

B.Tech Curriculum for Electronics and Communication Engineering

SEMESTER-III

Subject Name	Type	Subject Code	L-T-P	Credit	Contact Hour
	HSS 2		3-0-0	3	3
Network Theory	DC 2	EC2L101	3-1-0	4	4
Signals and Systems	DC 3	EC2L102	3-1-0	4	4
Digital Electronic Circuits	DC 4	EC2L103	3-1-0	4	4
Introduction to EDA Tools	SDC 3	EC2L104	1-0-3	3	4
Signals and Systems Lab	DC Lab 3	EC2P102	0-0-3	2	3
Digital Electronic Circuits Lab	DC Lab 4	EC2P103	0-0-3	2	3
Total				22	25

SEMESTER -IV

Subject Name	Type	Subject Code	L-T-P	Credit	Contact Hour
	HSS 3		3-0-0	3	3
Analog Communications	DC 5	EC2L105	3-0-0	3	3
Analog Electronic Circuits	DC 6	EC2L106	3-0-0	3	3
Embedded Systems	SDC 4	EC2L107	2-0-2	3	4
Analog Communications Lab	DC Lab 5	EC2P105	0-0-3	2	3
Analog Electronic Circuits Lab	DC Lab 6	EC2P106	0-0-3	2	3
Open Elective	OE 1		3-0-0	3	3
Total				19	22

Syllabus for 2nd Year (3rd & 4th Semesters)

Subject Code: EC2L101	Name: Network Theory	L-T-P-C: 3-1-0-4
Prerequisite: Basic Electrical and Electronics Engineering (EE1L002)		
Syllabus Module 1: Basic Circuit Fundamentals: KCL, KVL, node/mesh analysis, RLC elements, and sources, forming the basis for circuit modeling in VLSI. Module 2: Network Theorems: Superposition, Thevenin, Norton, and maximum power transfer to simplify complex circuits. Module 3: Transient Analysis: RC/RL circuits, time constants, and step responses, relevant to switching and delay. Module 4: AC Analysis & Frequency Response: Phasors, impedance, resonance, transfer functions, Bode plots, and basic filters for analyzing frequency behavior. Module 5: Laplace & s-Domain Analysis: Laplace transforms, poles, and zeros for system representation and stability analysis. Module 6: Two-Port Networks: Z, Y, H, and ABCD parameters for modeling multi-stage circuits. Module 7: Feedback, Compensation & Non-Ideal Effects: Feedback types, stability, pole-zero compensation (including Miller), and practical effects like parasitics, delay, and noise. Course Outcomes • Apply fundamental circuit laws and network theorems to analyze and simplify electrical networks relevant to integrated circuits. • Analyze transient and steady-state behavior of circuits using time-domain and phasor techniques for understanding signal behavior and switching effects. • Evaluate frequency response of circuits using transfer functions, poles-zeros, and Bode plots for filter and amplifier design. • Analyze feedback systems and stability using loop gain, sensitivity, and compensation techniques such as dominant pole and Miller compensation. • Model and interpret practical circuit behavior by considering non-ideal effects such as parasitics, delay, and noise using simulation tools. Text Books 1. M. E. Valkenburg, Network Analysis, 3rd Edition, Pearson Prentice Hall, 2006+. 2. F. F. Kuo, Network Analysis and Synthesis, 2nd Edition, Wiley India, 2007+. Reference Books 1. W. H. Hayt, J. E. Kemmerly and S. M. Durbin, Engineering Circuit Analysis, 6th Edition, Tata McGraw Hill, 2007+. 2. R. A. DeCarlo and P-M. Lin, Linear Circuit Analysis, 2nd Edition, Oxford University Press, 2007+.		

Subject Code: EC2L102	Name: Signals and Systems	L-T-P-C: 3-1-0-4
Prerequisite: Mathematics - I		
Syllabus Module 1: Introduction to Signals and Systems: Objective and overview of signal and system analysis. Classification of signals: continuous-time, discrete-time, deterministic, random, periodic, and aperiodic signals. System types and classifications: linearity, time-invariance, causality, stability. LTI systems: impulse response, step response, and convolution integral. Module 2: Fourier Analysis of Signals and Systems: Periodic signal analysis: Continuous-Time Fourier Series (CTFS) and properties. Aperiodic signal analysis: Fourier Transform (FT) and its properties. Sinusoidal steady-state analysis of systems. Discrete-Time Fourier Transform (DTFT) and Fourier transform for periodic signals. Magnitude and phase representation; time and frequency characterization of signals and systems. Module 3: Laplace, Z-Transform and Discrete Signal Processing: Unilateral and Bilateral Laplace Transforms and properties. Analysis and characterization of LTI systems using Laplace Transform. System function and block diagram representation; Bode plot. Discrete signals: sampling theorem, digitization, and reconstruction of analog signals. Fourier transform of discrete signals: Discrete Fourier Transform (DFT). Z-Transform and its properties; discrete system analysis, transfer function, and convolution. Module 4: Optional Practical Sessions: Convolution and correlation of continuous/discrete signals using MATLAB/Python. Fourier Series and Fourier Transform computation and visualization. Laplace and Z-transform-based system analysis. Sampling, quantization, and reconstruction experiments. Frequency response analysis and discrete-time signal processing demonstrations. Course Outcomes • CO1: Understand and classify different types of signals and systems, and analyze the properties of Linear Time-Invariant (LTI) systems in terms of causality, stability, and response. • CO2: Analyze continuous-time and discrete-time signals using Fourier series and Fourier transform, and interpret the frequency-domain characteristics. • CO3: Apply Laplace and Z-transforms for system analysis, characterization, and stability determination. • CO4: Understand sampling, digitization, and reconstruction of analog signals, and evaluate discrete systems using Fourier and Z-transform techniques. Text Books 1. A. V. Oppenheim, A. S. Willsky, and S. H. Nawab, Signals and Systems, 2nd Edition, Pearson Prentice Hall, 2008. Reference Books 1. A. V. Oppenheim, R. W. Schaffer, and J. R. Buck, Discrete-Time Signal Processing, 2nd Edition, Prentice Hall, 1999. 2. J. G. Proakis and D. K. Manolakis, Digital Signal Processing, 4th Edition, Prentice Hall, 2006. 3. A. Papoulis and S. U. Pillai, Probability, Random Variables, and Stochastic Processes, McGraw Hill, 2001. 4. Simon Haykin and Barry Van Veen, Signals and Systems, 2nd Edition, Wiley, 2007.		

Subject Code: EC2L103	Name: Digital Electronic Circuits	L-T-P-C: 3-1-0-4
Prerequisite: Basic Electrical and Electronics Engineering		
Syllabus Module 1: Number Representations: Number systems and codes: Binary, decimal, and hexadecimal number systems and conversions, Representation of unsigned and signed integers, Fixed-point representation of real numbers, Floating-point representation of real numbers, binary weighted and non-weighted codes; error detecting and error correcting codes. Module 2: Switching Theory: Laws of Boolean algebra, Theorems of Boolean algebra, switching functions, Methods for specification of switching functions – Truth table and Algebraic forms, representation of switching functions; SOP & POS forms; Canonical forms of Boolean functions, Karnaugh map representation; minimization using K-map method, Realization of functions using logic gates. Module 3: Design of Combinational Circuits: Logic gates and their static CMOS implementations, Gate level design of decoders, encoders, priority encoders, multiplexers and demultiplexers, multiplexer based realization of K-maps, design of ripple carry adder, carry look-ahead adder, two's complement adder-subtractor, magnitude comparator; BCD arithmetic. Module 4: Design of Sequential Circuits: Combinational vs. sequential circuits, Latches – RS latch and JK latch, Flip-flops – RS, JK, T and D flip flops, Master-slave flip flops, Edge-triggered flip-flops, Models of sequential circuits – Moore machine and Mealy machine, Flip-flops – Characteristic table, Characteristic equation and Excitation table, Analysis of sequential circuits – Flip-flop input expressions, Next state equations, Next state maps, State table and State transition diagram, Design of sequential circuits – State transition diagram, State table, Next state maps, Output maps, Expressions for flip-flop inputs and Expressions for circuit outputs, Modular sequential logic circuits – Shift registers, Registers, Counters, Serial arithmetic circuits, propagation delay, setup and hold time, critical path delay. Module 5: Capabilities and Minimization of Sequential Machines: State Machine Design – State machine as a sequential controller; Moore and Mealy state machines; Derivation of state graph and tables; Sequence detector; state table reduction and state assignment, logic realization; equivalent state machines. Asynchronous Sequential Circuits: Analysis and synthesis, static and dynamic hazards and their elimination. Module 6: Data Converters and Semiconductor Memories: Sample and hold circuits, ADCs and DACs, ROM, SRAM, DRAM. Course Outcomes • CO1: Translate a decision making process into digital logic. • CO2: Design digital circuits for different number systems. • CO3: Perform logic optimization for reducing area and delay. • CO4: Design datapath and control unit for system level specifications. Text Books 1. Zvi Kohavi and Niraj K. Jha, Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2010. 2. Randy H. Katz and Gaetano Borriello, Contemporary Logic Design, 2nd Edition, Pearson Education, 2005. 3. Larry L. Kinney and Charles H. Roth, Fundamentals of Logic Design, Cengage Learning India Pvt. Limited, 2015. Reference Books 1. M. Morris Mano and Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, 5th Edition, Pearson Education, 2013. 2. Joseph Cavanagh, Digital Design and Verilog HDL Fundamentals, CRC Press, 2008.		

Subject Code: EC2L104	Name: Introduction to EDA Tools	L-T-P-C: 1-0-3-3
Prerequisite: Basic Electrical and Electronics Engineering; Fundamentals of Semiconductor Devices		
Syllabus Module 1: Introduction to EDA: Overview of the Electronic Design Automation ecosystem: the purpose, capability and examples of few popular EDA tools for simulation of semiconductor devices and digital and analog circuits, and design of PCBs. Commercial tool suites versus Open-Source alternatives and their roles in industry and research. Module 2: Computing Environment – Linux/Unix: Introduction to the Unix/Linux operating system, terminal navigation, and file system management; File permissions; Basic shell commands; Environment variables. Configuration of the user environment via shell scripts and management of EDA tools including its license. Module 3: TCAD Simulation: Fundamentals of semiconductor device simulation; MOSFET structure generation. Simulation of current-voltage and capacitance-voltage characteristics of a MOSFET. Analysis of distribution of key parameters such as electron and hole concentrations and current densities, electric field and potential. Parameter extraction for compact modeling. Module 4: SPICE Simulation: Basics of SPICE; Netlist syntax; Mapping TCAD-extracted parameters with SPICE models; simulating simple circuits with resistors/capacitors/inductors connected to the drain/gate/source of the MOSFET; DC sweep, AC analysis, and transient simulations. Module 5: PCB Design: Introduction to the physical design of electronic systems. Schematic capture, library management, and component footprint creation based on datasheet information. Principles of multi-layer PCB layout, placement strategies, and manual and automated routing. Design Rule Check (DRC), and generation of Gerber files and drill files for fabrication. Course Outcomes • CO1: Navigate and manage files within a professional Linux/Unix environment for engineering workflows. • CO2: Simulate semiconductor device characteristics using TCAD tools and extract key parameters. • CO3: Perform circuit-level simulations using SPICE simulator. • CO4: Design basic multi-layer Printed Circuit Boards (PCBs) in accordance with design rules. Text Books 1. Paul Cobbaut, Mastering Linux – Fundamentals, Samurai Media Limited, 2016. 2. Dr. Peter Dalmaris, KiCad Like a Pro, Elektor, 2019. Reference Books 1. Sentaurus™ Device User Guide, Synopsys Inc., Mountain View, CA, 2024. 2. ATLAS™ Device Simulation Software User’s Manual, Silvaco Inc., Santa Clara, CA, 2024.		

Subject Code: EC2P102	Name: Signals and Systems Lab	L-T-P-C: 0-0-3-2
Prerequisite: Signals and Systems		
Syllabus Module 1: Introduction to MATLAB and Programming Concepts: Introduction to MATLAB environment, workspace and command window, basic commands and syntax, manipulation of vectors, arrays and matrices, arithmetic and logical operations, control structures including loops and conditional statements, creation of scripts and functions using M-files, use of built-in mathematical functions and symbolic computation. Module 2: Signal Visualization and Data Handling: Plotting of one-dimensional and two-dimensional signals, visualization of analytical and symbolic functions, three-dimensional plotting including surface and mesh plots, recording and playback of audio signals, data storage and retrieval using different file formats such as .wav, .txt and .mat. Module 3: Fourier Analysis of Signals: Computation and visualization of Continuous-Time Fourier Series (CTFS) coefficients, Discrete-Time Fourier Series (DTFS) coefficients, implementation of Continuous-Time Fourier Transform (CTFT) and Discrete-Time Fourier Transform (DTFT), comparison of time-domain and frequency-domain representations, analysis of signal symmetry and spectral properties. Module 4: Transform Techniques and System Analysis: Convolution and correlation of continuous-time and discrete-time signals, computation of Laplace transform and inverse Laplace transform, computation of Z-transform and inverse Z-transform, zero-pole analysis, system stability and response analysis. Module 5: Advanced Signal Processing and Applications: Sampling and reconstruction of continuous-time signals, frequency response analysis of LTI systems, implementation of convolution and basic filtering techniques, modeling and simulation using MATLAB Simulink, development of simple graphical user interfaces for signal processing applications. Course Outcomes • CO1: Develop proficiency in MATLAB for signal generation, manipulation, and visualization in time and frequency domains. • CO2: Implement fundamental operations such as convolution, correlation, and system response analysis using MATLAB and Simulink. • CO3: Apply mathematical tools like Laplace, Z-transform, and Fourier analysis for analyzing continuous and discrete systems. Apply Fourier analysis techniques – CTFS, DTFS, CTFT, and DTFT – for time and frequency-domain representation of signals. • CO4: Demonstrate the ability to perform signal sampling, filtering, and frequency response evaluation, and create simple MATLAB GUIs for signal analysis. Text Books 1. A. V. Oppenheim, A. S. Willsky, and S. H. Nawab, Signals and Systems, 2nd Edition, Pearson Prentice Hall, 2008. Reference Books 1. Simon Haykin and Barry Van Veen, Signals and Systems, 2nd Edition, Wiley India, 2007. 2. H. P. Hsu, Signals and Systems – Schaum's Outline Series, McGraw Hill, 1995.		

Subject Code: EC2P103	Name: Digital Electronic Circuits Lab	L-T-P-C: 0-0-3-2
Prerequisite: Basic Electrical and Electronics Engineering		
Syllabus 1. Analysis of Functions of BCD-to-7-segment Decoder / Driver and Operation of 7-segment LED Display. 2. Characterization of Digital Logic Families. 3. Analysis and Synthesis of Boolean Expressions using Basic Logic Gates. 4. Analysis and Synthesis of Logic Functions using Multiplexers and Decoders. 5. Analysis and Synthesis of Boolean Relations using Digital Comparators and Arithmetic Expressions using Adders / Subtractors. 6. Analysis and Synthesis of Sequential Circuits using Basic Flip-Flops and Multi-bit Sequential Circuits using Shift Registers. 7. Design of Arithmetic Logic Unit (ALU). 8. Introduction to Verilog HDL. 9. Design and simulation of combinational circuits using Verilog. 10. Design and simulation of sequential circuits using Verilog. Course Outcomes • CO1: Design and analyze different combinational & sequential circuits. • CO2: Develop skill to build, and troubleshoot digital circuits. • CO3: Implement digital circuits using hardware description language. • CO4: Perform post implementation timing simulation for FPGA based designs. Text Books 1. Stephen Brown and Zvonko Vranesic, Fundamentals of Logic Design with Verilog, Tata McGraw Hill, 2013. 2. Randy H. Katz and Gaetano Borriello, Contemporary Logic Design, 2nd Edition, Pearson Education, 2005. 3. Larry L. Kinney and Charles H. Roth, Fundamentals of Logic Design, Cengage Learning India Private Limited, 2015. Reference Books 1. M. Morris Mano and Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, 5th Edition, Pearson Education, 2013. 2. Joseph Cavanagh, Digital Design and Verilog HDL Fundamentals, CRC Press, 2008. 3. Reese and Thornton, Introduction to Logic Synthesis using Verilog HDL, Morgan & Claypool, 2006.		

Subject Code: EC2L105	Name: Analog Communications	L-T-P-C: 3-0-0-3
------------------------------	------------------------------------	-------------------------

Prerequisite: Introduction to Electronics

Syllabus

Module 1: Introduction: Signals, Discrete and continuous spectra of signals, Fourier Series, Complex Fourier Spectrum, Fourier Transform, Convolution, Parseval's Theorem, low pass and bandpass signals and channels, concept of complex envelope, Hilbert transform and phase shifting, Linear Systems.

Module 2: Analog Modulation: Concept of Modulation, Amplitude modulation: Double-Sideband Suppressed Carrier, Double-Sideband Full Carrier, Single Sideband and vestigial sideband modulation; Demodulation: Carrier Recovery in AM, coherent Demodulation, Envelope Detector, Square-Law Demodulator, Integrated Circuit Modulators and Demodulators, Super heterodyne Receiver.

Module 3: Angle Modulation: Frequency Modulation, Phase Modulation, Narrow Band Angle Modulation, Wideband FM, Modulators, Demodulation techniques for FM, Broadcast FM and Stereo, QAM.

Module 4: Effects of Noise in Analog Modulation Systems: Noise classification, Noise Calculations, mathematical modelling of noise, SNR and figure of merit for AM, DSB/SC, SSB, FM, threshold effect in FM, Noise in receivers; Noise figures, Noise temperature.

Module 5: Sampling: Sampling a signal by periodic pulse stream, spectra of ideally sampled signal, Nyquist sampling theorem, flat-top sampling, sampling of bandpass signals, Pulse amplitude modulation, pulse width modulation, pulse position modulation, PCM, Time-division multiplexing.

Course Outcomes

- Explain the fundamental concepts of communication signals and systems, including signal representation, Fourier series, Fourier transform, convolution, Parseval's theorem, and linear systems.
- Analyze time-domain and frequency-domain characteristics of signals and evaluate their spectral representation using complex Fourier spectrum and transform techniques.
- Describe the concept and necessity of modulation in communication systems and analyze different analog amplitude modulation techniques such as Double Sideband Suppressed Carrier (DSB-SC), Double Sideband Full Carrier (DSB-FC), Single Sideband (SSB), and Vestigial Sideband (VSB), Frequency modulation and Phase modulation.
- Compare various demodulation techniques and explain the working principles of coherent demodulation, envelope detector, and square-law demodulator.
- Explain the operation and practical implementation of integrated circuit modulators and demodulators used in analog communication systems.
- Describe the architecture and working principle of a Superheterodyne receiver and analyze its performance.
- Analyze the Pulsed modulation systems including PAM, PPM, PWM and PCM.

Text Books

1. Simon Haykin, Communication Systems, 5th Edition, Wiley, 2022.
2. U. Madhow, Introduction to Communication Systems, Cambridge University Press, 2014.

Reference Books

1. R. E. Ziemer, W. H. Tranter, Principles of Communications: Systems, Modulation, and Noise, 6th Edition, John Wiley & Sons, 2010.
2. A. Bruce Carlson, Communication Systems, 5th Edition, McGraw Hill, 2011.
3. Ifiok Otung, Communication Engineering Principles, 2nd Edition, John Wiley & Sons Ltd, 2021.

Subject Code: EC2L106	Name: Analog Electronic Circuits	L-T-P-C: 3-0-0-3
Prerequisite: Semiconductor Devices		
Syllabus Module 1: Review of BJT and MOSFET operation, characteristic equations, small-signal analysis, and nonlinear input–output transfer characteristics. Module 2: Amplifier models and cascading. CE and CS amplifiers – biasing, operation, small-signal analysis, design, numericals, and frequency response. Module 3: CC, CD, CB, and CG amplifiers – biasing, operation, analysis, and design. Module 4: Differential amplifier – structure, differential gain, common-mode gain, CMRR, ICMR, and output swing. Module 5: Current mirrors – operation, analysis, biasing applications in amplifiers, and use as active/signal mirrors. Module 6: Feedback theory, Op-amp circuits, stability analysis, and two-stage differential amplifier with compensation. Module 7: Oscillators (RC phase-shift, LC), Barkhausen criterion, and comparator circuits. Course Outcomes • CO1: Analyze the operation and characteristics of BJT and MOSFET devices, including their small-signal models and nonlinear behavior. • CO2: Design and evaluate single-stage amplifiers (CE, CS, CC, CD, CB, CG) for specified gain, biasing, and frequency response requirements. • CO3: Examine differential amplifier configurations and determine differential gain, common-mode gain, CMRR, ICMR, and output swing. • CO4: Apply current mirror circuits for biasing and active load applications in analog amplifier systems. • CO5: Assess feedback amplifiers, operational amplifier circuits, oscillators, and comparators with respect to stability, frequency response, and practical design considerations. Text Books 1. A. S. Sedra and K. C. Smith, Microelectronic Circuits, 7th Edition, 2015. 2. Behzad Razavi, Fundamentals of Microelectronics, Wiley, 2013. Reference Books 1. Paul R. Gray and Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 3rd Edition, John Wiley. 2. J. Millman and C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, McGraw Hill, 1985.		

Subject Code: EC2L107	Name: Embedded Systems	L-T-P-C: 2-0-2-3
Prerequisite: Digital Electronic Circuits		
Syllabus Module 1: Introduction to Embedded Systems and Microcontrollers: Definition of Embedded System, Embedded Systems vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. Embedded System design flow, Hardware-Software Co-Design. Module 2: Architecture of ARM Cortex-M: ARM Instruction set architecture, Register Set, Interrupts, Memory and Peripherals. Module 3: Assembly Language Programming: Basics of Assembly Programming, Data Processing Instructions, Memory Access Instructions, Branch and Control Instructions. Module 4: Interfacing: Fundamentals of Input-Output interfacing, GPIO, I/O Synchronization, Interrupt programming, Timing Interfaces. Module 5: Serial Communication and Analog Interfacing: Serial communication interfaces: UART, I2C, SPI, CAN; Analog Interfacing: A/D and D/A Converters. Course Outcomes • Understand embedded system concepts and design flow. • Explain ARM Cortex-M architecture and ISA. • Write assembly and embedded C programs. • Interface digital and analog peripherals. • Implement communication protocols. • Design real-time embedded applications. Text Books 1. Muhammad Tahir and Kashif Javed, ARM Microprocessor Systems: Cortex-M Architecture, Programming, and Interfacing, 1st Edition, CRC Press, 2017. 2. Yifeng Zhu, Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C, 4th Edition, 2023. Reference Books 1. Joseph Yiu, The Definitive Guide to ARM Cortex-M0 and Cortex-M0+ Processors, 2nd Edition, Newnes, 2015. 2. Alexander G. Dean, Embedded Systems Fundamentals with ARM Cortex-M Based Microcontrollers: A Practical Approach, 1st Edition, ARM Education Media, 2017. 3. William Hohl and Christopher Hinds, ARM Assembly Language: Fundamentals and Techniques, 2nd Edition, CRC Press, 2014.		

Subject Code: EC2P105	Name: Analog Communications Lab	L-T-P-C: 0-0-3-2
Prerequisite: Introduction to Electronics		
Syllabus • Generation and Analysis of Different Waveforms Using Function Generator and Oscilloscope. • Implementation and Analysis of Amplitude Modulation (AM) Using Analog Multiplier IC (AD633). • AM Demodulation Using Envelope Detector and Precision Rectifier Circuits. • Implementation of Double Sideband Suppressed Carrier (DSB-SC) Modulation Using Analog Multiplier. • Single Sideband (SSB) Generation Using Filter Method / Balanced Modulator. • Study on Frequency Modulation and Demodulation. • Study of Pre-Emphasis and De-Emphasis Circuits for Noise Reduction in Communication Systems. • Generation and Analysis of Frequency Modulation (FM) Using Voltage Controlled Oscillator (VCO). • Pulse Amplitude Modulation (PAM) Using Analog Switch / Sampling Circuit. • Pulse Width Modulation (PWM) Generation Using Comparator Based System. • Pulse Position Modulation (PPM) Generation and Analysis. • Sampling Theorem Verification Using Sample and Hold Circuit. Course Outcomes • Explain the operation and practical implementation of Analog communication systems. • Analysis of Analog communication system including the modulation and demodulation. • Analyse the Pulsed modulation systems including PAM, PPM, PWM and PCM and lab scale implementation. Text Books 1. Simon Haykin, Communication Systems, 5th Edition, Wiley, 2022. 2. U. Madhow, Introduction to Communication Systems, Cambridge University Press, 2014. Reference Books 1. R. E. Ziemer, W. H. Tranter, Principles of Communications: Systems, Modulation, and Noise, 6th Edition, John Wiley & Sons, 2010. 2. A. Bruce Carlson, Communication Systems, 5th Edition, McGraw Hill, 2011. 3. Ifiok Otung, Communication Engineering Principles, 2nd Edition, John Wiley & Sons Ltd, 2021.		

Subject Code: EC2P106	Name: Analog Electronic Circuits Lab	L-T-P-C: 0-0-3-2
Prerequisite: Semiconductor Devices, BEEE		
Syllabus 1. Experimental analysis of input–output characteristics and small-signal parameters of BJT in Common Emitter configuration. 2. Experimental study of drain and transfer characteristics of MOSFET and extraction of small-signal parameters. 3. Design, implementation, and performance evaluation of Common Emitter (CE) amplifier for gain and frequency response. 4. Design and analysis of Common Source (CS) MOSFET amplifier with emphasis on gain and bandwidth. 5. Design and performance evaluation of BJT/MOSFET differential amplifier for differential and common-mode gain. 6. Implementation and evaluation of MOSFET current mirror including non-ideal effects. 7. Design and analysis of inverting and non-inverting operational amplifier circuits. 8. Design and implementation of phase shift oscillators for frequency generation. 9. Design of two-stage Op-amp in LTSpice. Course Outcomes • BJT Characteristics (CE): Analyze BJT input–output characteristics and determine its small-signal parameters experimentally. • MOSFET Characteristics: Evaluate MOSFET drain and transfer characteristics to extract key device parameters. • CE Amplifier: Design and implement a CE amplifier to measure gain and frequency response. • CS MOSFET Amplifier: Design and analyze a CS amplifier to determine its gain and bandwidth. • Differential Amplifier: Design and evaluate a differential amplifier to determine differential and common-mode gain. • MOSFET Current Mirror: Implement and analyze a MOSFET current mirror considering non-ideal effects. • Op-Amp Circuits: Design and analyze inverting and non-inverting op-amp circuits for specified performance. • Phase Shift Oscillator: Design and implement a phase shift oscillator to generate stable sinusoidal output. • Two-Stage Op-Amp (LTSpice): Design and simulate a two-stage op-amp to evaluate gain, bandwidth, and stability. Text Books 1. A. S. Sedra and K. C. Smith, Microelectronic Circuits, 7th Edition, 2015. 2. Behzad Razavi, Fundamentals of Microelectronics, Wiley, 2013. Reference Books 1. Paul R. Gray and Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 3rd Edition, John Wiley. J. Millman and C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, McGraw Hill, 1985		

Subject Code: EC2L006	Name: Introduction to Signal Processing	L-T-P-C: 3-0-0-3
Prerequisite: None		
Syllabus Introduction and Basics: Signals and Systems; Classification of Signals, System Properties; Linear Algebra Basics- Vectors, Orthogonality, Eigenvalues and Eigenvectors; Probability and Random Signals: Random variables; probability density functions (PDFs); Moments and Cumulants; Multivariate distributions; Time averages, Ensemble averages, Autocorrelation functions, Crosscorrelation function; Estimation of parameters of random signals; Linear prediction; Auto-regressive model; Nonlinear models of signals; Analysis of Nonstationary signals; Continuous Signals and Systems: Laplace Transform, Transfer Functions, Causality and Stability, Poles/Zeros; Differential Equations, Steady State and Transient Responses, and Convolution Integral; Discrete-Time Signals and Systems: LTI Systems; Z-transform; Digital filters; Difference Equations; Causality and stability; Convolution and Correlation; Discrete Fourier Transform (DFT), FFT and Window Function; Frequency Analysis of Signals and Systems; Data Acquisition: Sampling theorem; Sampling of Bandpass Signals; Quantization; A/D conversion; D/A conversion; Sampling and Reconstruction; Interpolation and Decimation; Digital Filter Design: Butterworth, Elliptic, Chebyshev low-pass filters. Filter Realizations; Conversion to high-pass, band-pass, band-stop filters. Discrete-time filters: IIR and FIR. Linear phase filters. Frequency sampling filters. Text Books 3. A. Papoulis and S. U. Pillai, Probability, Random Variables, and Stochastic Processes, McGraw Hill, 2001. 4. A. V. Oppenheim, A. S. Willsky and H. Nawab, Signals and Systems, 2nd Edition, Prentice-Hall, 1996. Reference Books 2. A. V. Oppenheim, Ronald W. Schafer and John R. Buck, Discrete-Time Signal Processing, 2nd Edition, Prentice Hall, 1999. 3. J. G. Proakis and D. K. Manolakis, Digital Signal Processing, 4th Edition, Prentice Hall, 2006.		

