DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
Course Structure
Program– B. Tech in Electronics and Communication Engineering
Regulation-R25
(Applicable from the academic year 2026-2027)

Program: **B. Tech Electronics and Communication Engineering** **Regulation: R25**

II Year I Semester-Course Structure

S.No	Category	Course Code	Course Title	Hours per Week			
				Lecture	Tutorial	Practical	Credits
1	PC	R25PC0401	Probability Theory and Stochastic Processes	3	0	0	3
2	PC	R25PC0402	Signals and Systems	3	1	0	4
3	PC	R25ES06	Electronic Devices and Circuits	3	0	0	3
4	PC	R25PC0403	Digital Logic Design	3	0	0	3
5	PC	R25PC0404	Control Systems Engineering	2	0	0	2
6	HS	R25MS01	Innovation and Entrepreneurship	2	0	0	2
7	PC	R25PC0405	Modelling and Simulation Lab	0	0	2	1
8	PC	R25PC0406	Electronic Devices and Circuits Lab	0	0	2	1
9	PC	R25PC0407	Digital Logic Design Lab	0	0	2	1
10	SD	R25SD0401	Linux and Shell Scripting	0	0	2	1
11	BS	R25BS07	Environmental Science	1	0	0	0
			Total	17	1	08	21

Category	Courses	Credits
PC-Professional Core Courses	8	19
BS-Basic Science courses	1	0
HS-Humanities Science and Management Studies	1	1
SD-Skill Development Course	1	1
Total	11	21

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Program: B. Tech in Electronics and Communication Engineering **Regulation: R25**

II Year II Semester- Course Structure

S.No	Category	Course Code	Course Title	Hours per Week			
				Lecture	Tutorial	Practical	Credits
1	BS	R25MA211BS	Numerical Methods and Complex Variables	3	1	0	3
2	PC	R25PC0408	Electromagnetic Fields and Transmission Lines	3	0	0	3
3	PC	R25PC0409	Analog and Digital Communications	3	0	0	3
4	PC	R25PC04010	Electronic Circuit Analysis	3	0	0	3
5	PC	R25PC0411	Linear and Digital IC Applications	3	0	0	3
6	BS	R25MA216BS	Computational Mathematics Lab	0	0	2	1
7	PC	R25PC0412	Analog and Digital Communications Lab	0	0	2	1
8	PC	R25PC0413	Electronic Circuit Analysis Lab	0	0	2	1
09	PC	R25PC0414	Linear and Digital IC Applications Lab	0	0	2	1
10	SD	R25SD0402	Web and Mobile Applications	0	0		1
Total				**15**	**1**		**20**

Category	Courses	Credits
PC-Professional competence Courses	7	15
BS-Basic Science courses	2	4
SD-Skill Development Course	1	1
Total	10	20

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		L	T	P	C
R25PC0401	**PROBABILITY THEORY AND STOCHASTIC PROCESSES**	**3**	**0**	**0**	**3**

B.Tech. II Year I Sem.

Course Objectives:
1: Understand the fundamental concepts of probability, random variables, and their distributions.
2: Learn operations on single and multiple random variables, including transformations and moments.
3: Study temporal and spectral characteristics of random processes.
4: Analyse linear systems driven by stationary random processes using ACFs and PSDs.
5: Understand noise sources and basic concepts of information theory used in communication systems.

Pre-requisite: Mathematics

Course Code	**Course Outcomes**				**Mapping with POs**					
		PO1	**PO 2**	**PO 3**	**P04**	**P05**	**P06**	**P011**	**PO12**	**Dok**
CO1	Explain the basic concepts of probability, random variables, and their distributions.	3	3	2	-	-	-	-	-	L1,L2
CO2	Compute moments, transformations, and expected values of single and multiple random variables.	3	3	3	2	-	-	-	-	L2,L3
CO3	Analyze the temporal characteristics of random processes such as stationarity, ergodicity, and correlation functions.	3	3	2	3	-	-	-	-	L2,L3
CO4	Examine the spectral characteristics of random processes using power spectral density and cross-spectral density.	3	3	-	3	-	-	-	-	L4,L5
CO5	Evaluate noise models and understand their representation in communication systems.	3	3	2	-	-	-	-	3	L4,L5

UNIT - I

Probability: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events.

Random Variables- Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

UNIT - II

Operations on single Random Variable

Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable - Monotonic and Non-monotonic Transformations of Continuous and Discrete Random Variable, Computer generation of a Random Variable of a given PDF/CDF

UNIT - III

Multiple random variables and Operations on Multiple random variables: Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density– Point and Interval conditioning, Statistical Independence, Sum of Two and more Random Variables, Central Limit Theorem, Equal and Unequal Distribution (Proof notexpected).

Expected Value of a Function of Random Variables- Joint Moments about the Origin, Joint Central

Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT IV

Random processes – Temporal characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second Order and Wide- Sense Stationary, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean- Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross- Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

UNIT V

Random processes – Spectral characteristics: The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

Noise sources: Resistive / Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties.

TEXT BOOKS:

1. Peyton Z. Peebles - Probability, Random Variables & Random Signal Principles - TMH, 4th Edition

2. Murray R Spiegel, John Schiller, R Alu Srinivasan. – Probability and Statistics – Schaum's Outlines, 2nd Edition, TMH

REFERENCES:

1. P Ramesh Babu - Probability Theory and Random Processes – McGraw Hill Education

2. Athanasios Papoulis and S. Unnikrishna Pillai - Probability, Random Variables and Stochastic Processes – McGraw Hill Education, 4th Edition

3. K. N. Hari Bhat, K. Anitha Sheela and Jayant Ganguly - Probability Theory and Stochastic Processes for Engineers - Pearson, 1st Edition, 2011

4. Taub and Schilling - Principles of Communication systems by (TMH), 2008

5. Y Mallikarjuna Reddy - Probability Theory and Stochastic Processes, 4th Edition, University Press

Web References:

1. https://mathworld.wolfram.com/
2. https://web.stanford.edu/class/archive/stats/stats116/
3. https://www.coursera.org/courses?query=probability

E-Books:

1. "Introduction to Probability" – MIT (Grinstead & Snell)
2. "Probability, Random Variables and Stochastic Processes" – Athanasios Papoulis (Old Edition Public Domains)
3. "All of Statistics" – Larry Wasserman (Free PDF shared by author for education)
4. "Stochastic Processes" – MIT OCW
5. "Introduction to Probability for Data Science" – Blitzstein & Hwang

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L T P C

R25PC0402 **SIGNALS AND SYSTEMS** **3 1 0 4**

B.Tech. II Year I Sem.

Course Objectives:
1. Classify various signals and systems and analyze them in time and frequency domains.
2. Apply Fourier, Laplace, and Z-transform techniques for analysis of signals and systems.
3. Understand the concepts of distortion less transmission, convolution, correlation, and transforms.
4. Identify the need for sampling, types of sampling, conditions for reconstruction, and effects of sampling.
5. Understand and analyze LTI system behavior, system bandwidth, filtering, and noise removal.

Pre-Requisites: Mathematics

Course Code	**Course Outcomes**			**MappingwithPOs**						
		PO1	**PO2**	**PO3**	**P04**	**P05**	**P06**	**P011**	**PO12**	**Dok**
CO1	Understand and classify various signals, systems and their time/frequency domain representation.	3	3	2	2	-	-	-	-	L1,L2
CO2	Apply transform techniques (FS, FT, LT, ZT) for transmission and analysis of signals through systems.	3	3	2	2	-	-	-	-	L2,L3
CO3	Analyze the significance of sampling theorem, aliasing and reconstruction.	3	3	2	2	-	-	-	-	L2,L3
CO4	Understand correlation, PSD, energy/power spectral density and their applications.	3	3	2	2	-	-	2	-	L4,L5
CO5		3	3	2	3	-	-	2	-	L4,L5

UNIT - I

Signal Analysis

Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

UNIT - II

Fourier series: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

UNIT - III

Signal Transmission through Linear Systems: Linear System, Impulse response, Response of a Linear System, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution. Extraction of Signal from Noise by Filtering. Linear Time Invariant (LTI) System, Linear

Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and risetime. Extraction of Signal from Noise by Filtering.

UNIT-IV

Laplace Transforms: Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis. **Correlation**: Auto Correlation and Cross Correlation Functions, Relation between Convolution and Correlation, Properties of Correlation Functions, Energy Density Spectrum, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Parseval's Theorem, Detection of Periodic Signals in the presence of Noise by Correlation.

UNIT-V

Sampling theorem: Graphical and analytical proof of Sampling Theorem for Base band/Band Limited and Band Pass Signals, Types of Sampling: Impulse Sampling, Natural and Flattop Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, **Z–Transforms**: Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

TEXT BOOKS:

1. Signals, Systems & Communications -B.P. Lathi, BS Publications.
2. Signals and Systems – Allan. V. Oppenheim, Allan. S. Willsky with S. Hamid. Nawab, 2nd Ed. Pearson.

REFERENCES:

1. Signals and Systems–Simon Haykin, Barry Van Veen, 2nd Ed., Wiley.
2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH.
3. Fundamentals of Signals and Systems – Michel J. Roberts, Govind Sharma, 2nd Ed., MGH.
4. Signals, Systems and Transforms - Charles. L. Philips, John M. Parr and Eve A. Riskin, 4th Ed., 2004, Pearson, Prentice Hall.

Web References

1. https://ocw.mit.edu/courses/6-003-signals-and-systems
2. https://nptel.ac.in/courses/117/104/117104062/
3. https://www.coursera.org/learn/signals-and-systems
4. https://nptel.ac.in/courses/117/105/117105143/
5. https://www.khanacademy.org/math

E-Books:

1. Signals and Systems – B.P. Lathi (Free Edition)
2. Signals and Systems – Oppenheim & Willsky (Classic Edition)
3. Fundamentals of Signals and Systems – Michael Roberts
4. Philips, Parr & Riskin – Signals, Systems and Transforms

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		L T P C
R25ES06	**ELECTRONIC DEVICES AND CIRCUITS**	**3 0 0 3**

B.Tech. II Year I Sem.

Course Objectives:

1. To study the characteristics and applications of semiconductor diodes.
2. To understand the working principles and characteristics of Bipolar Junction Transistors (BJT).
3. To analyze biasing techniques and stability of BJT circuits.
4. To understand Field Effect Transistors (FETs), MOSFETs, and advanced devices like FinFETs and CNTFETs.
5. To explore the operation and applications of special-purpose diodes.

Course Code	Course Outcomes	Mapping with POs							
		PO1	PO2	PO3	P04	P05	P06	P011	Dok
C01	Describetheworkingofdiode,BJTandFET,theirbiasingmethods,anddeducethe expressions for device parameters/ current/ and current-voltage relationships.	3	3	-	2	2	-	-	L1,L2
C02	Analyze and design diode-based circuits such as rectifiers, clippers, and clampers.	2	3	2	2	2	-	-	L2,L3
C03	Design appropriate biasing circuits using BJT and analyze the low frequency transistor (BJT) amplifier circuits	3	3	3	2	2	-	-	L2,L3
C04	AnalyzethelowfrequencyFETamplifiercircuitsandunderstandtheMOSFEToperation.	3	3	2	2	2	-	1	L4,L5
C05	Acquiretheknowledgeabouttheroleofspecialpurposeelectronicdevicesandtheir applications.	2	2	2	2	2	1	2	L4,L5

Syllabus:

UNIT-I: **12 Hours**

Diode: PN junction as a Diode, V-I characteristics, Diode resistance, Transition and Diffusion capacitance, Diode equivalent circuit, Specifications.

Diode Applications: Rectifiers - Half-wave, Full-wave (center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers **COs-CO1**

UNIT-II: **14 Hours**

Bipolar Junction Transistor (BJT): Working principle, Current components, Common Base (CB), Common Emitter (CE), Common Collector (CC) configurations, Input and output characteristics, Transistor as an Amplifier.

BJT Biasing: Load line and operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Self bias, Bias Stability, Thermal runaway, Bias compensation using diodes. **COs-CO2**

UNIT-III: **12 Hours**

BJT Amplifiers: Transistor Hybrid parameter model, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier. **COs-CO3**

UNIT-IV: **11 Hours**

Field Effect Transistors (FET): Junction FET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion mode, Comparison of BJT and FET, FET Small Signal Model, Analysisof CS and CD JFETAmplifiers, Introduction to FinFET and CNTFET.**COs-CO4**

UNIT-V: **10 hours**

Special Purpose Devices: Breakdown mechanisms in Zener Diodes, Zener diode characteristicsand application, Structure, operation and characteristics of SCR and UJT, Principle of operation and characteristics of Tunnel diode, Varactor Diode, Photo diode, Solar cell, LED, Schottky diode.

COs-CO5

Self-Learning Topics: BJT and FET operations at high frequency

Board of Studies: Electronics and Communication Engineering

Approved in BOS No:01,08thSep2025

Approved in ACM No: 01

TEXTBOOKS:

1. JacobMillman, Christos C. Halkias,SatyabrataJit- Electronic Devices and Circuits,McGraw-Hill Education, 4ed., 2016.
2. RobertL.BoylestadandLouisNashelsky,ElectronicDevicesandCircuitTheory.Pearson, 11ed., 2015.

REFERENCEBOOKS:

1. Principles of Electronic Devices And Circuits, Dr S.Kishore Reddy, Dr.K. Sanjeevarao, Mr.Vasantha Naga Raju, Mrs.J.Merina.
2. DavidA.Bell,ElectronicDevicesandCircuits,OxfordUniversityPress,5ed.,2008.
3. AdelS.SedraandKennethC.Smith,MicroelectronicCircuits,OxfordUniversityPress,7ed., 2014.
4. G.K.Mithal,ElectronicDevicesandCircuits,KhannaPublishers,23ed.,2017.
5. S. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, McGraw-Hill Education, 4ed., 2017.

Web References:

1. https://www.allaboutcircuits.com/
2. https://nptel.ac.in/courses/108/105/108105158/
3. https://electronics-tutorials.ws/
4. https://www.electronics-notes.com/
5. https://www.ti.com/

E-Books:

1. Electronic Devices and Circuit Theory – Boylestad & Nashelsky.
2. Microelectronic Circuits – Sedra & Smith.
3. Electronic Devices – Floyd.
4. Semiconductor Physics and Devices – Neamen.
5. Fundamentals of Electronics – Agarwal & Lang.

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		L T P C
R25PC0403	**DIGITAL LOGIC DESIGN**	**3 0 0 3**

B.Tech. II Year I Sem.

Course Objectives:

1. To introduce number systems, Boolean algebra, and fundamental logic gates.
2. To teach simplification of Boolean functions using algebraic methods and Karnaugh Maps.
3. To impart knowledge on the analysis and design of combinational logic circuits.
4. To familiarize students with sequential logic circuits including latches, flip-flops, and counters.
5. To explain synchronous circuits, state machines, and programmable logic devices (PLA, PAL).

Course Code	**Course Outcomes**	**MappingwithPOs**								
		PO1	**PO 2**	**PO 3**	**P04**	**P05**	**P06**	**P011**	**PO12**	**Dok**
CO1	Apply Boolean algebra and minimization techniques to simplify Boolean expressions.	3	3	2	2	-	-	-	-	L1,L2
CO2	Design combinational circuits using logic gates and K-maps.	3	3	2	2	-	-	-	-	L2,L3
CO3	Analyze latches, flip-flops, and sequential logic circuits.	3	3	2	2	-	-	-	-	L2,L3
CO4	Construct synchronous counters and sequential circuits using flip-flops.	3	3	2	2	-	-	2	-	L4,L5
CO5	Utilize programmable logic devices (PLA/PAL) for digital system implementation.	3	3	2	3	-	-	2	-	L4,L5

UNIT–I:

Number Systems: Binary, Octal, Decimal, Hexadecimal, Fixed-point and Floating-point Number Representations, Complements of Numbers: 1's and 2's Complement, Error Detection and Correction Codes: Parity Check, Hamming Code.

Boolean Algebra and Logic Gates: Axiomatic definitions, basic theorems and properties, Boolean Functions: Canonical and standard forms, Digital Logic Gates Overview.

UNIT-II:

Gate-Level Minimization Techniques: Karnaugh maps: 2, 3, 4 and 5 variables, Sum-of-products (SOP) and product-of-sums (POS) simplification, Don't care conditions, Implementation using NAND and NOR gates, Tabular methods

UNIT-III:

Combinational Logic Circuits: Analysis and design procedures, Binary adder-subtractor and BCD adder, magnitude comparator, decoders, encoders, multiplexers and demultiplexers. Code converters

UNIT-IV:

Sequential Logic Circuits: Gated latches, Flip-flops: Clocked S-R, D, T, JK, Master-Slave JK, Design of synchronous and asynchronous counters, Shift registers: types and applications.

UNIT-V:

Synchronous Sequential Logic Moore and Mealy state machines, State diagrams, state tables, and state reduction, Case studies: sequence detector, traffic light controller, vending machine.

Programmable Logic Devices: Memory devices - RAM, ROM, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, Digital Design with an Introduction to the Verilog HDL, 6^{th} Edition, Pearson Education/PHI, 2017.

REFERENCES:

1. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital Systems: Principles and Applications, 10th Edition, Pearson Education.
2. Charles H. Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, 6th Edition, Cengage Learning.

Web References

1. https://nptel.ac.in/courses/117/106/117106086
2. https://www.allaboutcircuits.com/
3. https://www.electronics-tutorials.ws/
4. https://ieeexplore.ieee.org/

E-Books:

1. Digital Design,M. Morris Mano & Michael D. Ciletti – Pearson.
2. Fundamentals of Digital Logic with VHDL Design, Stephen Brown & Zvonko Vranesic – McGraw Hill.

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		L T P C
R25PC0404	**CONTROL SYSTEMS ENGINEERING**	**2 0 0 2**

B.Tech. II Year I Sem.

Course Objectives:

1. To introduce the fundamental concepts, classifications, and mathematical modeling of control systems for mechanical and electrical domains
2. To analyze control system behaviour in time and frequency domains and stability criteria using root locus, Bode plot, Nyquist plot, etc.
3. Design and evaluate compensators and controllers to improve system performance.
4. Explain state-space representation, solution of state equations, and assess system controllability and observability.

Course Code	Course Outcomes			Mapping with POs						
		PO1	**PO 2**	**PO 3**	**P04**	**P05**	**P06**	**P011**	**PO12**	**Dok**
CO1	Describe open- and closed-loop systems, and develop mathematical models using block diagrams and signal flow graphs.	3	2	2	-	-	-	-	-	-
CO2	Analyze time response of second-order systems using time-domain specifications, and assess stability using Routh-Hurwitz criterion and root locus techniques.	3	3	2	1	1	-	-	-	-
CO3	Analyse frequency response plots including Bode, Polar, and Nyquist plots, and investigate system stability.	3	3	2	1	1	-	-	-	-
CO4	Design compensators and controllers to meet specific performance criteria in control systems.	3	3	1	2	1	-	-	-	-
CO5	Apply the state-variable approach and analyze controllability and observability.	3	3	2	1	1	-	-	-	-

UNIT – I

Control System fundamentals: Classification of control systems, Open and Closed loop systems. Mathematical modelling of mechanical systems and their conversion into electrical systems. Block diagram reduction and Signal flow graphs.

UNIT - II

Time response Analysis: Transfer function and Impulse response, types of input. Transient response of second order system for step input. Time domain specifications. Types of systems, static error coefficients, Routh - Hurwitz criterion for stability. Root locus techniques: Analysis of typical systems using root locus techniques. Effect of location of roots on system response.

UNIT - III

Frequency response Analysis: Frequency domain specifications, bode plots, Gain margin and Phase Margin. Polar plot, Nyquist plot, and Nyquist criterion for stability.

UNIT - IV

Compensators and controllers: Introduction to compensators, Lag compensator, Lead compensator, Lag- Lead compensator, Design of compensators using bode plot. Introduction to controllers, P, I, D, PI, PD, PID controllers.

UNIT – V

State space representation: Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and observability.

TEXT BOOKS

1. J. Nagrath and M. Gopal, Control System Engineering, 5ed., New Age Publishers, 2009.
2. Benjamin C. Kuo, Automatic Control Systems, 7ed., PHI, 2010.

REFERENCE BOOKS

1. K. Ogata, Modern Control Engineering, 2ed., Prentice Hall, 2010.
2. M. Gopal, Control Systems: Principles and Design, Tata McGraw-Hill, 1997.
3. Norman S. Nise, Control Systems Engineering, 5ed., John Wiley & Sons, 2007.
4. A.K. Jairath, Solutions and Problems of Control Systems, CBS Publishers, 2013.
5. Nagoor Kani, Control Systems, 2ed., RBA Publications, 2007.

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R25MS01	**Innovation and Entrepreneurship**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

(ECE)

B.Tech. II Year I Sem.

Course Objectives:

1. To familiarize on the basic concepts of innovation, entrepreneurship and its importance.
2. To Identify and analyze the process of problem-opportunity identification, market segmentation, and idea generation techniques.
3. To initiate prototype development and understand minimum viable product.
4. To develop initial Business and financial planning and Go-to-Market strategies
5. To impart knowledge on establishing startups, venture pitching and IPR.

Course Outcomes:

1. Understand the entrepreneurship and the entrepreneurial process and its significance in economic development.
2. Assess the problem from an industry perspective and generate solutions using the design thinking principles.
3. Assess market competition, estimate market size, and develop a prototype. 4. Analyze Business and financial planning models and Go-to-Market strategies.
5. Able to build a start-up, register IP and identify funding opportunities.

Unit I: Fundamentals of Innovation and Entrepreneurship

Innovation: Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation.

Entrepreneurship: Introduction, types of entrepreneurship attributes mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship, Importance of on-campus startups. Understanding to build entrepreneurial mindset attributes and networks individuals while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity.

Unit II: Problem and Customer Identification

Identification of gap, problem, analyzing the problem from a industry perspective, real-world problems, market and customer segmentation, validation of customer problem fit, Iterating problem customer fit, Competition and Industry trends mapping and assessing initial opportunity, Porter’s Five Force Model. Idea generation, **Ideation techniques:** Brainstorming, Brain writing, Round robin, and SCAMPER, Design thinking principles, Mapping of solution to problem.

Core Teaching Tool: Several types of activities including: Class, game, Gen AI, Get out of the Building and Venture Activity.

Unit III: Opportunity assessment and Prototype development

Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity. Understanding prototyping and Minimum Viable Product (MVP). Developing a prototype: Testing, and validation.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity.

Unit IV: Business & Financial Models

Introduction to Business Model and types, Lean Canvas Approach: 9-block lean canvas model, building lean canvas for your startup. Business planning: components of Business plan- Sales plan, People plan and financial plan, Financial Planning: Types of costs, preparing a financial plan for profitability using a financial template, understanding the basics of Unit economics, Economies of Scale and analyzing financial performance. Go-To-Market (GTM) approach – Selecting the Right Channel, creating digital presence, and building customer acquisition strategy.

Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

Unit V: Startups and IPR

Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, institutional support to entrepreneurs, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features.

Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property. Patent Rights: Scope of Patent Rights. Copyright, trademark, and GI. Licensing and transfer of technology.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

Suggested Readings:

1. John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.

2. Ajay Batra, The Stratup Launch Book- A Practical Guide for Launching Customer Centric Ventures, Wiley, 2020. (For Core Teaching Tool).

3. Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 3E, Pearson, 2018.

4. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.

5. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.

6. NISP -Brochure inside pages - startup_policy_2019.pdf

Chairperson
Board of Studies (MBA)

		L	T	P	C
R25PC0405	**MODELLING & SIMULATION LAB**	**0**	**0**	**2**	**1**

B.Tech. II Year I Sem.

Course Objectives:

1. Understand and generate standard continuous-time and discrete-time signals and sequences.
2. Analyze signal operations and compute energy and average power of signals.
3. Determine system characteristics such as linearity, time invariance, stability, and realizability.
4. Analyze system responses using convolution, correlation, and impulse response concepts.
5. Apply Fourier, Laplace, and Z-transform techniques for signal and system analysis.

Course Code	Course Outcomes	Mapping with POs								
		PO1	**PO2**	**PO3**	**P04**	**P05**	**P06**	**P011**	**PO12**	**Dok**
CO1	Generate and visualize standard signals and perform signal operations using MATLAB	3	2	-	-	3	-	-	-	L1,L2
CO2	Compute energy, average power, even–odd and real–imaginary components of signals	3	3	-	-	2	-	-	-	L2,L3
CO3	Analyze system properties and compute output responses using convolution and correlation	3	3	2	-	2	-	-	-	L2,L3
CO4	Determine frequency-domain characteristics using Fourier, Laplace, and Z-transforms	3	3	-	-	2	-	-	-	L4,L5
CO5	Plot magnitude, phase spectra and pole-zero diagrams for given systems	3	3	2	-	2	-	-	3	L4,L5

List of Experiments:

Signals and Systems (Minimum 7 Experiments)

1. Write the code / script for generating various standard viz: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc and Nonstandard Signals and Sequences generated from these standard signals /sequences using Waveform synthesis. Also for perform different operations viz: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power on them.

2. Write the code / script for finding the Even and Odd parts of Signal / Sequence and Real and Imaginary parts of Signal.

3. Write the code / script for finding the output of a System for a given input and Impulse Response and finding Auto Correlation and Cross Correlation of Signals / sequences

4. Write the code / script for Verifying whether a given Continuous/Discrete System is Linear, Time Invariant, Stable and Physically Realizable

5. Write the code / script for obtaining Sinusoidal response and Impulse response of a given Continuous / Discrete LTI System.

a) Plot the Real and Imaginary part and

b) Magnitude and Phase Plot of the response

6. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Fourier Transform by using the properties where ever required.

7. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Laplace Transform by using the properties where ever required. Also plot pole-zero diagram in S-plane

8. Write the code/ script for finding and plotting the Magnitude and Phase Spectrum of any given Sequence by finding its Z-Transform by using the properties wherever required. Also plot pole – zero diagram in Z-plane

9. Design a Simulink or equivalent model for

a) Solving Differential Equations

b) Finding the response of any RLC Circuit with different initial Conditions for AC and DC inputs and plot the corresponding responses

10. Gibbs Phenomenon and waveform synthesis Probability Theory and Stochastic Processes (Minimum 3 Experiments)

11. Write the code / script for generating various Random Variables with different CDFs/ PDFs

12. Write the code / script for generating Gaussian noise and for finding its mean, Skewness, Kurtosis, PDF and PSD.

13. Write the code / script for Verifying Sampling theorem for different sampling rates, Sampling types and Duty Cycles and for plotting the sampled and reconstructed Signals.

14. Write the code / script for Removal of noise from the signal using Cross correlation.

15. Write the code / script for Extraction of Periodic Signal masked by noise using Auto Correlation

Control Systems (Minimum 2 Experiments)

16. Build and Simulate a DC Motor using Simulink

17. Implementation of a PID Controller from equations using Simulink

18. Controllability and Observability

Note: For the experiments with code/scripts written in MATLAB or equivalent (1-8, 11-15), the student can design a user interface or app using MATLAB App Designer or equivalent.

Web References:

https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/

https://nptel.ac.in/courses/108/101/108101174/

https://www.allaboutcircuits.com/technical-articles/category/signals/

E-Books:

1. B. P. Lathi – Signals and Systems
2. Alan V. Oppenheim & Alan S. Willsky – Signals and Systems
3. Simon Haykin & Barry Van Veen – Signals and Systems

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		L T P C
R25PC0406	**Electronic Devices and Circuits Lab**	**0 0 2 1**

B.Tech. II Year I Sem.

Course Objectives:

1. To understand the V–I characteristics of basic electronic devices such as diodes and BJTs.
2. To design and analyze rectifier, clipper, and clamper circuits.
3. To study biasing techniques and operating point stabilization of BJTs.
4. To analyze input–output characteristics of BJT configurations.
5. To use software tools for simulation and validation of electronic circuits.

Course Code	Course Outcomes			Mapping with POs						
		PO1	**PO2**	**PO3**	**P04**	**P05**	**P06**	**P011**	**PO12**	**Dok**
CO1	Analyze V–I characteristics of PN junction and Zener diodes.	3	2	-	-	-	-	-	-	L1,L2
CO2	Design and test rectifier circuits with and without filters.	3	3	2	-	-	-	-	-	L2,L3
CO3	Implement waveform shaping circuits such as clippers and clampers.	2	3	3	-	-	-	-	-	L2,L3
CO4	Analyze BJT characteristics and determine current gain and resistances.	3	3	2	2	-	-	-	-	L4,L5
CO5	Design biasing circuits and validate results using simulation tools.	2	2	3	3	2	-	-	-	L4,L5

List of Experiments:

A. Hardware-Based Experiments (7):

1. Study the I–V characteristics of a PN junction diode in forward and reverse bias to determine cut-in voltage and dynamic resistance.
2. Examine the reverse bias characteristics of a Zener diode and demonstrate its application as a voltage regulator under varying conditions.
3. Design and analyze half-wave and full-wave rectifiers (center-tap and bridge) with and without capacitor filters to evaluate ripple factor and output voltage.
4. Implement clipper and clamper circuits to observe waveform shaping through positive, negative, and biased configurations.
5. Plot the input and output characteristics of a BJT in common emitter configuration to determine input/output resistance and current gain.
6. Design and test fixed bias and voltage divider bias circuits to establish a stable operating point for a BJT amplifier and study DC load line behavior.
7. Construct and analyze a Common Base (CB) configuration of a BJT to study input-output characteristics and determine current gain (α) and input/output resistance.

B. Software-Based Simulation Experiments (7):

1. Simulate a full-wave bridge rectifier with capacitor filter to analyze waveform smoothing and ripple reduction in DC power supply design.
2. Simulate a Zener diode-based voltage regulator to study voltage stabilization against varying supply voltages and load resistances.
3. Simulate a common emitter amplifier with and without emitter bypass capacitor to analyze the effect on

voltage gain and signal amplification.
4. Simulate BJT operation as a switch and small-signal amplifier to understand its dual functionality in digital and analog applications.
5. Simulate the output and transfer characteristics of a JFET to determine parameters such as pinch-off voltage, drain resistance, and transconductance.
6. Simulate the characteristics of a MOSFET and design a CMOS inverter to study digital switching behavior and low-power logic design.
7. Simulate the transfer and output characteristics of an enhancement-mode NMOS transistor to analyze threshold voltage, drain current, and switching behavior.

Hardware Requirements:

1. Regulated DC Power Supply (0–30V)
2. Function Generator
3. Digital Multimeter
4. Cathode Ray Oscilloscope (CRO) or DSO
5. Breadboards and Connecting Wires
6. Resistors, Capacitors, Diodes (1N4007, Zener Diodes)
7. BJTs (e.g., BC107, 2N2222), JFETs (e.g., J201), MOSFETs (e.g., IRF540N)
8. Trainer Kits (optional but preferred for ease)

Software Requirements (Any one of the listed tools or equivalent):

1. LTSpice (Free from Analog Devices)
2. NI Multisim (Academic License or Student Version)
3. Proteus Design Suite (Simulation and PCB Design)
4. TINA-TI (Free from Texas Instruments)
5. PSPICE for TI or OrCAD Lite
6. Windows PC or Laptop with minimum 4GB RAM and i3 processor or better

Web References:

1. https://www.allaboutcircuits.com/

2. https://www.electronics-tutorials.ws/

3. https://nptel.ac.in/courses/108/105/108105102/

E-Books:

1. Millman & Halkias – Electronic Devices and Circuits
2. Boylestad & Nashelsky – Electronic Devices and Circuit Theory
3. Sedra & Smith – Microelectronic Circuits

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		L	T	P	C
R25PC0407	**DIGITAL LOGIC DESIGN LAB**	0	0	2	1

B.Tech. II Year I Sem.

Course Objectives:

1. To understand and implement combinational and sequential digital circuits using logic ICs.
2. To design and minimize Boolean functions using SOP/POS and universal gates.
3. To implement adders, subtractors, code converters, multiplexers, decoders, and comparators.
4. To model, simulate, and analyze digital circuits using Verilog HDL.
5. To develop skills in hardware realization and software-based verification of digital systems.

Course Code	Course Outcomes	Mapping with POs								
		PO1	PO 2	PO 3	P04	P05	P06	P011	PO12	Dok
CO1	Realize and minimize Boolean functions using basic and universal gates.	3	2	2	-	-	-	-	-	L1,L2
CO2	Design and implement combinational circuits such as adders, multiplexers, decoders, and code converters.	3	3	2	-	-	-	-	-	L2,L3
CO3	Analyze and implement parity generators, comparators, and majority logic circuits.	2	3	2	-	-	-	-	-	L2,L3
CO4	Design and simulate combinational and sequential circuits using Verilog HDL.	3	3	3	2	2	-	-	-	L4,L5
CO5	Design and analyze registers, counters, and FSM-based sequence detectors.	3	3	3	2	2	-	-	-	L4,L5

List of Experiments

A. Realization in Hardware Laboratory (Using Logic ICs)

These are fundamental hands-on experiments conducted using logic ICs such as AND, OR, NOT, NAND, NOR, XOR gates, flip-flops, multiplexers, and decoders.

1. Realize and minimize Boolean functions using basic gates and universal gates (NAND/NOR) in SOP/POS form.
2. Design and implement Half Adder, Full Adder, Half Subtractor, and Full Subtractor using logic gates.
3. Construct and analyze basic logic gates (AND, OR, NOT, XOR, XNOR) using only NAND and NOR gates.
4. Design and implement parity bit generators (even and odd) and a 4-input majority logic circuit.
5. Design and implement code converters such as Binary to Gray, Gray to Binary, and BCD to Excess-3 using gates.
6. Design and implement simple combinational circuits: 2-to-1 multiplexer, 1-bit comparator, and 7-segment decoder logic.

B. Verilog HDL-Based Digital Design Experiments (Simulation-Based)

These experiments are implemented using Verilog HDL with different modeling styles (dataflow, behavioral, structural) and simulated using tools like Vivado, ModelSim, or Xilinx ISE.

1. Design and simulate a 2-bit comparator using dataflow modeling; extend it to 4-bit using structural modeling.
2. Implement a 2:1 multiplexer using dataflow modeling and design an 8:1 multiplexer using structural modeling.

3. Design a 2-to-4 decoder using dataflow modeling and realize a 3-to-8 decoder using structural modeling.
4. Implement a given Boolean function using a decoder-based approach in behavioural modeling.
5. Design and simulate a universal n-bit shift register (left, right, hold, parallel load) using behavioural modeling.
6. Design a synchronous MOD-n counter using behavioural modeling with D or JK flip-flops.
7. Design and simulate an asynchronous (ripple) counter for a custom sequence using structural modeling.
8. Implement a sequence detector for a given binary pattern using FSM (Moore/Mealy) in behavioural modeling.

Web References:

1. https://nptel.ac.in/courses/108/105/108105132/
2. https://www.allaboutcircuits.com/technical-articles/category/digital/
3. https://www.electronics-tutorials.ws/logic/

E-Books:

1. M. Morris Mano – Digital Design
2. Thomas L. Floyd – Digital Fundamentals
3. R. P. Jain – Modern Digital Electronics

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Board of Studies (ECE)

R25SD0401	**Linux and Shell Scripting**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

B.Tech. II Year I Sem.

Course Objectives: By the end of the course, students will be able to:

1. Understand Linux system structure, OS architecture, and command-line environment.
2. Perform Linux installation and basic administration including file, user, and permission management.
3. Develop shell scripts to automate tasks such as backups, monitoring, and data processing.
4. Use Linux tools for software management, networking, and service configuration.
5. Implement backup, recovery, and basic troubleshooting techniques through practical labs.

Week 1: Introduction to OS Concepts
Lab Activity: Linux History, Opensource software basics & Licenses, Why Linux vs windows Identify system and application software on your PC. Differentiate their roles and explain basic OS functions.

Week 2: Linux Architecture & Kernel Types
Lab Activity: Compare Monolithic and Microkernel architectures using diagrams. Discuss how Linux's structure supports device-level control.

Week 3: Installing Linux (Ubuntu/CentOS)
Lab Activity: Install Linux using VirtualBox or WSL. Document each installation step and troubleshoot any permission or hardware issues.

Week 4: Linux Filesystem & Navigation
Lab Activity: Navigate key directories like /home, /etc, and /var. Create folder structures for a team project.

Week 5: File Permissions & Ownership
Lab Activity: Set permissions on project folders so only group members can access/edit them. Verify permissions using multiple users.

Week 6: User and Group Management
Lab Activity: Create users and groups for a coding team. Set up shared access using group permissions and configure hidden config files.

Week 7: Process Management
Lab Activity: Identify and terminate frozen or unresponsive processes during compilation using commands like ps and top.

Week 8: Process Priorities & Memory Tools
Lab Activity: Adjust priority of background jobs using nice and monitor system memory usage with vmstat and free. Display information about the processes using top and kill the applications/processes with the task id

Week 9: Shell Scripting Basics
Use Case: System Info Script for Lab Login
Lab Activity: Create a shell script that automatically displays system uptime, current date/time, available disk space, and active users each time a lab user logs in. Use variables and echo statements to present the information in a readable format.

Week 10: Loops, Functions, and Cron Jobs
Use Case: Automated Backup Scheduler for Project Folders
Lab Activity: Write a shell script that loops through all user folders in /home and backs them up to a predefined backup location. Add functions for logging success/failure. Schedule it to run daily at 2 AM using cron. Handle missing folders gracefully.

Week 11: Package Management & Archiving
Use Case: Setting Up Developer Environment + Archiving a Project
Lab Activity: Use apt (Ubuntu) or yum (CentOS) to install essential tools like vim, curl, or git. Archive a project directory using tar or zip. Use sha256sum to verify archive integrity before transferring it to another system. Installation of applications using apt, apt-get, yum, dnf, snap, or brew commands. Setup python virtual environment

Week 12: Text Processing & Networking Utilities
Use Case: Security Log Analysis & Network Check After Intrusion Alert
Lab Activity: Analyze /var/log/auth.log or /var/log/secure to detect failed login attempts using grep, awk, cut, and sort. Use ping, traceroute, netstat, nbtstat, arp and scp to check remote system connectivity and transfer reports securely. Concepts of Linux clusters, Virtual machines (virtual box in chapter 3), creating VMs, allocating resources, interconnection between VMs, Containers concepts

Week 13: Service Management & Disk Mounting
Use Case: Adding Extra Storage Without Reboot
Lab Activity: Create a new virtual disk in VirtualBox. Partition and format it. Mount it to /mnt/data and ensure it auto-mounts on reboot. Enable a required service (like ssh or apache2) using systemctl and check its status.

Week 14: Backup & Recovery
Use Case: Disaster Recovery After Accidental Deletion
Lab Activity: Use a backup script to create a backup of critical folders. Simulate file deletion and restore them using your backup. Analyze /var/log/syslog or equivalent to trace user activity that led to the issue.

Week 15: Mini Project – Tool Development
Use Case: Custom Shell Tool for New Employee Onboarding or Admin Task
Lab Activity: Develop a complete shell-based tool.
Examples:

- A user account creation wizard for new employees
- A disk usage monitoring alert system

- A log cleaner tool that archives and clears logs weekly Include user prompts, help menu, error checks, and logging features.

Week 16: Final Demo & Viva
Use Case: Present Your Solution to the Faculty Team
Lab Activity: Demonstrate your mini project. Explain your code, how it solves the problem, test cases handled, and improvements you'd make. Submit your code with screenshots, logs, and a short user manual or README

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Board of Studies (ECE)

R25MC02 **Environmental Science** **1 0 0 1**

(Common to all branches)

B.Tech. II Year I Sem.

Course Objectives:

1. Understand the components, structure, and functions of ecosystems and their relevance to human society.
2. Comprehend classification, sustainable management, and challenges of natural resources including water, minerals, land, forests, and energy.
3. Grasp the significance, value, and conservation approaches for biodiversity, including threats and legislative frameworks.
4. Analyze types, sources, and impacts of environmental pollution, and learn technological and policy measures for pollution prevention and control.
5. Develop awareness about global environmental challenges, international agreements, and the role of policy, law, and Environmental Impact Assessment (EIA) in sustainable development.

Course Outcomes:

1. Understand the structure, function, and significance of ecosystems, including energy flow, biogeochemical cycles, and biodiversity conservation through field experiences.
2. Analyze the classification, utilization, and sustainable management of natural resources, along with alternative energy options.
3. Evaluate biodiversity at genetic, species, and ecosystem levels, its values, threats, and conservation methods under national and international frameworks.
4. Identify types, sources, and impacts of environmental pollution, and apply suitable control technologies while assessing global environmental challenges and protocols.
5. Interpret environmental policies, legislation, and the EIA process to propose management plans addressing contemporary environmental and sustainability issues.

SYLLABUS

UNIT-I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity, Field visits. **COs-CO1**

UNIT-II

Natural Resources: Classification of Resources: Living and Non-Living resources, water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies. **COs-CO2**

UNIT-III

Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act. **COs-CO3**

UNIT-IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Sources and types of pollution, drinking water quality standards.

Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil.

Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Waste water Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives. **COs-CO4**

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of base line data acquisition. Overview on Impacts of air, water, biological and Socio- economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). Contemporary Environmental Issues Climate change; Sustainable development goals (SDGs); Global environmental challenges; Environmental policies and international agreements. **COs-CO5**

TEXTBOOKS:

1. Introduction to Environmental Science by Y. Anjaneyulu, B S. Publications.
2. Text book of Environmental Studies for under graduate Courses by Erach Bharucha for University Grants Commission.
3. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCEBOOKS:

1. Environmental Science: towards a sustainable future by Richard T.Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and WendellP. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Tex t book of Environmental Science and Technology- Dr. M. Anji Reddy 2007, BS Publications.

Chairperson
Board of Studies (Chemistry)

R25MA211BS **NUMERICAL METHODS AND COMPLEX VARIABLES**

B.Tech. II Year II Sem.(ECE

L	T	P	C
3	0	0	3

Pre-requisites: Mathematics courses of first year of study.

Course Objectives: To learn

- Expressing periodic function by Fourier series and a non-periodic function by Fourier transforms
- Various numerical methods to find roots of polynomial and transcendental equations.
- Concept of finite differences and to estimate the value for the given data using interpolation.
- Evaluation of integrals using numerical techniques
- Solving ordinary differential equations of first order using numerical techniques.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent's series.

Course outcomes: After learning the contents of this paper, the student must be able to

- Express any periodic function in terms of sine and cosine.
- Find the root of a given polynomial and transcendental equations.
- Estimate the value for the given data using interpolation
- Find the numerical solutions for a given first order ODE's
- Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
- Taylor's and Laurent's series expansions in complex function.

UNIT-I: Fourier Series & Fourier Transforms **8 L**

Fourier series – Dirichlet's Conditions – Half-range Fourier series – Fourier Transforms: Fourier Integral Theorem (Only statements), Fourier Sine and Cosine transforms (Elementary illustrations)

UNIT-II: Numerical Methods-I **10 L**

Solution of polynomial and transcendental equations: Bisection method – Iteration Method – Newton- Raphson method and Regula-Falsi method. Finite differences: forward differences – backward differences – central differences – symbolic relations – Interpolation using Newton's forward and backward difference formulae – Lagrange's method of interpolation.

UNIT-III: Numerical Methods-II **10 L**

Numerical integration: Trapezoidal rule - Simpson's 1/3rd and 3/8th rules.
Ordinary differential equations: Taylor's series – Euler's method – Runge-Kutta method of fourth order for first order ODE.

UNIT-IV: Complex Differentiation **10 L**

Differentiation of Complex functions – Analyticity – Cauchy-Riemann equations (without proof) – Harmonic Functions – Finding harmonic conjugate – Milne-Thomson method – Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT-V: Complex Integration **10 L**

Line integral – Cauchy's theorem – Cauchy's Integral formula – Zeros of analytic functions – Singularities – Taylor's series – Laurent's series. Residues – Cauchy Residue theorem (All theorems without Proof).

TEXT BOOKS

- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
- S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

REFERENCE BOOKS

- Murray R. Spiegel, Ph.D., Seymour Lipschutz, Ph.D., John J. Schiller, Ph.D., Dennis Spellman, Ph.D., Complex Variables (Schaum's outline).
- M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
- Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley &Sons, 2006.
- J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, Mc-Graw Hill, 2004.

Chairperson
Board of Studies (Maths)

L T P C

R25PC0408 **Electromagnetic Fields and Transmission Lines** **3 0 0 3**

B.Tech. II Year II Sem.

Course Objectives:

1. To understand electrostatic and magnetostatic fields using Maxwell's equations.
2. To analyze time-varying electromagnetic fields and boundary conditions.
3. To study plane wave propagation in different media and polarization concepts.
4. To understand transmission line theory, parameters, and wave behavior.
5. To analyze impedance matching techniques and practical applications of transmission lines.

Course Code	Course Outcomes			Mapping with POs						
		PO1	PO 2	PO 3	P04	P05	P06	P011	PO12	Dok
CO1	Explain electrostatic and magnetostatic field concepts using vector calculus	3	2	-	-	-	-	-	-	L1,L2
CO2	Analyze Maxwell's equations for time-varying electromagnetic fields	3	3	2	-	-	-	-	-	L2,L3
CO3	Apply plane wave concepts in conducting and dielectric media	2	3	2	-	-	-	-	-	L2,L3
CO4	Analyze transmission line characteristics and wave propagation	2	3	3	-	1	-	-	-	L4,L5
CO5	Apply impedance matching techniques using Smith chart	2	3	2	-	2	-	-	-	L4,L5

UNIT I – Electrostatics

Review of Coordinate Systems & Vector Calculus, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and its applications, Electric Potential, Relation between E and V, Maxwell's Equations for Electrostatic Fields, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitors–Parallel Plate, Coaxial, Spherical.

UNIT II – Magnetostatics

Biot-Savart's Law, Ampere's Circuit Law and its applications, Magnetic Flux Density, Maxwell's equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law.

UNIT III - Maxwell's Equations (Time Varying Fields)

Faraday's Law, Transformer and Motional EMF, Inconsistency in Ampere's Law and Displacement Current Density, Maxwell's Equations in Differential, Integral and Phasor form. Electric and magnetic Boundary Conditions (Dielectric – Dielectric, Conductor– Dielectric, Conductor– Free Space interfaces).

UNIT IV - EM Wave Characteristics

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves–Definitions, Relation between E&H, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Skin Depth, Surface Impedance, Wave Polarization. Poynting Vector and Poynting Theorem. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection.

UNIT V Transmission Lines

Types, Parameters, Equivalent Circuit, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless Lines, Types of Distortions, condition for Distortion less transmission lines, Minimum Attenuation, Loading – Types of Loading, Input Impedance, SC and OC Lines, Reflection Coefficient, VSWR, Impedance Transformations - $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines, Smith Chart- Configuration and Applications, Single Stub Matching.

TEXTBOOKS:

1. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck,8thEd., McGrawHill,2014
2. Principles of Electromagnetics –Matthew N.O. Sadiku and S.V. Kulkarni, 6thEd., Oxford University Press,AsianEdition,2015.

REFERENCES:

1. Electromagnetic Waves and Radiating Systems–E.C. Jordan and K.G. Balmain,2ndEd., bPHI,2000.
2. Engineering Electromagnetics – NathanIda, 2ndEd., Springer (India) Pvt. Ltd., New Delhi,2005.
3. Electromagnetic Field Theory Fundamentals –Bhag Singh Guru and Husey in R. Hiziroglu, Cambridge University Press, 2nd Ed., 2006.

Web References

1. https://www.tutorialspoint.com/electromagnetic_theory
2. https://ocw.mit.edu/courses/electromagnetics
3. https://www.electronics-notes.com/articles/electromagnetics

E-Books:

1. Matthew N. O. Sadiku – Elements of Electromagnetics (Internet Archive)
2. William H. Hayt – Engineering Electromagnetics
3. David K. Cheng – Field and Wave Electromagnetics

Chairperson
Board of Studies (ECE)

L T P C

R25PC0409 **ANALOG AND DIGITAL COMMUNICATIONS** **3 0 0 3**

B.Tech. II Year II Sem.

Course Objectives:

1. To understand the need for modulation and analyze AM, FM and PM techniques.
2. To study transmitters, receivers and noise performance in communication systems.
3. To understand detection, estimation and baseband data transmission.
4. To analyze digital modulation techniques and their performance.
5. To understand information theory, source coding and channel coding concepts.

Course Code	Course Outcomes				Mapping with POs					
		PO1	PO 2	PO 3	P04	P05	P06	P011	PO12	Dok
CO1	Explain principles of analog modulation techniques and their detection	3	2	1	-	-	-	-	-	L1,L2
CO2	Analyze transmitters, receivers and noise effects in communication systems	3	3	2	-	-	-	-	-	L2,L3
CO3	Apply detection and estimation techniques for data transmission	2	3	2	-	-	-	-	-	L2,L3
CO4	Analyze digital modulation techniques and compare their performance	2	3	3	-	1	-	-	-	L4,L5
CO5	Apply information theory and coding techniques in communication systems	2	3	2	-	2	-	-	-	L4,L5

UNIT–I
Amplitude Modulation

Need for modulation, Amplitude Modulation: Time and frequency domain description, Generation Switching modulator, Detection - Envelope detector, DSB-SC Modulation: Generation – Balanced Modulator, Detection- Synchronous detector, COSTAS Loop, SSB Modulation: Time and frequency domain description, Generation – Phase discrimination Method and Demodulation - coherent detection, Vestigial side band modulation and demodulation.

Angle Modulation

Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis, Carson’s Rule, Generation of FM Waves- Armstrong Method, Detection of FM Waves – Phase locked loop, Comparison of FM and AM.

UNIT-II

Transmitters & Receivers Classification of Transmitters, AM Transmitters, FM Transmitters, AM Receiver - Super heterodyne receiver, FM Receivers, Stereo FM multiplex reception, Comparison of AM and FM Receiver. Noise analysis in AM, DSB, SSB and FM Modulation System, Threshold effect in Angle Modulation System, Pre- emphasis, and de-emphasis Pulse Modulation Types of Pulse modulation-PAM, PWM and PPM, Comparison of FDM and TDM.

UNIT–III

Detection and Estimation: Model of Digital Communication Systems, Geometric Interpretation of

Signals, Gram-Schmidt Orthogonalization, Response of Bank of correlators to Noisy Input, Detection of Known Signals in Noise, Probability of error, Optimum Receivers Using Coherent Detection: Matched filter Receiver and its Properties, Correlation receiver, Detection of signals with unknown Phase in Noise **Base Band Shaping for Data Transmission:** Requirements of a line encoding format, various line encoding formats- Unipolar, Polar, Bipolar, Discrete PAM signals, Inter symbol interference, Nyquist's criterion, Correlation coding: Duobinary signaling, Modified Duobinary technique, generalized form of correlation coding, Eye pattern.

UNIT - IV

Digital Modulation Techniques:

PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, DM and Adaptive DM, Noise in PCM and DM. Digital Modulation formats, Coherent binary modulation techniques (BPSK, BFSK), Coherent quadrature modulation techniques (QPSK), Non-Coherent binary modulation techniques (BFSK, DPSK), QAM, M-ary modulation techniques (PSK, FSK, QAM), Comparison of M-ary digital modulation techniques, power spectra, bandwidth efficiency, constellation diagrams.

UNIT - V

Information theory: Entropy, Information rate, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade-off between bandwidth and SNR. Source coding - Huffman coding, Shannon Fano coding, Channel coding - Linear block codes and cyclic codes.

TEXT BOOKS:

1. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, PHI, 2009.
2. Digital and Analog Communication System – K. Sam Shanmugam, Wiley, 2019.
3. Principles of Communication Systems - Herbert Taub, Donald L Schiling, Goutam Saha, 3rd Edition, McGraw-Hill, 2008.

REFERENCES:

1. Electronic Communications – Dennis Roddy and John Coolean, 4th Edition, PEA, 2004
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH, 2004
3. Communication System - Simon Haykin and Michael Moher, Wiley, 5th edition, 2022

Web References

1. https://ocw.mit.edu/
2. https://nptel.ac.in/courses/108/104/108104095
3. https://www.tutorialspoint.com/analog_communication

E-Books:

1. Simon Haykin – Communication Systems (Internet Archive)
2. Proakis – Digital Communications (selected chapters)
3. Herbert Taub & Donald Schilling – Principles of Communication Systems

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		L T P C
R25PC0410	**ELECTRONIC CIRCUIT ANALYSIS**	**3 0 0 3**

B.Tech. II Year II Sem.

Course Objectives

1. Understand classification, operation and frequency response of multistage amplifiers.
2. Analyze transistor amplifier models and evaluate gain, bandwidth and stability.
3. Explain the concept of feedback and its impact on amplifier performance.
4. Design and analyze oscillators and power amplifiers for practical applications.
5. Understand the working and applications of multivibrators and waveform generators.

Course Code	Course Outcomes			Mapping with POs						
		PO1	**PO 2**	**PO 3**	**P04**	**P05**	**P06**	**P011**	**PO12**	**Dok**
CO1	Analyze multistage amplifiers and their frequency response characteristics	3	2	1	-	-	-	-	-	L1,L2
CO2	Evaluate transistor amplifier parameters using hybrid and h-models	3	3	2	-	-	-	-	-	L2,L3
CO3	Apply feedback concepts to improve amplifier stability and bandwidth	2	3	2	-	-	-	-	-	L2,L3
CO4	Design and analyze RC, LC and crystal oscillators	2	3	3	-	-	-	-	-	L4,L5
CO5	Analyze power amplifiers and multivibrators for signal generation	2	2	3	-	-	-	-	-	L4,L5

UNIT - I:

Multistage Amplifiers: Classification of Amplifiers, Distortion in Amplifiers, Coupling schemes: RC, Transformer, Direct coupling, Frequency response of multistage amplifiers, Transistor configuration choice in cascade amplifiers, Cascade and Cascode amplifiers, Darlington pair amplifier. High-Frequency Transistor Model: Hybrid-π model, Hybrid-π parameters: Conductances and capacitances, CE short-circuit current gain, Gain with resistive load and gain-bandwidth product

UNIT - II:

Feedback Amplifiers: Concept and need for feedback in amplifiers, Types and classification of feedback amplifiers, Characteristics of negative feedback: Gain stability, bandwidth, noise, distortion, Voltage series, Voltage shunt, Current series, Current shunt configurations.

UNIT - III:

Oscillators: Principle of positive feedback, Barkhausen Criterion for oscillations, LC Oscillators: Generalized analysis, Hartley, Colpitts, RC Oscillators: RC phase shift, Wien bridge, Crystal oscillator: Working and advantages

UNIT - IV:

Power Amplifiers: Classification: Class A, B, AB, C, Series-fed Class A amplifier, Transformer- coupled Class A amplifier, Class B amplifier: Push-pull, Complementary symmetry, Efficiency calculations and Crossover distortion.

UNIT-V:

Multivibrators: Analysis and design of Bistable, Monostable and Astable multivibrators and Schmitt Trigger using transistors. Time Base Generators: General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators, Linearity improvement techniques

TEXTBOOKS:

1. Millman, Jacob, and Christos C. Halkias. Electronic Devices and Circuits. McGraw-Hill Education,2008.
2. Bell, David A. Electronic Devices and Circuits. Oxford University Press, 2008.
3. Sedra, Adel S., and Kenneth C. Smith. Microelectronic Circuits. 7th ed., Oxford University Press, 2015.

REFERENCE BOOKS:

1. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. 11th ed., Pearson Education, 2013.
2. Millman, Jacob, and Arvin Grabel. Microelectronics. 2nd ed., McGraw-Hill, 1987.
3. Malvino, Albert Paul. Electronic Principles. 7th ed., McGraw-Hill Education, 2007.
4. Millman, Jacob, and Herbert Taub. Pulse, Digital, and Switching Waveforms. McGraw-Hill Education, 1991

Web References

1. https://www.electronics-tutorials.ws/
2. https://www.allaboutcircuits.com/
3. https://www.tutorialspoint.com/electronic_circuits

E-Books:

1. Boylestad & Nashelsky – Electronic Devices and Circuit Theory
2. Sedra & Smith – Microelectronic Circuits
3. Millman & Halkias – Integrated Electronics

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		L T P C
R25PC0411	**Linear and Digital IC Applications**	**3 0 0 3**

B.Tech. II Year II Sem.

Course Objectives:

1. To understand the fundamentals and applications of operational amplifiers.
2. To analyze waveform generators and timer circuits using IC 555 and PLL (IC565).
3. To study data conversion techniques using ADCs and DACs.
4. To design and analyze combinational logic circuits using TTL & CMOS ICs.
5. To understand sequential logic circuits and memory organization.

Course Code	Course Outcomes	Mapping with POs								
		PO1	PO 2	PO 3	P04	P05	P06	P011	PO12	Dok
CO1	Explain characteristics and applications of Op-Amps and voltage regulators.	3	2	2	1	-	-	-	-	-
CO2	Analyze and design waveform generators using IC555 and PLL circuits.	3	3	2	2	1	-	-	-	-
CO3	Compare and implement different types of ADCs and DACs.	3	3	3	2	2	-	-	-	-
CO4	Design combinational logic circuits using standard ICs.	3	3	3	2	2	-	-	-	-
CO5	Analyze sequential circuits and memory systems like RAM and ROM.	3	3	3	2	2	-	-	-	-

UNIT – I

Operational Amplifier

Ideal and Practical Op-Amp Characteristics, Features of 741 Op- Amp, Modes of Operation - Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT - II

Op-Amp, IC-555 & IC565 Applications

Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL - Block Schematic, principle and Applications.

UNIT - III

Data Converters

Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2Rladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT – IV

Combinational Logic ICs

Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT - V Sequential Logic IC's and Memories

Familiarity with commonly available 74XX & CMOS40XX Series ICs– All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers. Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXT BOOKS

1. Op-Amps & Linear ICs– Ramakanth A. Gayakwad, PHI, 2003.
2. Digital Fundamentals –Floydand Jain, Pearson Education,8th Ed., 2005.

REFERENCE BOOKS

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2ndEd., 2003
2. Digital Design Principles and Practices–John. F. Wakerly, Pearson 3rd Ed., 2009.
3. Linear Integrated Circuits and Applications – Salivahana, TMH, 2008.
4. OperationalAmplifierswithLinearIntegratedCircuits,4th Ed., William D. Stanley, Pearson Education India, 2009.

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R25MA216BS **COMPUTATIONAL MATHEMATICS LAB**

(Using Python/MATLAB software)

B.Tech. II Year II Sem. ECE

L	T	P	C
0	0	2	1

Pre-requisites: Matrices, Iterative methods and ordinary differential equations

Course Objectives: To learn

- Solve problems of Eigen values and Eigen Vectors using Python/MATLAB.
- Solution of Algebraic and Transcendental Equations using Python/MATLAB
- Solve problems of Linear system of equations
- Solve problems of **First-Order ODEs Higher order linear differential equations with** constant coefficients

Course outcomes: After learning the contents of this paper, the student must be able to

- Develop the code to find the Eigen values and Eigen Vectors using Python/MATLAB.
- Develop the code find solution of Algebraic and Transcendental Equations and Linear system of equations using Python/MATLAB
- Write the code to solve problems of **First-Order ODEs Higher order linear differential equations with** constant coefficients

* **Visualize all solutions Graphically through programmes**

UNIT - I: Eigen values and Eigenvectors: **6P**

Programs:

- Finding real and complex Eigen values.
- Finding Eigen vectors.

UNIT-II: Solution of Algebraic and Transcendental Equations **6P**

Bisection method, Newton Raphson Method

Programs:

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.

UNIT-III: Linear system of equations: **6P**

Jacobi's iteration method and Gauss-Seidal iteration method

Programs:

- Solution of given system of linear equations using Jacobi's method
- Solution of given system of linear equations using Gauss-Seidal method

UNIT-IV: First-Order ODEs 8P

Exact and non-exact equations, Applications: exponential growth/decay, Newton's law of cooling.

Programs:

- Solving exact and non-exact equations
- Solving exponential growth/decay and Newton's law of cooling problems

UNIT-V: Higher order linear differential equations with constant coefficients 6P

Programs:

- Solving homogeneous ODEs
- Solving non-homogeneous ODEs

TEXT BOOKS:

- MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson publication.
- Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.

- Think Python First Edition, by Allen B. Downey, Orielly publishing.
- Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novak et al., NCLab Public Computing, 2012.
- Introduction to Python Programming, ©Jacob Fredslund, 2007.

REFERENCE BOOKS:

- An Introduction to Python, John C. Lusth, The University of Alabama, 2011.
- Introduction to Python, ©Dave Kuhlman, 2008.

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		L	T	P	C
R25PC0412	**ANALOG AND DIGITAL COMMUNICATIONS LAB**	0	0	2	1

B.Tech. II Year II Sem.

Course Objectives:

1. Understand the principles of analog and digital modulation techniques.
2. Generate, analyze, and demodulate analog communication signals.
3. Design and implement pulse and digital modulation systems.
4. Analyze time-domain and frequency-domain characteristics of signals.
5. Evaluate system performance under noise and bandwidth constraints.

Course Code	Course Outcomes			Mapping with POs						
		PO1	PO 2	PO 3	P04	P05	P06	P011	PO12	Dok
CO1	Generate and analyze AM, FM, DSB-SC and SSB signals	3	2	1	2	1	-	-	-	L1,L2
CO2	Perform modulation and demodulation of pulse modulation systems	2	3	2	2	1	-	-	-	L2,L3
CO3	Implement PCM, DM, and digital modulation techniques	2	3	3	2	2	-	-	-	L2,L3
CO4	Analyze signal constellations, eye diagrams, and ISI	2	3	2	3	2	-	-	-	L4,L5
CO5	Evaluate performance of communication systems under noise	2	3	2	3	3	-	-	-	L4,L5

List of Experiments

1. Generate Amplitude modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index the oretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index.
2. Generate Frequency modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index.
3. Generate modulated and demodulate DSB-SC Signal for different modulation indices and plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically
4. Generate and demodulate SSB-SC modulated Signal (Phase Shift Method) for different modulation indices and plot the corresponding waveforms and their spectrum. Also calculate theoretically and practically the modulation index in each case
5. Demonstrate the Frequency Division Multiplexing & De multiplexing practically by transmitting at least 4 different signals simultaneously with respect to time and recovering without distortion.
6. Verify Sampling theorem for different sampling rates, Sampling types and Duty Cycles and Plot the sampled and reconstructed Signals. Write the conclusions, based on practical observations
7. Design and implement a Pulse Amplitude Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
8. Design and implement a Pulse Width Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations

9. Design and implement a Pulse Position Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
10. Generate PCM Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations
11. Generate Delta Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
12. Generate FSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
13. Generate practically Binary PSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
14. Generate practically DPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
15. Generate practically QPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
16. Plot Signal Constellation for BPSK, BFSK and QPSK
17. Analyze the performance of BPSK, BFSK and QPSK under noisy environment through constellation diagram
18. Demonstrate ISI through eye diagram
19. Simulate raised cosine signal and duo binary signals
20. Encode data using Shannon Fano /Huffman Coding through Hardware / Simulator
21. Analyze the performance of a Matched filter.

Web References:

1. https://www.allaboutcircuits.com/
2. https://nptel.ac.in/
3. https://www.electronics-tutorials.ws/

E-Books:

1. B.P. Lathi – Modern Digital and Analog Communication Systems
2. Simon Haykin – Communication Systems
3. Taub & Schilling – Principles of Communication Systems

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		L	T	P	C
R25PC0413	**ELECTRONIC CIRCUIT ANALYSIS LAB**	**0**	**0**	**2**	**1**

B.Tech. II Year II Sem.

Course Objectives:

1. Understand the working principles of electronic amplifiers, oscillators, and multivibrators.
2. Design and analyze amplifier circuits using BJT and FET.
3. Study the effect of feedback on gain, bandwidth, and stability.
4. Analyze power amplifier performance, efficiency, and distortion.
5. Simulate electronic circuits using industry-standard simulation tools**.**

Course Code	**Course Outcomes**			**Mapping with POs**						
		PO1	**PO 2**	**PO 3**	**P04**	**P05**	**P06**	**P011**	**PO12**	**Dok**
CO1	Design and analyze RC coupled and feedback amplifiers	3	2	2	2	1	-	-	-	L1,L2
CO2	Design and analyze oscillators and multivibrators	3	3	2	2	1	-	-	-	L2,L3
CO3	Analyze performance of power amplifiers	2	3	2	2	1	-	-	-	L2,L3
CO4	Use simulation tools to verify circuit behavior	2	2	3	3	2	-	-	-	L4,L5
CO5	Evaluate frequency response, gain, and distortion	2	3	2	3	2	-	-	-	L4,L5

List of Experiments

A. Hardware Experiments (7):

Perform practical design, implementation, and waveform analysis of amplifiers, oscillators, power stages, and multivibrators to validate theoretical concepts and observe real-world circuit behavior

1. Design and analyze a two-stage RC coupled amplifier to demonstrate gain enhancement and study coupling capacitance effects.
2. Design Hartley and Colpitts oscillators for a specified frequency and observe their output waveforms.
3. Design an RC phase shift oscillator and derive the practical gain condition for oscillations at a given frequency.
4. Design a transformer-coupled class A power amplifier, observe input/output waveforms, and calculate efficiency.
5. Design a class B power amplifier, analyze input/output waveforms, and evaluate harmonic distortion.
6. Design a bistable multivibrator, analyze commutating capacitor effects, and record transistor waveforms.
7. Design an astable multivibrator and observe transistor base and collector waveforms.

B. Software Simulations (7):

Use circuit simulation software to design, analyze, and verify the performance of feedback amplifiers, waveform generators, and power amplifier circuits through virtual experimentation and frequency response evaluation.

1. Simulate four feedback amplifier topologies and compare their frequency responses with and without feedback.
2. Simulate a monostable multivibrator and analyze its input/output waveforms.
3. Simulate a Schmitt trigger for gain values greater than and less than one and analyze response behavior.
4. Simulate a bootstrap time base generator using BJT and observe the output sweep waveform.
5. Simulate a Miller sweep circuit using BJT and observe the time base output waveform.
6. Simulate a complementary symmetry push-pull amplifier and verify elimination of crossover distortion.
7. Simulate a single tuned amplifier and determine the quality factor (Q) of its tuned circuit.

Software Requirements:

Simulation Tools: LTspice / Multisim / PSpice / Proteus / NI Multisim Live or equivalent

Operating System: Windows 10/11 or Linux (Ubuntu preferred)

Hardware Requirements:

1. Dual Power Supply (±15V, 0–30V)
2. Function Generator (up to 1 MHz)
3. CRO / DSO (Dual Channel, 20 MHz or more)
4. Digital Multimeters
5. Breadboards and Connecting Wires
6. BJTs: BC107, BC547, BC557, 2N2222, etc.
7. Resistors, Capacitors (Wide range of values)
8. Transformers (for power amplifiers)
9. Inductors, Crystals (1 MHz, 4 MHz, etc.)
10. Heat sinks, transistors for power stages (e.g., TIP41, TIP42 etc.)

Web References:

1. https://www.electronics-tutorials.ws/
2. https://www.allaboutcircuits.com/
3. https://ocw.mit.edu/

E-Books:

1. Boylestad & Nashelsky – Electronic Devices and Circuit Theory
2. Sedra & Smith – Microelectronic Circuits
3. Millman & Halkias – Integrated Electronics

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		L T P C
R25PC0414	**LINEAR AND DIGITAL IC APPLICATIONS LAB**	**0 0 2 1**

B.Tech. II Year II Sem.

Course Objectives:

1. Understand the operation and applications of operational amplifiers.
2. Design and analyze linear IC based circuits such as amplifiers, filters, and waveform generators.
3. Design and test timer circuits and multivibrators using IC 555.
4. Understand the working of data converters (ADC & DAC).
5. Design and verify digital logic circuits using standard ICs.

Course Code	**Course Outcomes**			**Mapping with POs**						
		PO1	**PO 2**	**PO 3**	**P04**	**P05**	**P06**	**P011**	**PO12**	**Dok**
CO1	Design and analyze Op-Amp based linear circuits	3	2	2	2	1	-	-	-	L1,L2
CO2	Design waveform generators and multivibrators	3	2	2	2	1	-	-	-	L2,L3
CO3	Design and analyze ADC and DAC circuits	2	3	2	2	1	-	-	-	L2,L3
CO4	Design and verify combinational digital circuits	2	2	3	3	2	-	-	-	L4,L5
CO5	Design and analyze sequential digital circuits	1	2	2	3	2	-	-	-	L4,L5

List of Experiments

1. Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.
2. Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3. Design a Comparator using Op-Amp and draw the comparison results of A=B, A<B, A>B.
4. Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically.
5. Design a Active LPF, HPF cutoff frequency of 2 KHz and find the roll off of it.
6. Design a Circuit using IC741 to generate sine / square / triangular wave with period of 1 KHz and draw the output waveform.
7. Construct Mono-stable Multivibrator using IC555 and draw its output waveform.
8. Construct Astable Multivibrator using IC 555 and draw its output waveform and also find its duty cycle.
9. Design a Schmitt Trigger Circuit and find its LTP and UTP.
10. Design Frequency modulator and demodulator circuit and draw the respective waveforms.
11. Design Voltage Regulator using IC723, IC 7805 / 7809 / 7912 and find its load regulation factor.
12. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages.
13. Design Parallel comparator type / counter type / successive approximation ADC and find its efficiency.
14. Design a Gray code converter and verify its truth table.
15. Design an even priority encoder using IC74xx and verify its truth table.
16. Design a 8x1multiplexer using digital ICs.
17. Design a 4-bit Adder / Subtractor using digital ICs and Add / Sub the following bits.
    (i)1010 (ii)0101 (iii)1011
    0100 0010 1001.
18. Design a Decade counter and verify its truth table and draw respective waveforms.

19. Design a Up/downcounterusingIC74163anddrawread/write waveforms.
20. Design a Universal shift register using IC74194 / 195and verify its shifting operation
21. Design a 16x4 RAM using 74189 and draw its read /write operation.
22. Design a 8x3 encoder / 3x8 decoder and verify its truth table.

Web References:

1. https://nptel.ac.in/
2. https://www.allaboutcircuits.com/
3. https://www.electronics-tutorials.ws/

E-Books:

1. Ramakant Gayakwad – Op-Amps and Linear Integrated Circuits
2. Malvino & Brown – Digital Computer Electronics
3. M. Morris Mano – Digital Design

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R25SD0402	**WEB AND MOBILE APPLICATIONS**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

B.Tech. II Year II Sem.

Course Objectives:

1. Understand and apply core web technologies (HTML, CSS, JavaScript) for structured, styled, and interactive webpages.
2. Build responsive websites using frameworks like Bootstrap and manage code using Git/GitHub.
3. Create simple server-side functionality using Node.js and store/retrieve data from basic databases.
4. Design and develop mobile applications using Flutter for Android and iOS.
5. Integrate web and mobile development into a functional mini-project with deployment.

Week 1: Introduction to the Web

Understand web architecture, clients, servers, and workflows. Explore an existing website's structure and elements using browser DevTools.

Week 2: HTML Basics

Learn about different markup languages and their significance. Create a homepage for a static site using paragraphs, headings, lists, links, and images.

Week 3: CSS – Layout & Design Foundations

Apply colors, spacing, and layouts using CSS. Practice Flexbox and Grid techniques by cloning a simple website layout.

Week 4: Introduction to JavaScript

Understand the Document Object Model (DOM) and basic JavaScript constructs. Add interactivity to a webpage with a 'Contact Us' form that dynamically displays/hides details.

Week 5: Combining HTML, CSS, and JavaScript

Integrate skills from previous weeks to start building a personal portfolio website.

Week 6: Responsive Design using Bootstrap

Make your site adapt to different screen sizes (mobile, tablet, desktop) using Bootstrap's grid system and components.

Week 7: Deployment using GitHub

Learn version control basics with Git and GitHub. Publish your portfolio online via GitHub Pages and collaborate with classmates for code reviews.

Week 8: Basic Server Concepts & Node.js

Set up a basic Node.js server to serve web content. Understand server-side fundamentals and simple routing.

Week 9: Introduction to Databases

Learn to store and retrieve data using JSON or SQLite. Save contact form submissions from your portfolio into a database.

Week 10: Introduction to Flutter

Understand Flutter's widget structure and framework basics. Design a simple login and landing page for a mobile app.

Week 11: Mobile App Interactivity

Create a Flutter app that displays a list of events. Add RSVP functionality with confirmation messages.

Week 12: Full-Stack Integration

Build a registration page that saves new members to a database and displays a welcome message. Connect your Flutter app to a database for data-driven functionality.

Week 13: Project Work

Apply all learned skills to build a real-world project such as a club/college event management application integrating both web and mobile interfaces.

Week 14: Final Presentations

Present your completed project to classmates, highlighting key features, responsive design, and integration. Gather peer feedback for improvement.

Mini-Project Example Themes

- Event registration & tracking for college clubs
- Simple inventory tracking system
- Student feedback & announcement portal
- IoT project dashboards (linking to electronics projects)

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1. Web Technologies: HTML, CSS, JavaScript – Uttam K. Roy (Oxford University Press).

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4. Mobile Application Development – Debasis Samanta & Goutam Kumar Panda (Prentice Hall India).

5. Full Stack Web Development – V. Srinivasa Rao (Notion Press).

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