollers	EC205	3-0-2	4	85
4	Principles of Communication Systems	EC207	3-0-2	4	85
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	Statistical Signal Analysis	EC202	3-1-0	4	70
2	Linear IC Applications	EC204	3-0-2	4	85
3	Electromagnetic Waves	EC206	3-0-2	4	85
4	Digital Integrated Circuits	EC208	3-0-2	4	85
5	Control Systems	EE258	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.2 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 Practicals:**	
	Practicals are to be performed using breadboard and SPICE Simulators.	
	1. Study and design a single-stage RC coupled amplifier and obtain its high-frequency response curve. 2. Study and design a double-stage RC coupled amplifier and obtain its high-frequency response curve. 3. Study and design a differential amplifier and measure its differential and common mode output voltages. 4. Study and design a Voltage Series Feedback amplifier and obtain its frequency response characteristics with and without feedback. 5. Study and design a Current Series Feedback amplifier and obtain its frequency response characteristics with and without feedback. 6. Study and design a Voltage Shunt Feedback amplifier and obtain its frequency response characteristics with and without feedback. 7. Study & Design a Class Power Amplifier and obtain its efficiency. 8. Study and design a Push-Pull Amplifier and obtain its efficiency. 9. Design a Current Mirror Circuit using BJT/MOSFET 10. Design of Differential Amplifier 11. SPICE Simulation for Analog Circuits 12. Mini Project.	
4.	**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.2 Semester III SIGNALS AND SYSTEMS EC203	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 Signals and Systems with their classifications
CO2	Describe Z-transform and its properties
CO3	Analyse discrete-time system with Z-transform
CO4	Understand the process of sampling and aliasing error.
CO5	Analyze Discrete Time Fourier Transform and Discrete Fourier Transform for LTI systems

2. Syllabus:

- **INTRODUCTION** **(05 Hours)**

  Introduction to Signal and its Classification, Concept of Frequency in Continuous-Time and Discrete-Time Signal.

- **DISCRETE TIME SIGNAL AND SYSTEM** **(08 Hours)**

  Discrete-Time Signals and basic operations, Discrete Time Systems, Linear Time-Invariant Systems, Properties of LTI Systems, Causal LTI Systems Described by Difference equations.

- **Z-TRANSFORM** **(08 Hours)**

  Z-transform, Properties of Region of convergence, Inverse Z-transform, properties of Z-transform. Z-transform for LTI systems with pole-zero patterns

- **SAMPLING** **(08 Hours)**

  Sampling theorem, Periodic Sampling, Frequency-Domain Representation of Sampling, Reconstruction of sampled signals, Aliasing error, sampling theorem, Sampling of Bandlimited Signals

- **DISCRETE TIME FOURIER TRANSFORM (DTFT) and DISCRETE FOURIER TRANSFORM (DFT)** **(08 Hours)**

  DTFT and it's convergence, Properties of DTFT, Sampling the Fourier Transform, The Discrete Fourier Transform, Properties of the Discrete Fourier Transform.

- **FREQUENCY DOMAIN ANALYSIS OF LINEAR TIME-INVARIANT SYSTEMS** **(08 Hours)**

  Frequency Domain Representation of Discrete-Time Systems, Frequency Response for Rational systems Functions, Frequency Response of LTI Systems, System analysis with frequency domain representation. Time domain and Frequency domain aspects of ideal and non-ideal filters

- **TUTORIALS** **(15 Hours)**

(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)

3.	**Books Recommended:**	
	1. Barry Van Veen Simon Haykin, “Signals and Systems”, 2nd Ed., Wiley, 2007 2. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, “Signals and Systems Prentice Hall India”, 2nd Ed., Pearson, 2009. 3. B.P. Lathi, “Principles of Linear Systems and Signals”, 2nd Ed., oxford, 22 Jul 2009 4. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing, Principles, Algorithms, and Applications”, 4th Ed., PHI, 2007. 5. Robert A. Gable, Richard A. Roberts, “Signals & Linear Systems”, 3rd Ed., John Wiley, 1995.	

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B.Tech.2 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, 200	

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B.Tech.2 Semester III PRINCIPLES OF COMMUNICATION SYSTEMS EC207	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 basic principles of communication techniques including important terminology
CO2	Explain about signal processing and statistical aspects involved in communication with time and frequency domain fundamentals.
CO3	Implement analog communication systems and digital baseband preparation stages.
CO4	Analyze the performance parameter for analog communication link and digital baseband.
CO5	Evaluate the various stages of analog communication link, baseband digital and point to point link performance parameters by experimentation using modern tools/simulators and hardware.
CO6	Design various stages of analog communication system and digital database preparation with optimum parameter selection criteria satisfying given parameters.

2. Syllabus:

- **ANALYSIS AND TRANSMISSION OF SIGNALS** **(06 Hours)**

Aperiodic signal representation by Fourier Integral, Signal Transmission Through a Linear System, Ideal versus Practical Filter, Signal Distortion over a Communication Channel, Signal Energy and Energy Spectral Density, Signal Power and Power spectral Density.

- **AMPLITUDE MODULATION AND DEMODULATION** **(09 Hours)**

Baseband Vs Carrier Communications, DSB-C And DSB- SC Amplitude Modulation, QAM, SSB, Vestigial Sideband (VSB) Transmission, Carrier Acquisition, AM transmitter design, AM receiver.

- **ANGLE MODULATION AND DEMODULATION** **(09 Hours)**

Concept of instantaneous frequency, Bandwidth of Angle Modulated Waves, NBFM and WBFM, Generating FM Waves, Demodulation of FM, Phase Modulation Concepts, Effects of Nonlinear Distortion and Interferences in angle modulated systems, FM Receiver

- **NOISE** **(05 Hours)**

Various Types of Noises: Internal and External Noise, White Noise and Filtered Noise, AWGN Properties, Noise Equivalent Bandwidth Concept, Noise Sampling, Signal to Noise ratio, AM & FM in the presence of noise

- **PULSE MODULATION TECHNIQUES** **(08 Hours)**

Sampling and A to D conversion, Quantization techniques—Uniform and Non-uniform, A-law and μ-law, Pulse Code Modulation, Pulse Amplitude Modulation, Pulse Position Modulation, Pulse Width Modulation, TDM, DPCM and ADPCM, Delta Modulation

- **PRINCIPLES OF DIGITAL DATA TRANSMISSION** **(08 Hours)**

	Digital communication system, Line coding: properties of line coding, various line coding formats and their PSDs, Pulse shaping: Inter symbol Interference, Nyquist criterion for zero ISI, signaling with controlled ISI, Scrambling, Regenerative Repeater	
	• **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY**	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	
3.	**List of Practicals:**	
	1. Study of the Spectrum Analyzer. 2. Study of Various Signals and their Spectrum Using MATLAB. 3. DSB-SC and DSB-C AM Transmitter and Receiver. 4. FM Transmission and Reception Techniques. 5. AM and FM Simulation on MATLAB with AWGN Channel and Concept of SNR. 6. Study of various Pulse Modulation Techniques 7. Sampling and Pulse Modulation Technique 8. Pulse code modulation and demodulation technique 9. Differential pulse code modulation and demodulation 10. Delta and Adaptive Delta Modulation and demodulation technique. 11. Study of various Line coding formats	
4.	**Books Recommended:**	
	1. Lathi B. P., and Ding Zhi, “Modern Digital and Analog Communication Systems”, 4th Ed., Oxford University Press 2010/ 5th Ed., 2018. 2. Proakis J. and Salehi M., “Fundamental of Communication Systems”, 1st Ed., PHI/Pearson Education-LPE, 2006. 3. Carlson Bruce A., Paul B Crilly “Communication Systems- An Introduction to Signal and Noise in Electrical Communication”, 5th Ed., McGraw-Hill, 2011. 4. Leon W. Couch, II “Digital and Analog Communication Systems”, 8th Ed., Pearson Education-LPE, 2013. 5. Taub Herbert, Donald Schilling, Goutam Saha “Principal of Communication Systems”, 4th Ed., Tata McGraw-Hill, 2013.	

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B.Tech.2 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
CO2	Develop knowledge of Economics in engineering
CO3	Develop managerial skills to become future engineering managers
CO4	Develop skills related to various functional areas of management (Marketing Management, Financial Management, Operations Management, Personnel Management, etc.)
CO5	Build knowledge about modern management concepts
CO6	Develop experiential learning through Assignments, Management games, Case study discussions, Group discussions, Group presentations, etc.

2. Syllabus:

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

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

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

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

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

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

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

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

	• **MODERN MANAGEMENT ASPECTS**	**(02 Hours)**
	Introduction To ERP, e – CRM, SCM, RE – Engineering, WTO, IPR Etc.	
	• **TUTORIAL**	**(15 Hours)**
	Case Study Discussion, Group Discussion, Management games and Assignments / Mini projects & presentation on related Topics	
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	
3.	**Tutorial:**	
	1. Case Study Discussion 2. Group Discussion 3. Management games 4. Assignments / Mini projects & presentation on related Topics	
4.	**Books Recommended:**	
	1. Balachandran V. and Chandrasekaran, Corporate Governance, Ethics and Social Responsibility, PHI, 2nd Edition, 2011 2. Prasad L.M., Principles & Practice of Management, Sultan Chand & Sons, 8th Edition,2015 3. Banga T. R. & Sharma S.C., Industrial Organisation & Engineering Economics, Khanna Publishers, 25th Edition, 2015 4. Everett E. Adam, Ronald J. Ebert, Production and Operations Management, Prentice Hall of India, 5th edition, 2012 5. Kotler P., Keller K. L, Koshi A.& Jha M., Marketing Management – A South Asian Perspective, Pearson, 14th Edition, 2014 6. Tripathi P.C., Personnel Management & Industrial Relations, Sultan Chand & sons, 21st Edition, 2013 7. Chandra P., Financial Management, Tata McGraw Hill, 9th Edition, 2015	
5.	**Reference Book:**	
	1. Crane A. & Matten D., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Oxford University, 2010 2. Fritzsche D. J., Business Ethics: a Global and Managerial Perspectives, McGraw Hill Irwin, Singapore, 2004 3. Mandal S. K., Ethics in Business and Corporate Governance, Tata McGraw Hill, 2011	

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B.Tech.2 Semester IV STATISTICAL SIGNAL ANALYSIS EC202	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 probability, random variables, and random processes and parameters related to them
CO2	Classify different types of random variables and random processes.
CO3	Analyze random variables and random processes using knowledge of PDF, CDF, autocorrelation functions, Power spectral density, etc. and LTI systems with random inputs
CO4	Evaluate Moments & Characteristic inequalities and probabilistic limits
CO5	Design problems based on probability, Random variables and Random processes.

2. Syllabus:

- **COMBINATORIAL ANALYSIS** **(04 Hours)**

Introduction, The Basic Principle of Counting, Permutations, Combinations, Multinomial Coefficients, The Number of Integer solutions of Equations

- **PROBABILITY THEORY** **(05 Hours)**

Scope and History, Probability as Frequency of Occurrence, Set, Fields, Sample Space and Events, Axiomatic Definition of Probability, Mutually Exclusive Events, Joint Probability, Conditional Probability and Statistical Independence, Bays Theorem

- **RANDOM VARIABLES** **(12 Hours)**

Continuous and Discrete Random Variables, Cumulative Distribution Function CDF), Probability Density Function (PDF), Properties of CDF and PDF, Mathematical Expectation, Moments of a random variable, Standard Probability distributions: Bernoulli, Binomial, Poisson, Uniform, Exponential, Gaussian, Chi-Square, Function of random Variable, Transformations of Random Variables, Moment Generating Function, Characteristic Functions

- **MULTIPLE RANDOM VARIABLES** **(08 Hours)**

Joint Distribution Functions, Marginal Distributions, Conditional Distributions, Joint Expectation, Sum of Independent random variables, Covariance, Conditional Expectation, Correlation between Rando variable, Multivariate Gaussian Distribution, Law of Large Numbers, Central Limit Theorem and its Significance

- **STOCHASTIC PROCESS** **(10 Hours)**

Definition and Description of Random Processes, classification of random processes, Mean, Autocorrelation, Auto covariance functions Stationary Random Processes: Strict Sense Stationary and Wide Sense Stationary, Joint Statistical Averages of Two Random Processes, Cross Correlation and Cross Covariance, Ergodicity, Ergodic Processes, Markov Process: Markov Chain, Probability distribution and stationary distribution of Markov chain, Chapman Kolmogorov theorem, Binomial, Poisson and Normal Processes

	• **RANDOM PROCESSES IN LINEAR SYSTEMS**	**(06 Hours)**
	Transmission of a Random Process Through LTI System, Power spectral density and cross-spectral density Functions, Examples with White Noise as Input, Linear Shift Invariant Discrete Time System with a WSS Sequence as Input	
	• **TUTORIALS**	**(14 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	
3.	**Books Recommended:**	
	1. Papoulis A., S. Unnikrishna Pillai, "Probability, Random Variables, and Stochastic Processes", 4th Ed., McGraw-Hill, 2006 2. V. Sundarapandian, "Probability, Statistics and Queueing theory, 1st Edition, PHI 2009 3. Alberto Leon-Garcia, "Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Ed., Pearson, 2007 4. Steven Kay, "Intuitive Probability and Random Processes using MATLAB", 1st Ed., Springer, 2006 5. Sheldon Ross, "A First Course in Probability", 9th Ed., Pearson, 2012 6. Montgomery and Ruger, "Applied Statistics and Probability for Engineers", 1st Ed., John Wiley, 2006	

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B.Tech.2 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.	

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B.Tech.2 Semester IV ELECTROMAGNETIC WAVES EC206	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 basic concepts and theorems of electromagnetic theory and its applications.
CO2	Explain the wave propagation and radiation phenomenon in different environments
CO3	Apply the principles of electromagnetic theory and wave propagation to model transmission line and radiating systems.
CO4	Analyze the theoretical concepts based on Maxwell's equation, transmission line theory and antennas.
CO5	Evaluate the wave propagation behavior between two mediums.
CO6	Formulate the aspects of electromagnetic theory for different applications.

2. Syllabus:

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

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

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

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

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

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

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

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

	• **ATMOSPHERIC WAVE PROPAGATION**	**(05 Hours)**
	Plane Earth Reflection, Spherical Earth Propagation, Tropospheric Waves. The Ionosphere, Reflection and Refraction Waves by the Ionosphere, Regular and Irregular Variations of the Ionosphere.	
	• **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY**	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	
3.	**List of Practicals:**	
	1. To obtain Radiation Pattern of a Dipole Antenna in two planes. 2. To observe Current Distribution on a Dipole Antenna. 3. To obtain radiation Pattern of a Yagi-Uda Antenna in two planes. 4. Measurement of Dielectric Constant using Solid Dielectric Cell 5. To determine the Standing Wave-Ratio and Reflection Coefficient for different loads 6. To measure an unknown impedance of the given load using a Smith chart 7. Phase shift measurement of the given DUT 8. To perform gain measurement of different antennas. 9. Return loss measurement of given DUT 10. Insertion loss measurement of given DUT 11. To simulate Dipole antenna / Microstrip Patch Antena in HFSS/CST 12. To simulate waveguide-based components in HFSS/CST	
4.	**Books Recommended:**	
	1. E.C. Jordan & G. Balmain, “Electromagnetic Waves and Radiating Systems”, 2nd Ed., PHI, Reprint 2011. 2. R. K. Shevgaonkar, “Electromagnetic Waves”, 1st Ed., Tata McGraw Hill, 2006. 3. M.N.O. Sadiku, “Principles of Electromagnetics”, 4th Ed., Oxford University Press, 2011. 4. W.H. Hayt, “Engineering Electromagnetics”, 7th Ed., McGraw Hill, 2006. 5. Roger F. Harrington, “Time-Harmonic Electromagnetic Fields”, Wiley-IEEE Press, 2001.	

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

B.Tech.2 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 and scaling trends in MOSFETs and illustrate various short channel effects.
CO2	Recognize the fundamental concepts of various logic families with their comparative analysis
CO3	Illustrate the various processing techniques of NMOS and CMOS technology.
CO4	Analyse the design of an inverter using CMOS logic and estimate the switching parameters, power dissipation and CMOS-TTL interfacing.
CO5	Evaluate the performance of different sequential and combinational circuits using CMOS logic.
CO6	Design the sequential and combinational circuits using CMOS with layout and stick diagrams.

2. Syllabus:

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

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

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

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

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

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

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

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

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

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

3.	**List of Practicals:**	
	1. Introduction to SPICE circuit simulator 2. Realization of MOSFET characteristics using circuit simulator characteristics and BSIM models. 3. Realization of NOR gate using RTL logic. Obtain & plot its transfer characteristics and determine noise margins, fan-out and propagation delay. 4. Realization of NAND gate using TTL logic. Obtain & plot Its transfer characteristics and determine noise margins, fan-out and propagation delay 5. Implementation of CMOS inverter, obtain & plot its transfer characteristics, determine noise margins and measure propagation delay 6. Realization of inverter gate using BiCMOS logic, obtain & plot its transfer characteristics, determine noise margins 7. Design and implementation of TTL-CMOS & CMOS-TTL interfacing. 8. Design and implementation of pass transistor and transmission gate-based logic circuits. 9. Design and implement of JK & SR flip-flop using CMOS. 10. Layout of CMOS inverter and parasitic extraction and obtain VTC of extracted net list. 11. Design and implementation of inverter and NAND gate circuits using the DTL logic family 12. Design and implementation of inverter and NAND gate circuits using the ECL logic family	
4.	**Books Recommended:**	
	1. Taub H. and Schilling D., "Digital Integrated Electronics", International Ed., McGraw-Hill, 2008 2. R P Jain, “Modern Digital Electronics”, 4th Ed. Tata McGraw-Hill New Delhi. 3. Sung-Mo Kang and Leblebici Y., "CMOS Digital Integrated Circuits: Analysis and Design", 3rd Ed., Tata McGraw-Hill; 2003. 4. Rabaey Jan, Chandrakasan Anantha Nikolic, "Digital Integrated Circuits: A Design Perspective", 2nd Ed., Pearson Education, 2008. 5. Hodges D. A. and Jackson H. G. "Analysis And Design Of Digital Integrated Circuits", 3rd Ed., McGraw-Hill, 2004. 6. Baker R. J., Li H. W. and Boyce D. E., "CMOS Circuits Design Layout and Simulation", 2nd Ed., PHI 2005.	

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

B.Tech.2 Semester IV CONTROL SYSTEMS EE258	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 various types of control systems and to impart knowledge of mathematical modelling of physical systems
CO2	Explain the response of various control systems in the time domain.
CO3	Demonstrate the stability of control systems using a variety of methods.
CO4	Analyze the response and stability of control systems using frequency domain techniques
CO5	Design of PD, PI, and PID controllers.
CO6	Demonstrate various control systems applications with laboratory experiments

2. Syllabus:

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

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

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

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

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

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

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

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

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

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

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

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

	• **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY**	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	
3.	**List of Practicals:**	
	1. To obtain the open-loop response and open-loop transfer function of an OVEN. 2. To control the speed of a two-phase AC Servo motor using an auto-tunable PI controller. 3. To understand the practical Air blower control system and to control the speed of the blower using Programmable Logic Controller (PLC) and VFD from SCADA. 4. a) To obtain no load speed vs control voltage curve for the two-phase servo motor. b) To obtain speed–torque curves for the various control voltages of the servo motor. 5. To obtain a close loop response of an OVEN. 6. To understand the transient behavior of a practical Air blower control system. 7. To obtain the frequency response of the phase lead network 8. a) To obtain step response and to find transient time domain specification for a second-order system using MATLAB. b) To obtain the Bode plot and Root locus using MATLAB. 9. a) To obtain step response and to find transient time domain specification for a second-order system using MATLAB. b) To obtain the Bode plot and Root locus using MATLAB.	
4.	**Books Recommended:**	
	1. I.J. Nagrath, M. Gopal, “Control system engineering”, New Age International Publishers, 3rd Ed., 2001. 2. K. Ogata, “Modern control system engineering”, Pearson Education Asia, 4th Ed., 2002. 3. B.C. Kuo, “Automatic control system”, Prentice Hall of India, 7th Ed., 1995 4. R.C. Dorf, R.H. Bishop, “Modern control system”, Pearson Education Asia. 8th Ed., 2004. 5. N. S. Nice, “Control System Engineering”, John willey& sons, 4th Ed., 2004	