GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING FOR WOMEN

(Autonomous)

(Approved by AICTE, New Delhi and Permanently Affiliated to Andhra University, Visakhapatnam)

Madhurawada :: Visakhapatnam – 530 048

COURSE STRUCTURE

(Applicable for the Academic Year 2024-25 onwards)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech. Electronics and Communication Engineering

SCHEME AND SYLLABI

(With effect from 2024-25 admitted batch)

I Year - I Semester

Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24BM11RC01	BS	Calculus and Differential Equations	3	0	30	70	100	3
24BP11RC01	BS	Engineering Physics	3	0	30	70	100	3
24EE11RC02	ES	Network Theory and Machines	3	0	30	70	100	3
24CT11RC02	ES	Problem Solving using C	3	0	30	70	100	3
24EC11RC01	ES	Electronic Devices and Circuits	3	0	30	70	100	3
24BP11RC02	BS	Engineering Physics Lab	0	3	50	50	100	1.5
24CT11RC04	ES	Problem Solving using C Lab	0	3	50	50	100	1.5
24EC11RC02	ES	Electronic Devices and Circuits Lab	0	3	50	50	100	1.5
							Total Credits	**19.5**

I Year - II Semester

Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24BM11RC02	BS	Linear Algebra and Vector Calculus	3	0	30	70	100	3
24BC11RC01	BS	Green Chemistry	3	0	30	70	100	3
24HE11RC01	HSS	English	3	0	30	70	100	3
24EC11RC05	ES	Digital Logic Design	3	0	30	70	100	3
24EC11RC06	ES	Electronic Circuit Analysis	3	0	30	70	100	3
24HE11RC02	HSS	Communication Skills Lab	0	3	50	50	100	1.5
24EC11RC07	ES	Digital Logic Design Lab	0	3	50	50	100	1.5
24EC11RC08	ES	Electronic Circuit Analysis Lab	0	3	50	50	100	1.5
							Total Credits	**19.5**

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II Year - I Semester								
Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24BM11RC04	BS	Complex and Fourier Analysis	3	0	30	70	100	3
24CT11RC09	PC	Data Structures	3	0	30	70	100	3
24EC11RC09	PC	Linear ICs & Applications	3	0	30	70	100	3
24EC11RC10	PC	Pulse and Digital Circuits	3	0	30	70	100	3
24EC11RC11	PC	Signals & Systems	3	0	30	70	100	3
24CT11RC14	PC	Data Structures lab	0	3	50	50	100	1.5
24EC11RC12	PC	Linear ICs & Pulse Circuits Lab	0	3	50	50	100	1.5
24EC11RC13	PC	Signals & Systems lab	0	3	50	50	100	1.5
24EC11SC01	SC	Python Programming	1	2	50	50	100	2
24HM11MC01	MC	Professional Ethics and Human Values	2	0	-	100	100	0
24EC11SW01	MC	Social Activity/Life Skills	0	0	-	-	-	0
							Total Credits	21.5
II Year - II Semester								
Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24HM11RC01	HSS	Managerial Economics	3	0	30	70	100	3
24EC11RC16	ES	Probability Theory and Random Process	3	0	30	70	100	3
24EC11RC17	PC	Digital System Design	3	0	30	70	100	3
24EC11RC18	PC	Electromagnetic Field Theory and Transmission Lines	3	0	30	70	100	3
24EC11RC19	PC	Microprocessors and Microcontrollers	3	0	30	70	100	3
24EC11RC20	PC	Digital System Design Lab	0	3	50	50	100	1.5
24EC11RC21	PC	Microprocessors and Microcontrollers Lab	0	3	50	50	100	1.5
24IT11SC02	SC	Object Oriented Programming through JAVA	1	2	50	50	100	2
24BC11MC01	MC	Environmental Science	2	0	-	100	100	0
							Total Credits	20

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III Year - I Semester

Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24EC11RC22	PC	Analog Communication	3	0	30	70	100	3
24EC11RC23	PC	Antennas and Wave Propagation	3	0	30	70	100	3
24EC11RC24	PC	VLSI Design	3	0	30	70	100	3
	PE1	Professional Elective-I	3	0	30	70	100	3
	OE1	Open Elective-I	3	0	30	70	100	3
24EC11RC25	PC	Analog Communication lab	0	3	50	50	100	1.5
24EC11RC26	PC	VLSI Lab	0	3	50	50	100	1.5
24HE11SC01	SC	Soft skills	1	2	50	50	100	2
24HM11MC02	MC	IPR & Patents	2	0	-	100	100	0
24EC11IN01	IN	Internship-I			-	100	100	2
							Total Credits	**22**

III Year - II Semester

Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24EC11RC27	PC	Digital Communication	3	0	30	70	100	3
24EC11RC28	PC	Digital Signal Processing	3	0	30	70	100	3
24EC11RC29	PC	Microwave Engineering	3	0	30	70	100	3
	PE	Professional Elective-II	3	0	30	70	100	3
	OE	Open Elective-II	3	0	30	70	100	3
24EC11RC30	PC	Digital Communication Lab	0	3	50	50	100	1.5
24EC11RC31	PC	Digital Signal Processing Lab	0	3	50	50	100	1.5
24EC11RC32	PC	Antennas and Microwave Engineering Lab	0	3	50	50	100	1.5
24EC11SC02	SC	IoT applications	1	2	50	50	100	2
24EC11MC01	MC	Design Thinking, Innovation and Entrepreneurship	2	0	50	50	100	0
							Total Credits	**21.5**

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IV Year - I Semester								
Course Code	**Category**	**Course Title**	**Hours per Week**		**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
			L	**P**				
	HSS	HSS-Elective	3	0	30	70	100	3
	PE	Professional Elective-III	3	0	30	70	100	3
	PE	Professional Elective-IV	3	0	30	70	100	3
	PE	Professional Elective-V	3	0	30	70	100	3
	OE	Open Elective-III	3	0	30	70	100	3
	OE	Open Elective-IV	3	0	30	70	100	3
24AI11SC03	SC	Machine learning using Python	1	2	50	50	100	2
24EC11IN02	IN	Internship-II			-	100	100	2
							Total Credits	**22**

IV Year - II Semester							
Course Code	**Category**	**Course Title**	**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
24EC11PR01	PROJ	Project Work	100	100	200	14
					Total Credits	**14**

Note: It is mandatory to complete one MOOCS Course (12 weeks or more duration) to obtain B.Tech Degree in ECE. This can be added in Lieu of any other courses.

Professional Electives (PE)	
Course Code	**Course Title**
24EC11PE01	Advanced Microprocessors
24EC11PE02	Analog and Digital IC Design
24EC11PE03	Cellular Mobile Communication
24EC11PE04	Computer Architecture & Organization
24EC11PE05	Data Networks
24EC11PE06	Digital Image Processing
24EC11PE07	Electronic Measurements and Instrumentation
24EC11PE08	Embedded Systems
24EC11PE09	Fibre Optic Communication
24EC11PE10	FPGA Design
24EC11PE11	Global Positioning System
24EC11PE12	Low Power VLSI Design
24EC11PE13	Radar Engineering
24EC11PE14	RTL Design Verification
24EC11PE15	Satellite Communication
24EC11PE16	Statistical Data Analysis

Open Electives (OE) for ECE	
Course Code	**Course Title**
24EE11EL01	Basics of Electrical Wiring
24EE11EL02	Fundamentals of Power Electronics
24EE11EL03	Fundamentals of Utilization of Electrical Energy
24EE11EL04	Linear Control Systems
24EE11EL05	Sustainable Energy Sources
24CS11EL01	Human Machine Interaction
24CS11EL02	Introduction to Artificial Intelligence
24CS11EL03	Software Project Management
24IT11EL01	Introduction to Blockchain Technology
24IT11EL02	Introduction to Cloud Computing
24IT11EL03	Information Retrieval and Search Engines
24AI11EL01	Introduction to AI Chatbots
24AI11EL02	Natural Language Processing and its Applications
24AI11EL03	Python for Data Science

OPEN ELECTIVES (OE) offered by ECE to the other Departments	
Course Code	**Course Title**
24EC11EL01	Basic VLSI Design
24EC11EL02	Basics of Signal Processing
24EC11EL03	Data Communication
24EC11EL04	Microprocessor & Controllers with Interfacing

HSS ELECTIVES	
Course Code	**Course Title**
24HM11EL01	Accounting and Finance for Engineers
24HM11EL02	Human Relations at Work
24HM11EL03	Industrial Management and Startup Eco System
24BM11EL01	Operation Research
24HM11EL04	Organisational Behaviour

B.Tech with MINOR Degree in ECE	
Course Code	**Course Title**
24EC11MN01	Analog and Digital Communication Systems
24EC11MN02	Digital System Modeling Through Verilog
24EC11MN03	Embedded C Programming
24EC11MN04	Information Theory and Coding
24EC11MN05	Mobile Cellular Communication
24EC11MN06	Analog and Digital Communications Lab
24EC11MN07	Digital Applications using Verilog Lab

B.Tech with HONORS Degree in ECE	
Course Code	**Course Title**
24EC11HN01	5G communication
24EC11HN02	Application Specific Integrated Circuit
24EC11HN03	Bio Medical Signal Processing
24EC11HN04	Design for Testability
24EC11HN05	DSP Processors and Architectures
24EC11HN06	Wireless Sensor Network

- MOOCs course must be of minimum 12 weeks duration in any of the courses approved by the department from time to time and are advanced for both Minors and Honors

CALCULUS AND DIFFERENTIAL EQUATIONS

I Year B. Tech. I Semester

[Common to EEE, ECE, CSE, IT, CSE (AI&ML)]

L	T	P	C
3	0	0	3

Course Code: 24BM11RC01

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Examine the functional dependency and utilize Taylor's theorem to expand the function of two variables. (L3)

CO2: Determine extrema of multivariable functions. (L5)

CO3: Utilize double and triple integrals to evaluate areas of plane curves and the volumes of solids. (L5)

CO4: Solve the first order differential equations and higher order differential equations with constant coefficients, apply the techniques to solve problems related to various engineering fields. (L3)

CO5: Find the Laplace Transforms of various functions and apply it to solve ordinary differential Equations with initial conditions. (L3)

UNIT-I: **8 Lectures**

Partial Differentiation: Functions of two or more variables: Introduction - Partial derivatives - Total derivative - Change of variables - Jacobians – Functional dependence - Taylor's theorem for function of two variables. [Sections: 5.1, 5.2, 5.5, 5.6, 5.7, 5.9 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Examine the functional dependencies using the Jacobian. (L3)
2. Make use of Taylor's theorem to write series expansion of function of two variables. (L3)

UNIT-II: **7 Lectures**

Applications of Partial Differentiation: Maxima and minima of function of two and three variables - Constrained maximum/minimum problems using Lagrange's method of multipliers. [Sections: 5.11, 5.12 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Determine the critical points, maxima and minima of functions several variables. (L5)

UNIT-III: **11 Lectures**

Integral Calculus: Introduction - Double integrals - Change of order of integration - Double integrals in polar Coordinates - Triple integrals - Change of variables.

Applications: Area enclosed by plane curves - Volumes of solids. [Sections: 7.1 – 7.7 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Evaluate double integrals and triple integrals in Cartesian and polar coordinates also over the given region. (L5)
2. Evaluate the double integrals by change of order of integration. (L5)
3. Evaluate double and triple integrals by change of variables. (L5)
4. Determine the areas and volumes using multiple integrals. (L5)

UNIT-IV: **11 Lectures**

Differential Equations and its Applications: Exact differential equations - Equations reducible to exact equations - Solutions of higher order linear ordinary differential equations with constant coefficients - Method of variation of parameters.

Applications: Orthogonal Trajectories - Newton's law of cooling - Law of Natural growth and decay. [Sections: 11.11, 11.12, 12.3, 12.6, 12.8, 13.1 – 13.8 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Solve the first-order differential equations and higher order Linear differential equations with constant coefficients. (L3)
2. Apply the techniques to solve problems related to various engineering fields. (L3)

UNIT-V: **11 Lectures**

Laplace Transforms: Introduction - Existence conditions - Transforms of elementary functions - Properties of Laplace transforms - Transforms of derivatives - Transforms of

integrals - Multiplication by t - Division by t– Evaluation of integrals by Laplace transforms - Laplace transforms of Unit step function, Unit impulse function and Laplace transforms of periodic functions - Inverse Laplace transforms - Convolution theorem - Second shifting theorem.

Applications: Laplace Transforms to ordinary differential Equations. [Sections: 21.1 – 21.5, 21.7 – 21.15, 21.17, 21.18 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Find the Laplace transform of the function. (L1)
2. Find the Inverse Laplace transform of a function. (L1)
3. Make use of convolution theorem to find the Inverse Laplace transform of a function. (L3)
4. Apply Laplace transform to solve ordinary differential equations. (L3)

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 45th Edition, Khanna Publishers, 2024.

Reference Books:

1. R K Jain and SRK Iyengar, Advanced Engineering Mathematics, Narosa Publishers, 5th Edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, 2011.
3. Peter V. O'Neil, Advanced Engineering Mathematics, 7th edition, Cengage Learning, 2011.
4. Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson, 2017.

Web References:

1. https://nptel.ac.in/courses/111104125
2. https://nptel.ac.in/courses/111105160

ENGINEERING PHYSICS

I Year B. Tech. I Semester

[Common to ECE, EEE, CSE (AI&ML)]

Course Code: 24BP11RC01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Apply the principles of interference, diffraction, and polarization in wave optics, and utilize optical instruments for practical applications. (L3)

CO2: Familiarize the basic concepts of Thermodynamics relevant to engineering applications. (L2)

CO3: Outline the knowledge of basic principles of Electromagnetism and EM Waves. (L2)

CO4: Describe the basic principles of lasers, optical fibres and their use in technological applications. (L2)

CO5: Understand the basic principles of Quantum mechanics, Quantum computing. (L2)

UNIT-I **10 Lectures**

Interference: Principle of superposition, Young's Experiment (qualitative treatment), Coherence, Interference in thin films (reflected light), Newton's Rings, Michelson's Interferometer and its applications (thickness of thin sheet, determination of wavelength).

Diffraction: Introduction, Differences between Interference and Diffraction, Differences between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction at a single slit (Qualitative and Quantitative treatment)

Polarization: Introduction - types of Polarization. Polarization by reflection, Brewster's law, refraction and double refraction in uniaxial crystals, Nicol Prism, Quarter wave plate and Half wave plate, Applications of Polarization.

Text Book 1: 5.16,5.17,5.18, 5.20, 6.1, 6.2, 6.8.(1-3), 6.11, 6.13, 6.14.1, 6.14.3, 7.1, 7.2, 7.3, 7.4, 7.5, 8.1, 8.2,8.5, 8.6,8.11,8.12, 8.16,8.20.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the principles of interference patterns and apply Michelson's Interferometer to measure physical quantities such as thickness and wavelength. (L2)
2. Distinguish between interference and diffraction and perform qualitative and quantitative analysis of Fraunhoffer diffraction at a single slit. (L2)

3. Apply polarization concepts through various optical devices to explore and solve problems related to polarized light. (L3)

UNIT-II **7 Lectures**

Thermodynamics: Heat and Work, First law of thermodynamics and its applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of Entropy, Entropy and disorder, Third law of thermodynamics (statement only). [TextBook-1: 16.3,16.5.1,16.6,16.8,16.11,16.12,16.14,16.16,16.17, 16.17.1, 16.18]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply the first and second laws of thermodynamics to analyse energy transformations and process efficiencies. (L3)
2. Understand the Carnot cycle and its efficiency and calculate entropy changes to explain thermodynamic processes. (L2)
3. Differentiate between reversible and irreversible processes and relate entropy to disorder. (L2)
4. State the third law of thermodynamics and understand its implications for materials at absolute zero. (L2)

UNIT-III **11 Lectures**

Electromagnetism: Concept of electric flux, Gauss' law, applications of Gauss' law (wire, sheet, sphere), Magnetic Field, Gauss' law in magnetostatics, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation, qualitative treatment), Electromagnetic wave equations, Introduction to EM waves, The Biot-Savart's law, magnetic field near a long wire, magnetic field for a circular Current loop, Ampere's law. [TextBook-1: 2.12,2.14,2.18, 3.5, 3.8, 3.9,3.12, 3.13,3.14, 3.10, 3.12, 3.3,3.4]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply Gauss's law and Faraday's law of induction to solve problems involving electric and magnetic fields. (L3)
2. Use Maxwell's equations to understand electromagnetic wave phenomena. (L2)

3. Analyse magnetic fields using Biot-Savart's law, Ampere's law, and apply e magnetostatic field distributions. (L3)

UNIT-IV **10 Lectures**

Lasers: Characteristics of laser beam, Spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser (homojunction), Applications of lasers.

Optical fibres: principle of propagation of light in optical fibres, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagation, Classification of fibres based on refractive index profile and modes, Losses in optical fibres- scattering and bending losses, Fibre optics in communication- Block diagram, Applications of optical fibres. [TextBook-1: 24.12, 24.2, 24.5,24.6, 24.7, 24.11.1, 24.11.3, 24.11.5.1, 24.13, 10.2, 10.3, 10.4, 10.5, 10.6, 10.10, 10.11, 10.19,10.20 (only for list of applications]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the principles of laser operation, including spontaneous and stimulated emission, and analyse various types of lasers such as Ruby, He-Ne, and Semiconductor lasers. (L2)
2. Describe the fundamentals of optical fibre technology, including light propagation, acceptance angle, numerical aperture, and classification of fibres. (L2)
3. Apply these concepts to fibre optics communication systems and explore their practical applications. (L2)

UNIT-V **10 Lectures**

Quantum Physics: de Broglie concept of matter waves, Heisenberg's uncertainty principle, Schrödinger time independent wave equation, Physical significance of wave function, particle in a one-dimensional box.

Quantum Computing Quantum bits, Introduction to Pauli spin matrices, Bloch sphere, Entanglement, Qubit Vs classical bit, Single Qubit gates, Quantum Teleportation – Basic Idea. [Textbook-1 20.5, 20.11, 20.17, 20.18, 20.22; Textbook -3 Sec 1.8, 1.9, 1.10.1]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the concepts quantum mechanics such as the de Broglie wavelength and Heisenberg's uncertainty principle and use the Schrödinger equation (L2).

2. Describe the fundamentals of quantum computing (L2)

Textbooks:

1. M. N. Avadhanulu, P. G. Kshirsagar, and T. V. S. Arun Murthy, A textbook of Engineering Physics, 11th edition, S. Chand and Company Ltd., 2019.
2. H. K. Malik and A. K. Singh, Engineering Physics, 2nd Edition, McGraw Hill Education Pvt Ltd. ,2018.
3. P.K. Palanisamy, Engineering Physics, SCITECH Publications, 2011.

Reference Books:

1. Modern Engineering Physics by A.S. Vasudeva S. Chand and Company Ltd., 2010
2. University Physics by Young and Freedman Pearson Education, 2010.
3. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information Cambridge University Press, 10 th Ed., 2010

Web References:

1. https://nptel.ac.in/courses/115105537 (Wave optics)
2. https://nptel.ac.in/courses/115106122 (Electromagnetism)
3. https://nptel.ac.in/courses/112102255 (Thermodynamics)
4. https://nptel.ac.in/courses/115107095 (Fiber Optics)
5. https://nptel.ac.in/courses/104104085 (Lasers)
6. https://nptel.ac.in/courses/104104082 (Quantum Computing)
7. https://www.intechopen.com/online-first/73811 (Quantum Computing)
8. https://lewisla.gitbook.io/learning-quantum/quantum-circuits/single-qubit-gates (Quantum Computing)
9. https://profmcruz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-and-quantum-information-nielsen-chuang.pdf (Quantum Computing)

NETWORK THEORY AND MACHINES

I Year B. Tech. I semester

[ECE]

Course Code: 24EE11RC02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Analyze DC circuits using Kirchhoff's laws, nodal and mesh analysis methods. (L2)

CO2: Summarize network theorems and two-port network parameters. (L2)

CO3: Analyze circuits with AC excitations. (L2)

CO4: Determine the transient response of first and second-order circuits. (L2)

CO5: Understand the Construction and Principle of Operation of DC and AC machines. (L2)

UNIT-I **10 Lectures**

Introduction to Electrical Circuits: Circuit Concept – Types of elements and their V-I relations; Kirchhoff's laws, Network Reduction Techniques- Series, Parallel, Series-Parallel, Star-delta transformation, Source transformation, Nodal analysis method and Mesh analysis method including super node and super mesh analysis. [TextBook-1: Chapter 1 (S-1.1 – S-1.6), Chapter 2 (S-2.1 – S-2.7), Chapter 3 (S-3.1- S-3.5)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the active and passive elements and their VI characteristics. (L2)
2. Analyse the electrical circuits using KVL and KCL. (L2)
3. Analyse the electrical circuits using mesh and nodal analysis. (L2)

UNIT-II **10 Lectures**

Network theorems: Superposition theorem, Thevinin's theorem, Norton's theorems, Maximum power transfer theorem and Reciprocity theorem (DC Excitations). Two-port Networks: Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also. [TextBook-1: Chapter 4 (S-4.1 – S-4.8), Chapter 19 (S-19.1 – S-19.6)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Summarize various network theorems. (L2)
2. Summarize the various two-port networks parameters. (L2)
3. Analyze the interconnected two port networks. (L2)

UNIT-III **10 Lectures**

Single Phase A.C Circuits: Periodic and non-periodic wave forms, R.M.S, Average Values and Form Factor for Alternating Quantities. Phase and Phase Difference, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation. Phasor diagrams. Concept of Reactance, Impedance, Susceptance and Admittance. Power Triangle - Apparent Power, Active and Reactive Power - Concept of Power Factor.

Resonance: Introduction, Series resonance and parallel resonance, Definition of Q, Bandwidth and selectivity. [TextBook-1: Chapter 11 (S-11.1 – S-11.7), Chapter 9 (S-9.1 – S-9.7), Chapter 16 (S-16.1– S-16.4)]

Learning Outcomes:

1. At the end of the unit, the student will be able to
2. Analyse periodic and non-periodic waveforms. (L2)
3. Analyze RLC circuits for AC excitations. (L2)
4. Determine bandwidth and selectivity in resonant circuits. (L2)

UNIT-IV **9 Lectures**

DC Transients: Evaluation of initial conditions, First order circuits, Definition of time constant, R-L circuit, R-C circuit with excitation, second order circuits, problem-solving. [TextBook-1: Chapter 7 (S-7.1– S-7.6), Chapter 8 (S-8.1– S-8.6)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Evaluate initial conditions in electrical circuits. (L2)
2. Analyse first-order circuits. (L2)
3. Analyse second-order circuits. (L2)

UNIT-V **9 Lectures**

DC Machines:

Principle of operation of DC machines, Constructional Details, EMF equation, DC motor - Torque Equation, Speed control of shunt motor (Field and armature-controlled methods), Applications of DC Machines.

AC Machines:

Transformer construction Details, Principle of operation, EMF equation, Three phase Induction Motors-Construction Details, Principle of operation. Single phase induction motor - Constructional Details, Principle of operation, Double Field Revolving Theory. Applications. [TextBook-3: Chapter 26 (S-26.1 – S-26.10 & S-26.33), Chapter 29 (S-29.6 – S-29.8), Chapter 30 (S-30.1 – S-30.2), Chapter 32 (S-32.1 – S-32.6 & S-32.20-S-32.22), Chapter 34 (S-34.1 – S-34.6), Chapter 36 (S-36.1 – S-36.3)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the Construction and principle of operation of DC and AC machines. (L2)
2. Understand the speed control methods of electrical motors. (L2)
3. Summarize the applications of DC and AC machines. (L2)

Text Books:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.
3. A Textbook of Electrical Technology: Ac and Dc Machines (volume - 2) by B L Theraja and A K Theraja.

Reference Books:

1. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018.
2. Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and K. Rao, Mc Graw Hill Education, 2010, Fifth Edition.
3. Electric Machines, D. P. Kothari, I. J. Nagrath Tata McGraw-Hill, 2004.

Web References:

1. https://archive.nptel.ac.in/courses/108/105/108105159/
2. https://nptel.ac.in/courses/108104139

PROBLEM SOLVING USING C

I Year B. Tech. I semester

[Common to CSE, CSE (AI&ML), IT, ECE]

Course Code: 24CT11RC02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Explain the basic constructs of C through the use of simple applications. (L2)

CO2: Demonstrate the utilization of arrays and strings in the development of C programs. (L2)

CO3: Utilize functions and pointers to construct various applications in C. (L3)

CO4: Apply concepts of structures and unions to build and implement C applications. (L3)

CO5: Develop applications using sequential and random-access file processing techniques. (L3)

UNIT-I **10 Lectures**

Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output. [TextBook-1: Chapter 2 (S-2.1 – S-2.12)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Outline the Basic Structure and Components of C Programs. (L2)
2. Demonstrate Variables, Data Types, Operators, and Expressions. (L2)
3. Illustrate Input and Output Operations. (L2)

UNIT-II **11 Lectures**

Decision Making, Branching, Looping: Decision making with if statement, Simple if statement, The if…else statement, Nesting of if…else statement, the else.. if ladder, switch statement, the (? :) operator, the goto statement, The while statement, the do statement, the for statement, Jumps in Loops.

Arrays & Strings: One, Two-dimensional Arrays, multi-dimensional Arrays, Character Arrays. Declaration and Initialization of Strings, reading and writing of strings, string handling functions. [TextBook-1: Chapter 3 (S-3.1 – S-3.8), TextBook-2: Chapter 13,14,15,16 (PP:215-283)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Classify Decision Making and Branching (L2)
2. Interpretation of Looping Constructs (L2)
3. Summarize Arrays and Strings (L2)

UNIT-III **10 Lectures**

Function and Dynamic Memory Allocation: Functions: Designing structured programs, declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, passing arrays to functions, recursion.

Introduction to Pointers, Pointer Arithmetic, Pointers for Inter-Function Communication, passing pointers to functions, call by reference, Dynamic Memory Allocation. [TextBook-1: Chapter 4 (S-4.1 – S-4.11), Chapter 5 (S-5.1 – S-5.12)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Utilize Functions (Understand and Implement Functions, Utilize Various Function Types, Advanced Function Techniques) (L3)
2. Experiment with Pointers (Basic Pointer Operations, Pointers and Data Structures) (L3)
3. Explain Advanced Pointer Usage (Pointers in Functions, Pointers to Complex Data Types) (L2)

UNIT-IV **9 Lectures**

Structure and Unions: Defining a structure and union, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, definition and usage of union, structures and unions using functions, size of structures and bit-fields. The Type Definition (Type def), Enumerated Types. [TextBook-1: Chapter 6 (S-6.1 – S-6.9)]

Learning Outcomes:

1. At the end of the unit, the student will be able to
2. Define Structures and Build C programs using Structures. (L3)
3. Explain Complex Data Structures. (L2)
4. Explain Unions and Bit-Fields. (L2)

UNIT-V **8 Lectures**

File handling: Introduction to Files, Modes of File operations, Text and Binary Files, Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments, user defined header files. [TextBook-2: Chapter 19 (PP:325-348)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Outline File Operations. (L2)
2. Summarize Error Handling and Random Access. (L2)
3. Utilize Command Line Arguments. (L3)

Text Books:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, 2015, Pearson Education India, ISBN: 978-93-3254-944-9.
2. Yashavant P. Kanetkar, "Let Us C", 16th Edition, 2019, BPB Publications, ISBN: 978-93-8728-449-4.

Reference Books:

1. N. B. Venkateswarlu, E. V. Prasad, "C and Data Structures", 1st Edition, S. Chand Publishing, 2010, ISBN: 978-93-525-3356-5.
2. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, 2018, Oxford University Press, ISBN: 978-01-9949-147-6.
3. Jacqueline A. Jones and Keith Harrow, "Problem Solving with C", Pearson Education. ISBN: 978-93-325-3800-9.
4. E. Balagurusamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.

Web References:

1. https://nptel.ac.in/courses/106105171
2. https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/pages/lecture-notes/
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843237039374336 34517_shared/overview
4. https://cse02-iiith.vlabs.ac.in/List%20of%20experiments.html

ELECTRONIC DEVICES AND CIRCUITS

I Year B. Tech I semester

[ECE]

L	T	P	C
3	0	0	3

Course Code: 24EC11RC01

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline the concepts of basic semiconductor devices(L2)

CO2: Understand the characteristics of different semiconductor diodes and their applications(L2)

CO3: Analyse the operation of BJT under different biasing methods(L4)

CO4: Analyse BJT amplifier circuits with small signal low frequency model(L4)

CO5: Understand the construction and working of FET(L2)

UNIT-I **10 Lectures**

Energy band theory of solids and transport phenomenon in semiconductors: Energy Band Theory of Solids, Insulators, Semiconductors, Metals, Intrinsic and Extrinsic Semiconductors, donor and acceptor impurities, band diagrams, mass action law, intrinsic carrier concentration, continuity equation, Hall effect, Carrier Mobility, Conductivity, Drift and Diffusion currents. Band structure of PN Junction, PN diode biasing, diode current equation, Volt – Amp. Characteristics, Temperature Dependence, Transition and Diffusion Capacitance of PN Junction. [Textbook 1: Chapter -1 Section 1.5 - 1.8, Chapter- 2 Section 2.1 - 2.3 & 2.6 – 2.10, Chapter -19 Section 19.5, Chapter -3 Section 3.1 - 3.9, Chapter -19 Section 19.10]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Explain the energy band theory of solids (insulators, semiconductors, and metals) based on their band structures(L2)
2. Describe the transport phenomena in semiconductors. (L2)
3. Understand the band structure representation of PN junction, interpret the Volt-Ampere characteristics along with the temperature effects. (L2)

UNIT-II **9 Lectures**

Rectifiers and special diodes: Half-wave, Full-wave, and Bridge Rectifiers with and without Filters: Series inductor filter and shunt capacitor filter, Ripple Factor and Regulation Characteristics. Zener and Avalanche Breakdowns, Characteristics of Zener diode, voltage

regulator, Tunnel Diode, Varactor Diode, Schottky Barrier Diode. [Textbook 3: Chapter-8 Section 8.2-8.6, Chapter-5 Section 5.3, 5.4, 5.6, 5.7]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Describe the operation of rectifiers and evaluate their performance metrics like ripple factor and regulation characteristics. (L2)
2. Explain the working principles of special diodes such as Zener diode, tunnel diodes, varactor diodes, and Schottky barrier diodes(L2)

UNIT-III **10 Lectures**

Transistor Characteristics and Transistor Biasing: Operation of NPN and PNP junction Transistor, Current components in a transistor, Input and Output Characteristics of CB, CE, CC, relation between α, β, γ, typical transistor junction voltages, Comparison of CE, CB, and CC Configurations. Junction Biasing for Saturation, Cutoff and Active Region, Biasing circuits analysis, fixed bias, collector to base bias, emitter bias, voltage divider bias, thermal runaway, thermal stability, stability factors. [Textbook 1: Chapter 5 Section 5.4 - 5.11, Textbook 3: Chapter 10 Section 10.1-10.8]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Describe the characteristics of transistor in CE, CB, and CC configurations. (L2)
2. Understand the principals of transistor biasing and stabilization(L2)
3. Analyse the transistor operation with different biasing techniques(L4)

UNIT-IV **10 Lectures**

Transistor at Low Frequencies: Small Signal: Transistor as an Amplifier, h – parameter model, Analysis of Transistor Amplifier Circuits using h –parameters, CB, CE and CC Amplifier configurations and performance factors, effects of Bypass and Coupling Capacitors. Multistage transistor Amplifier, RC Coupled Amplifier, Frequency Response and band width, Emitter – Follower. [Textbook 3: Chapter -11 Section 11.9 - 11.14 & 11.17 - 11.20

Learning Outcomes:

At the end of the unit, the student will be able to

1. Represent transistor with its equivalent h parameter model(L2)
2. Analyse the performance of transistor amplifiers with h Models(L4)

UNIT-V **9 Lectures**

Field Effect Transistors:

Construction of JFET and its drain, transfer characteristics, pinch off Voltage, Drain Saturation Current, Construction of MOSFET –Enhancement and Depletion Modes, drain and transfer characteristics. JFET Configurations, Common Source JFET biasing, fixed bias, self-bias, voltage divider bias. [Textbook 2: Chapter 5 Section 5.1 - 5.3, 5.7, 5.8, Chapter 6 Section 6.2, 6.3, 6.4]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Comprehend the characteristics of BJT and FET(L2)
2. Explain the construction of JFET and MoSFETs (L2)
3. Describe the characteristics of JFET and MoSFET (L2)
4. Understand various biasing methods for FETs (L2)

Text Books:

1. Jacob Millman, Christos C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, McGraw-Hill.
2. Robert Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 7th Edition, Prentice Hall,1998
3. Sanjeev Gupta, Electronic Devices and Circuits, 2nd Edition, Dhanpat Rai Publications,2005.

Reference Books:

1. Thomas L. Floyd, Electronic Devices, 9th Edition, Prentice Hall, 2012.
2. B. V. Rao and K. Raja Rajeswari, Electronic Devices and Circuits 2nd Edition, Pearson Education,2010
3. Electronic Devices and Circuits, G. S. N. Raju, I. K. International Publications, New Delhi, 2006.
4. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008.

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_ee80/preview
2. https://be-iitkgp.vlabs.ac.in/

ENGINEERING PHYSICS LAB

I Year B. Tech I Semester

[Common to ECE, EEE, CSE(AI&ML)]

Course Code: 24BP11RC02

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the course the student will be able to

CO1: Interpret the physical parameters based on optical phenomena. (L2)

CO2: Verify the behaviour of double refraction in birefringent material like quartz. (L2)

CO3: Demonstrate the concepts of diffraction through experiments. (L3)

CO4: Calibrate instruments like low range voltmeters and ammeters. (L3)

CO5: Design temperature sensors based on diodes and thermistors. (L3)

List of Experiments: (Any TEN of the following experiments shall be conducted)

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Thickness Given Paper Strip or hairline by Wedge Method.
3. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer in minimum deviation position
5. Determination of Refractive Index of Ordinary ray and Extra-ordinary ray in quartz prism
6. Laser- Diffraction – determination of wavelength of laser source using diffraction grating
7. Determination of wavelength of laser source using Fraunhofer single slit diffraction
8. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
9. Study of Intensity Variation of the Magnetic Field along the axis of circular Current Carrying conductor using Stewart and Gee apparatus
10. Calibration of Low Range Voltmeter using Potentiometer Bridge
11. Calibration of Low Range Ammeter using Potentiometer Bridge
12. Determination of dielectric constant of material using charging discharging method with a parallel plate capacitor
13. Determination of energy band gap of semiconductor using PN junction diode in reverse bias
14. Determination of thermo electric coefficients for thermistor
15. Determination of Planck's constant using LED.

Textbooks:

1. Practical physics by CL Arora, S.chand publishing company, 1995.
2. Advanced Practical Physics For Students by B.l.worsnop And H.t.flint, 1923

Web References:

1. http://lo-au.vlabs.ac.in/laser-optics/Newtons_Rings_Wavelength_of_light/
2. http://ov-au.vlabs.ac.in/optics/Spectrometer_Refractive_Index/
3. http://ov-au.vlabs.ac.in/optics/Diffraction_Grating/
4. http://htv-au.vlabs.ac.in/heat-thermodynamics/Characteristics_of_Thermistor/
5. https://bop-iitk.vlabs.ac.in/exp/energy-band-gap/simulation.html

PROBLEM SOLVING USING C LAB

I Year B. Tech. I semester

[Common to CSE, CSE (AI&ML), IT, ECE]

Course Code: 24CT11RC04

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Outline the use of basic constructs of C for simple applications. (L2)

CO2: Develop C programs for simple applications using Arrays and Strings. (L3)

CO3: Illustrate concepts such as functions, recursion, and pointers with suitable examples. (L2)

CO4: Build C programs involving Structures and Unions. (L3)

CO5: Develop applications using sequential and random-access file processing. (L3)

Module-1:

1. Write a C program to demonstrate Format Specifiers and Input/Output Statements.
2. Write a C program to demonstrate various Data Types.

Module-2:

1. Write a C program to demonstrate various Operators including Bitwise Operator.
2. Write a C program to demonstrate Arithmetic Expressions and Type Casting.

Module-3:

1. Write a C program to demonstrate decision making statements.
2. Write a C program to demonstrate iterative statements.
3. Write a C program to demonstrate break and continue Statement.

Module-4:

1. Write a C program to demonstrate arrays (one-dimensional and two-dimensional).
2. Write a C program to demonstrate string handling functions using built-in and user defined functions.

Module-5:

1. Write a C program to demonstrate user defined functions.
2. Write a C program to demonstrate nested functions.

Module-6:

1. Write a C program to demonstrate arithmetic expressions using pointers.
2. Write a C program to demonstrate Pointers to Arrays.
3. Write a C program to demonstrate manipulate strings using pointers.

4. Write a C program to demonstrate dynamic memory allocation.

Module-7:

1. Write a C program to demonstrate Call-by-value, Call-by-reference.
2. Write a C program to demonstrate recursive function.
3. Write a C program to demonstrate Functions with Storage Classes (Static).

Module-8:

1. Write a C program to demonstrate structures.
2. Write a C program to demonstrate structures within structures.
3. Write a C program to demonstrate pointer to a structure.
4. Write a C program to demonstrate unions.

Module-9:

1. Write a C program to demonstrate I/O operations on files.
2. Write a C program to demonstrate concatenating two files.
3. Write a C program to demonstrate copy content of one file to another file.

Case Study: Select any one application mentioned below.

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

1. Develop a library management system to add, delete, and search for books efficiently.
2. Develop an ATM system to check balance, deposit money, and withdraw funds.
3. Develop a C program to calculate salary increments using a lookup table which stores the percentage of increment based on the current salary.
4. Develop a voting system where users can vote for candidates and view results.
5. Develop a basic calculator for arithmetic operations like addition, subtraction, multiplication, and division.
6. Develop a contact management system to store and manage details like name, phone number, and email.
7. Develop a banking system supporting multiple users for account management and transactions.
8. Develop a C program to calculate SGPA and CGPA based on students' marks across semesters.
9. Develop a registration page in C using file handling to securely store usernames and passwords.

10. Develop an encryption and decryption algorithm to securely transform and restore data by using the GNU C Library: crypt.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, 2015, Pearson Education India, ISBN: 978-93-3254-944-9.
2. Yashavant P. Kanetkar, "Let Us C", 16th Edition, 2019, BPB Publications, ISBN: 978-93- 8728-449-4.
3. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.
4. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, 2018, Oxford University Press, ISBN: 978-01-9949-147-6.
5. N.B. Venkateswarulu, "C programming", 1st Edition, S.Chand Publishing, 2017, ISBN: 978-93-525-3356-5.
6. Jacqueline A Jones and Keith Harrow, "Problem Solving with C", Pearson Education. ISBN: 978-93-325-3800-9.

Web References:

1. https://nptel.ac.in/courses/106105171
2. https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/pages/lecture-notes/
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384323703937433634517_shared/overview
4. https://cse02-iiith.vlabs.ac.in/List%20of%20experiments.html

ELECTRONIC DEVICES AND CIRCUITS LAB

I Year B. Tech I semester

[ECE]

L	T	P	C
0	0	3	1.5

Course Code: 24EC11RC02

Course Outcomes: At the end of the Course the student shall be able to:

CO1: Understand the operation of CRO for signal measurements. (L2)

CO2: Analyze the characteristics of P-N junction diode and special diodes. (L4)

CO3: Build the rectifier circuits and regulator circuits using diode. (L3)

CO4: Analyze the operation and characteristics of BJT and FET. (L4)

CO5: Construct and analyze the performance of BJT and FET amplifier circuits. (L4)

List of Experiments:

1. Study of CRO and Applications.
2. Characteristics of PN Junction Diode
3. Characteristics of Zener Diode and Zener Voltage regulator.
4. Characteristics of Photo diode
5. Half-wave and full-wave rectifiers with diodes
6. Half-wave and full-wave rectifiers with capacitor filter
7. Characteristics of BJT CE configuration, h-parameters
8. Characteristics of BJT CB configuration, h-parameters
9. Voltage gain, input impedance and output impedance of emitter follower
10. Drain and transfer characteristics of JFET
11. Frequency response of CE amplifier
12. Demonstration of virtual tool for simulation of electronic device characteristics.

Reference Books:

1. Thomas L.Floyd, “Laboratory Exercises for Electronic Devices”, 9th ed., Prentice Hall.
2. Robert Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 7th ed., Prentice Hall.
3. David A. Bell, “Laboratory manual for electronic devices and circuits”, 4th ed., 2001.

Web References:

1. https://be-iitkgp.vlabs.ac.in/
2. https://www.multisim.com/content/t6fPJvwcHYMD4qzJSYpGHQ/edc-lab1/

LINEAR ALGEBRA AND VECTOR CALCULUS

I Year B. Tech. II Semester

[Common to EEE, ECE, CSE, IT, CSE (AI&ML)]

Course Code: 24BM11RC02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Test for consistency and solve linear system of equations, also determine unknown currents in the electrical circuits. (L5)

CO2: Find the Eigen values and Eigen vectors of a matrix and apply Cayley- Hamilton theorem to find the inverse of a matrix. (L3)

CO3: Reduce quadratic form to canonical form and examine the nature of quadratic form. (L4)

CO4: Interpret the meaning and evaluate gradient of a scalar valued, curl and divergence of vector valued functions. (L5)

CO5: Apply line integrals, surface integrals, volume integrals and their relations using Green's theorem, Stoke's theorem, Gauss Divergence theorems in various engineering applications. (L3)

UNIT-I: **10 Lectures**

Matrix Algebra: Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations – Gauss elimination and Gauss Jordan methods, LU Factorization method.

Applications: Finding the current in electrical circuits. [Sections: 2.7, 2.10, 28.6 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Find the rank of a matrix. (L1)
2. Test for consistency and solve a system of linear equations. (L4)
3. Apply Gauss elimination and Gauss Jordan methods, LU factorization to solve linear systems. (L3)
4. Determine unknown currents in electrical circuits. (L5)

UNIT-II: **10 Lectures**

Eigen Values and Eigen Vectors: Eigen Values and Eigen Vectors of a real Matrix – Properties - Cayley- Hamilton theorem (without proof) - Inverse and Powers of a Matrix using

Cayley-Hamilton's theorem – Pseudo inverse of a matrix, Singular value decomposition. [Sections: 2.13 - 2.15 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Find eigenvalues and corresponding eigenvectors of a matrix. (L1)
2. Apply Cayley-Hamilton theorem to find powers and the inverse of a matrix. (L3)
3. Calculate the Pseudo Inverse of a matrix. (L3)
4. Calculate the singular values of a matrix. (L3)

UNIT-III: **9 Lectures**

Quadratic Forms: Inner Product – Orthogonal Vectors – Orthogonal matrix – Diagonalization of a Matrix-Quadratic Forms - Reduction of Quadratic Form to Canonical Form (Orthogonal Transformation) - Nature of a Quadratic Form. [Sections: 2.16 - 2.18 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Make use of Eigen values and eigen vectors to diagonalize the matrix. (L3)
2. Reduce the Quadratic form to canonical form examine the nature of a quadratic form. (L4)

UNIT-IV: Vector Differentiation **9 Lectures**

Introduction - Scalar and Vector point functions, General rules for vector differentiation - Vector operator ∇ applied to scalar point functions- Gradient, ∇ applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and curl (i.e., ∇f, $\nabla . \overline{F}$, $\nabla \times \overline{F}$), Irrotational and Solenoidal fields, Vector Identities.

(Sections: 8.1, 8.4 - 8.9 of Text Book)

Learning Outcomes:

At the end of the unit, the student will be able to

1. Find the gradient of a scalar point function, divergence and curl of a vector point function. (L1)
2. Determine the directional derivative of scalar point function. (L5)

UNIT-V: Vector Integration **10 Lectures**

Integration of vectors - Line integral – Circulation - work done - surface integral-flux - Green's theorem in the plane - Stoke's theorem - Volume integral - Gauss Divergence theorem (All theoremswithout proofs). (Sections: 8.10 - 8.16, 8.18 of Text Book)

Learning Outcomes:

At the end of the unit, the student will be able to

1. Determine the work done in a moving particle along a path. (L5)
2. Interpret surface and volume integrals. (L2)
3. Apply vector integral theorems to multiple integral. (L3)

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 45th Edition, Khanna Publishers, 2024.

Reference Books:

1. David Poole, Linear Algebra- A modern introduction, 4th edition, 2015.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, 2011.
3. Peter V. O'Neil, Advanced Engineering Mathematics, 7th edition, Cengage Learning, 2011.
4. Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson, 2017.

Web References:

1. https://nptel.ac.in/courses/111107112

GREEN CHEMISTRY

I Year B. Tech. II semester
[Common to CSE (AI&ML), ECE]

Course Code: 24BC11RC01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: To develop knowledge about water and its treatment for industrial and potable purpose. (L3)

CO2: Utilize the theory of construction and discharge reactions of various types of batteries are used in commercial society. (L3)

CO3: Explain the importance of working principle, fabrication of electrodes and other components, advantages, disadvantages and environmental aspects of fuel cells. (L4)

CO4: Classify the corrosion mechanism of metals and factors influenced by rate and extent of corrosion and categorize the reasons for corrosion control methods. (L4)

CO5: Apply green chemistry technology processes the knowledge for solving existing challenges faced in various engineering and societal areas. (L5)

UNIT-I **10 Lectures**

Water-Technology: Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water –Reverse Osmosis Method Electro-dialysis. Chemical analysis of water. [TB1: Chapter1]

Learning Outcomes:

At the end of the unit the student will be able to

1. Explain the principles of reverse osmosis (L4)
2. Compare the quality of drinking water with BIS and WHO standards (L4)
3. Illustrate problems associated with Boiler Troubles (L2)
4. Demonstrate the estimation of hardness of water (L3)

UNIT-II **10 Lectures**

Batteries: Primary batteries: The Chemistry-Types: Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells and lithium-ferrous sulphide cells. Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel cadmium, nickel-zinc, nickel- metal hydride batteries, lithium-ion batteries, ultrathin lithium polymer cells. Advanced Batteries for electric vehicles, requirements of the battery – sodium-beta and redox batteries. [TB1: Chapter6]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Deduct the working mechanism of various types of cells (L5)
2. Illustrate difference between primary and secondary cells (L2)
3. List the environmental applications of Various types of batteries (L4)
4. Utilize the manufacturing methods of advanced batteries for electric vehicles (L3)

UNIT-III **8 Lectures**

Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells-Membranes and Fuels, Electrochemical Sensors and Optical fibres. [TB1: Chapter 6]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Explain the fundamental theories of fuel cells (L2)
2. Classify types of fuel cells (L4)
3. Make use of the various components fabrication of fuel cells (L3)
4. Distinguish the advantages, disadvantages and environmental aspects of fuel cells(L4)

UNIT-IV **10 Lectures**

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion. Corrosion Controlling Methods, Protective Coatings, Electroplating and Electroless Plating, Paints, Varnishes, Lacquers, Enamels. [TB1: Chapter 7]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Explain the Mechanism of corrosion (L4)
2. List the various types of Corrosion (L4)
3. Describe the Factors Effecting Corrosion (L5)
4. Differentiate between Paints Lacquers Enamels (L4)

UNIT-V **10 Lectures**

Green-Chemistry and Technology: Introduction and significance of green chemistry, Goals of green chemistry, 12 principles of green chemistry, toxicity of chemicals, concept of zero pollution technologies; Aqueous phase method, Super critical fluid method, Phase transfer catalytic method, atom economy, functional toxicity vs non- functional toxicity, functional group approaches to green chemistry, Elimination of toxic functional group, optimization of frameworks for the design of greener synthetic pathways -Green synthesis of Adipic acid and Paracetamol- energy minimization-Microwave synthesis, ultra sound assisted method Bio catalyzed reaction and Only explanation with examples Processes involving solid catalysts – zeolites, ion exchange resins, applications of Green Chemistry, Green solvents, green fuels & propellants. [TB2: Chapter- 2,3,4&5]

Learning Outcomes:

At the end of the unit the student will be able to

1. Processes involving Green Chemistry and apply the knowledge for solving existing
2. Challenges faced in various engineering and societal areas (L-5)
3. Differentiate between functional toxicity vs non- functional toxicity (L-4)
4. Explain the green chemistry, 12 principles (L-2)

Textbooks:

1. Engineering Chemistry – PC Jain and M. Jain –15th Edition, Dhanpath Rai and Sons, New Delhi.
2. Anastas, P. T., Warner, J. C. Green Chemistry: Theory and Practice, Oxford UniversityPress Inc., New York, 1998.

Reference Books:

1. M. Aulice Scibioh and B. Viswanathan ‘Fuel Cells – principles and applications’, University Press India (2006).

2. A Textbook of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi
3. Handbook of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

Web References:

1. https://archive.nptel.ac.in/course.html
2. https://nptel.ac.in/courses/engineering

ENGLISH

I Year B. Tech II Semester

[Common to ECE, EEE & CSE(AI&ML)]

L	T	P	C
3	0	0	3

Course Code: 24HE11RC01

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Develop moral values and inner peace(L3), Demonstrate the use of LSRW skills, Vocabulary and basic grammar concepts. (L3)

CO2: Identify the impact of different social backgrounds (L3), recognize the poet's insights. (L4) Demonstrate the use of LSRW skills, Vocabulary and basic grammar concepts. (L3)

CO3: Analyse socio-cultural context(L4), Establish effective interpersonal and communication skills(L3), Demonstrate the use of LSRW skills, Vocabulary and basic grammar concepts(L3)

CO4: Focus on value of education(L4), Relate to the poet's nostalgia(L4), Demonstrate the use of LSRW skills, Vocabulary and basic grammar concepts (L3)

CO5: Determine the central idea of the text(L3), Identify one's resilience(L3), Demonstrate the use of LSRW skills, Vocabulary and basic grammar concepts (L3)

UNIT-I **10 Lectures**

Prose:	Swami Vivekananda: The Secret of Work
Poetry:	Grenville Kleiser: Stay Calm
Grammar & Vocabulary:	Synonyms & Antonyms
Listening:	Listening for Context and Specific Information
Speaking:	Introducing Oneself and Others
Writing:	Basics of writing

Learning Outcomes:

At the end of the unit, the student will be able to

1. Interpret the spiritual growth and capacity building of the individual in the 21st century. (L3)
2. Use appropriate synonyms and antonyms to communicate effectively. (L3)
3. Listen and understand for specific information in the audio(L2)
4. Establish connections between oneself and others(L3)

5. Apply appropriate punctuation marks for clarity and organization of written text (L3)

UNIT-II **10 Lectures**

Prose:	Katherine Mansfield: The Doll's House
Poetry: Rabindranath Tagore:	Where the Mind Is Without Fear
Grammar & Vocabulary:	Phrasal Verbs
Listening:	Listening for Main Idea and Supporting Ideas
Speaking:	Getting Someone's Attention and Interrupting
Writing:	Formal Letters

Learning Outcomes:

At the end of the unit, the student will be able to

1. Relate to the world through adult & child's points of view (L3)
2. Identify the sense of self dignity & rationality in the poem (L4)
3. Utilize appropriate phrasal verbs for effective communication(L3)
4. Listen & identify main and supporting ideas in the audio(L3)
5. Practice conversational etiquette(L3)
6. Write formal letters(L3)

UNIT-III **10 Lectures**

Prose:	O. Henry: The Last Leaf
Poetry:	Rudyard Kipling: If
Grammar & Vocabulary:	Idiomatic Expressions
Listening:	Listening for Global Comprehension
Speaking:	Asking for Information and Giving Information
Writing:	Note-Making

Learning Outcomes:

At the end of the unit, the student will be able to:

1. Analyze strategies to face challenges in life (L4)
2. Develop one's own personality (L3)
3. Use idiomatic expressions in oral & written communication (L3)
4. Listen & Interpret the audio for Global Comprehension (L3)
5. Ask & provide information (L3)
6. Practice note making study skills(L3)

UNIT-IV **10 Lectures**

Prose:	Francis Bacon: Of Studies
Poetry:	Toru Dutt: Our Casuarina Tree
Grammar & Vocabulary:	Remedial Grammar I
Listening:	Listening to Make Inferences
Speaking:	Expressing Opinions, and Agreeing and Disagreeing with Opinions
Writing:	Essay Writing

Learning Outcomes:

At the end of the unit, the student will be able to

1. Prioritize the habits of continuous learning(L4)
2. Recognize the significance of Indian philosophy (L4)
3. Identify and correct common errors in English grammar and usage(L3)
4. Draw inferences from the audio(L3)
5. Articulate one's own opinions(L3)
6. Develop different types of essays (DEAN)(L3)

UNIT-V **8 Lectures**

Prose:	Mark Twain: Whitewashing the Fence
Poetry:	William Ernest Henley: Invictus
Grammar & Vocabulary:	Remedial Grammar II
Listening:	Listening for Key Ideas
Speaking:	Telephone Etiquette
Writing:	E-mail Etiquette

Learning Outcomes:

At the end of the unit, the student will be able to

1. Discover the humour & moral lessons in the text (L3)
2. Show resilience in adverse situations. (L3)
3. Modify sentences with appropriate grammar, vocabulary and usage (L3)
4. Identify key ideas (L3)
5. Practice telephone Etiquette (L3)
6. Apply the knowledge of E-mail Etiquette (L3)

Text Books:

1. English for Engineers: Theory to practice. Board of Editors, Orient Black Swan Publishers, India.2024.

Reference Books:

1. English Grammar in Use by Raymond Murphy
2. Oxford English Grammar Course by Michael Swan
3. Word Power Made Easy by Norman Lewis
4. Cambridge Vocabulary for IELTS by Pauline Cullen
5. The Elements of Style by William Strunk Jr. and E.B. White
6. English Vocabulary in Use by Michael McCarthy and Felicity O'Dell
7. Practical English Usage by Michael Swan
8. The Only Grammar Book You'll Ever Need by Susan Thurman
9. Advanced English Grammar: A Linguistic Approach by Ilse Depraetere and Chad Langford

DIGITAL LOGIC DESIGN

I Year B. Tech. II semester

[Common to ECE, CSE, CSE(AI&ML), IT]

Course Code: 24EC11RC05

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Represent different number systems & binary codes and perform conversions & binary arithmetic (L2)

CO2: Apply different simplification methods for minimizing Boolean functions. (L3)

CO3: Model various combinational circuits using gates and PLD's. (L3)

CO4: Outline the concept of latches and flip-flops. Construct sequential logic circuits like counters and registers using flip-flops. (L3)

CO5: Categorize Mealy & Moore models and Design Synchronous Sequential machines. (L3)

UNIT-I **9 Lectures**

Number systems: Number systems, Base conversion methods, Representation of signed numbers and Binary Arithmetic.

Codes: Binary, Non binary, Decimal, Alphanumeric, XS-3, Gray. Error detecting and error correcting codes.

Logic Gates: AND, OR, NOT, NAND, NOR, XOR, EX-NOR. [Textbook1: Chapter1, Chapter 2: section 2.1 to 2.8]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the advantages of using different number systems. (L2)
2. Describe the usefulness of different binary codes. (L2)
3. Summarize the error detection and correction concepts. (L2).

UNIT-II **10 Lectures**

Minimization of Boolean Functions: Fundamental postulates of Boolean algebra, Basic theorems, Simplification of Boolean equations, Min terms, Max terms, Standard form of Boolean functions. Simplification of functions using Karnaugh map method (2,3,4,5 variables) Don't care conditions, AOI implementation, NAND and NOR Realizations. [Textbook1: Chapter 2: Sections 2.11 to 2.19,2.21,2.22,2.23, Chapter 3: sections 3.2 to 3.6,3.7]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply basic laws and theorems to simplify Boolean expressions and construct logic circuits. (L3)
2. Understand concepts of sum-of-products and product-of-sums representations. (L2)
3. Apply K- Map for minimizing logic functions and build logic circuits. (L3)

UNIT-III **12 Lectures**

Combinational Logic-Circuit Design-I: Logic design of combinational circuits: Adders and Subtractors: Binary, BCD, Excess-3 and Look–ahead-carry adder, Code converters, Multiplexers, De multiplexers, Encoders, Decoders and priority encoders, Realization of Boolean functions using multiplexers and Decoders.

Combinational Logic-Circuit Design-II: Design of 4-bit comparator, Parity checker/Generator. Basics of PLDs: Basic structure of PROM, PAL, PLA, Realization of Boolean functions with PLDs and their merits and demerits. [Textbook1: Chapter 4: section 4.1 to 4.27, Chapter 5 Sections 5.1 to 5.11]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply Boolean algebra for describing combinational digital circuits (L3)
2. Describe standard combinational circuits such as adders, subtractors, comparators etc. (L2)
3. Develop the digital circuits using PLDs (L3)

UNIT-IV **10 Lectures**

Sequential Circuits: Classification of sequential circuits, SR-latch, Gated latches, Flip flops: RS, JK, D, T and Master slave flip flops, Excitation tables, flip flop conversion from one type to another. Design of counters: Ripple counters, Synchronous counters, asynchronous counters, up-down counters, Johnson counter, ring counter. Design of registers: Buffer registers, Shift registers, Bi directional shift registers, Universal shift register. [Textbook1: Chapter 6]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the principle of Flip-Flops and Latches. (L2)
2. Summarize the concepts of Shift Registers and Counters. (L2)
3. Construct different sequential logic circuits using Flipflops. (L3)

UNIT-V **7 Lectures**

Analysis and Design of Synchronous Sequential Machines: Moore and Mealy machine models, State Equations, State Table, State diagram, State reduction & assignment, Synthesis of synchronous sequential circuits- sequence detector and generator. [Textbook1: Chapter 7 Sections 7.1 to 7.5]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand Moore and Mealy machine models (L2)
2. Discuss the concepts of State assignment & Reduction (L2)
3. Analyse the design and synthesis of synchronous sequential circuits (L3)

Textbooks:

1. Anand Kumar, Switching Theory and Logic Design. PHI, 2014.
2. M. Morris Mano and Michael D. Ciletti, Digital Design, 4th Edition, Pearson Education, 2013.

Reference Books:

1. Foundation of Switching theory and Logic Design, A k Singh, New age International Publishers,2008
2. Modern Digital Electronics, R P Jain, 4th Edition, Tata McGraw Hill Education Pvt. Ltd, New Delhi,2010
3. Fundamentals of Logic Design, Charles. R. Roth, Thomson Publications,5th edition,2004.

Web References:

1. https://nptel.ac.in/courses/108105132 (Digital Electronic Circuits)
2. https://onlinecourses.nptel.ac.in/noc24_ee147/preview (Digital Circuits)
3. https://nptel.ac.in/courses/117105080 (Digital Systems Design)
4. https://onlinecourses.swayam2.ac.in/nou24_ec07/preview (Digital electronic and System design)

ELECTRONIC CIRCUIT ANALYSIS

I Year B. Tech. II semester

[ECE]

Course Code: 24EC11RC06

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Formulate small signal high frequency amplifiers using BJT and FET. (L3)

CO2: Classify multistage amplifiers. (L2)

CO3: Design different types of feedback amplifiers. (L3)

CO4: Interpret the condition for oscillations in oscillators and design different types of oscillators. (L3)

CO5: Analyse and examine different types of power amplifiers and Tuned amplifiers, compare them in terms of efficiency. (L4)

UNIT-I **10 Lectures**

Small Signal High Frequency Transistor Amplifier models: BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid-π conductance's, Hybrid-π capacitances, validity of Hybrid-π model, determination of high frequency parameters in terms of low frequency parameters, Millers Theorem and its Dual, CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product. FET: Analysis of common source and common drain amplifier circuits at high frequencies. [Textbook 1: Chapter -11, Chapter -8: Section 8.11, Chapter -10:Section 10-10 & 10-11]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Explain the Hybrid-π model of BJT and FET. (L2)
2. Apply Hybrid-π model to BJT and FET amplifiers. (L3)
3. Analyze BJT and FET amplifiers with Hybrid-π model. (L3)

UNIT-II **10 Lectures**

Multistage Amplifiers: BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. high input resistance transistor amplifiers- Darlington and Bootstrap

circuits, Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product. [Textbook 1: Chapter -10]

Learning Outcomes:

At the end of the unit, the student will be able to

1. List the various multistage amplifiers. (L1)
2. Interpret the frequency response and relationship between gain and bandwidth in amplifiers. (L2)
3. Design and analyze different multistage amplifiers. (L2)

UNIT-III **10 Lectures**

Feedback Amplifiers: Classification of Amplifiers, Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers. [Textbook 1: Chapter -13]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Outline the basic amplifiers and fundamental concepts of Feedback amplifiers. (L2)
2. Design and analyze feedback amplifiers using each of the four topologies. (L3)
3. Compare the advantages and disadvantages of each feedback topology in different applications. (L3)

UNIT-IV **9 Lectures**

Sinusoidal Oscillators: Condition for oscillations – RC Oscillators -- RC Phase Shift and Wein bridge Oscillators (BJT and JFET models), LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators, Frequency and amplitude Stability of Oscillators– Crystal Oscillators. [Textbook 1: Chapter -14: Section 14-15 to 14-21]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Describe the significance of the loop gain and phase shift in sustaining oscillations. (L2)
2. Determine the frequency of oscillation and design criteria for RC, LC and crystal oscillators. (L3)
3. Compare the performance of crystal oscillators with other types of oscillators. (L3)

UNIT-V **9 Lectures**

Tuned Voltage Amplifiers and Power Amplifiers: Single Tuned and Stagger Tuned Amplifiers – Analysis, Double Tuned Amplifier, and Bandwidth Calculation. Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers. Series Fed, Single Ended Transformer Coupled Class A Power Amplifiers. Harmonic Distortions, Class B Push-pull amplifiers and their analysis, Complementary symmetry push pull amplifier, Class AB power amplifier. [Textbook 1: Chapter -18, RB1: Chapter -13]

Learning Outcomes:

At the end of the unit, the student will be able to

1. List the varieties of Tuned and Power Amplifiers. (L1)
2. Illustrate the operation of Tuned and power amplifiers. (L2)
3. Design and analyze various Tuned and power amplifiers. (L4)

Text Books:

1. Jacob Millman and C.Halkias, Integrated Electronics, Analog Digital Circuits and systems McGraw Hill, 1972.
2. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Microelectronic Circuits, 6/e, Oxford University Press, 2013.
3. B.V.Rao, K. RajaRajeswari et.al, Electronic Circuit Analysis ,Pearson Publishers,2010.

Reference Books:

1. Salivahanan, N.Suresh Kumar,Electronic Devices and Circuits, TMH, 4th Edition,2017
2. G.K.Mithal, Electronic Devices and Circuits, Khanna Publishers, 23rd Edition, 2004.
3. Robert L. Boylestad and Louis Nashelsky Electronic Devices and Circuits Theory, Pearson/Prentice Hall, Tenth Edition,2009.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_ee106.
2. https://onlinecourses.nptel.ac.in/noc24_ee140.

COMMUNICATION SKILLS LAB

I Year B. Tech. II Semester

[Common to ECE, EEE, CSE (AI&ML)]

Course Code: 24HE11RC02

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Identify and pronounce the sounds of English; choose the accurate stress in connected speech for proper intonation. (L3)

CO2: Apply the main theme and ideas of the audio/video to take notes and summarize. (L3)

CO3: Develop speaking skills by taking part in Just A Minute (JAM) – Picture Prompts-Narratives-Role Play. (L3)

CO4: Practice discussions and debates. (L3)

CO5: Demonstrate Presentation Skills. (L3)

ACTIVITY-I

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply the knowledge of Phonetics for better pronunciation and articulation. (L3)
2. Choose appropriate stress, intonation and rhythm of English language for clear communication. (L3)

ACTIVITY-II

Listening Skills: Listening for gist and specific information - listening for Note taking, Summarizing and for opinions - Listening to the speeches of eminent personalities.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Develop effective listening skills for better comprehension of academic lectures and English spoken by native speakers. (L3).
2. Apply effective strategies for good writing. (L3)
3. Demonstrate writing skills in note taking and summarizing. (L3)

ACTIVITY-III

Speaking Skills: Just A Minute (JAM) session –Picture Prompts- Narrating stories and anecdotes-Role Play

Learning Outcomes:

At the end of the unit, the student will be able to

1. Make use of dialogues for different roles. (L3)
2. Develop communication skills in formal and informal situations. (L3)
3. Practice speaking skills through participation in activities such as narrating stories and role plays(L3)

ACTIVITY-IV

Speaking skills: Group Discussions-Arguments-Debates

Learning Outcomes:

At the end of the unit, the student will be able to

1. Organize one's own ideas for various Group-Discussion formats. (L3)
2. Develop ideas and arguments to debate. (L3)

ACTIVITY-V

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation

Learning Outcomes:

At the end of the unit, the student will be able to

1. Design presentations with PowerPoint slides(L3)
2. Apply appropriate body language (postures, gestures, facial expressions and eye contact) in formal presentations. (L3)

LIST OF LAB ACTIVITIES:

1. Identification and pronunciation of Vowel sounds and Consonant sounds (CO1)
2. Identification of word stress, Intonation and Rhythm (CO1)
3. Listening for specific information & Note taking (CO2)
4. Listening to the speeches of eminent personalities and summarizing (CO2)
5. Just A Minute sessions (CO3)
6. Picture Prompts (CO3)
7. Narrating Stories& anecdotes (CO3)

8. Role-Plays (CO3)
9. Group Discussions (CO4)
10. Debates (CO4)
11. Presentation Skills-I (CO5)
12. Presentation Skills-II (CO5)

Reference Books:

1. Language and Life: A Skills Approach Board of Editors, Orient Black swan Publishers, India.2018.
2. A Textbook of English Phonetics for Indian Students, T.Balasubramanian, Macmillan India Ltd.
3. Ashraf Rizvi. Effective Technical Communication. Tata McGraw Hill Education Private Limited, New Delhi.
4. Speak Well. Orient Black swan Publishers, Hyderabad.
5. Allan Pease. Body Language. Manjul Publishing House, New Delhi.

Web References:

1. https://www.englishlanguageclub.co.uk
2. https://www.ted.ed.com/
3. https://learningenglish.voanews.com/
4. https://www.bbc.co.uk/learningenglish/
5. https://www.abc.net.au/education/learn-english
6. NDTV News

DIGITAL LOGIC DESIGN LAB

I Year B. Tech. II semester

[ECE]

Course Code: 24EC11RC07

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course the student shall be able to:

CO1: Verify the functional behavior of different logic gates and realize the Boolean expressions using these gates. (L3)

CO2: Build combinational circuits to implement different logic functions. (L3)

CO3: Verify the functional behavior of different Flipflops (L3)

CO4: Construct sequential circuits like counters and registers using flip-flops. (L3)

CO5: Make use of Digital ICs for verification and design of Digital circuits. (L3)

List of Hardware Experiments:

1. Verification of Logic Gates
2. Verification of Demorgan's Laws
3. Realization of Gates by using universal building blocks
4. Realization of SOP and POS
5. Half Adder & Full adder
6. Implementation of a function by using Decoders
7. Implementation of a function by using Multiplexers.
8. 3 bit Parity Generator
9. Verification of Flip - flops
10. Mod-8 Synchronous counter
11. Johnson Counter
12. 4 - bit Shift-register

Reference Books:

1. Digital Electronics- A Comprehensive Lab Manual by Cherry Bhargava, BS Publications, 2019.
2. Switching theory and Logic Design by Prof. K. Sivani and Prof. B. Ramadevi, BlueRose publishers, 2020.

Web References:

1. https://dec-iitkgp.vlabs.ac.in/
2. https://de-iitr.vlabs.ac.in/
3. https://de-iitg.vlabs.ac.in/

ELECTRONIC CIRCUIT ANALYSIS LAB

I Year B. Tech. II semester

[ECE]

Course Code: 24EC11RC08

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course the student shall be able to:

CO1: Design and analyze feedback amplifiers (voltage series and current shunt feedback amplifiers). (L3)

CO2: Design and analyze various oscillators (RC phase shift oscillator and Colpitt's oscillator. (L3)

CO3: Design and analyze various amplifiers (Multistage amplifiers and Single tuned amplifier). (L3)

CO4: Design and analyze power amplifiers (Class A and Class B complimentary symmetry). (L3)

CO5: Become expert with computer skills (Multisim, OrCAD Pspice and Capture) for the analysis and design of circuits. (L3)

List of Experiments:

Cycle I (Hardware)

1. Voltage-Series Feedback Amplifier
2. Current-Shunt Feedback Amplifier
3. RC Phase Shift Oscillator
4. Colpitt's Oscillator
5. Two Stage RC Coupled Amplifier
6. Darlington Pair Amplifier

Cycle II (Software)

1. Class A Series-fed Power Amplifier
2. Transformer-coupled Class A Power Amplifier
3. Wien Bridge Oscillator
4. Hartley Oscillator
5. Complementary Symmetry Class B Push-Pull Power Amplifier
6. Single Tuned Voltage Amplifier

Equipment required:

Hardware:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Active & Passive Electronic Components

Software:

1. Multisim/ Equivalent Industrial Standard Licensed simulation software tool.
2. Computer Systems with required specifications

Reference Books:

1. Electronic Devices, Thomas L.Floyd, Tenth edition,2012
2. Electronic Devices and Circuits, David A. Bell, Fifth Edition,2008

Web References:

1. https://www.circuitlab.com

COMPLEX AND FOURIER ANALYSIS

II Year B. Tech. I Semester
[ECE]

L	T	P	C
3	0	0	3

Course Code: 24BM11RC04

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Evaluate the integral along the given path using Cauchy's theorem and Cauchy's integral formula [L5].

CO2: Expand a given complex function in Taylor's & Laurent's series in the given region. **Evaluate** certain integrals using Cauchy residue theorem [L5].

CO3: Utilize Euler's formula to find the Fourier Expansion of a periodic function. [L3]

CO4: Determine Fourier transforms, Fourier Sine, Cosine transforms for a given function [L5].

CO5: Apply Fourier series to **evaluate** One-dimensional wave equation, One-dimensional heat equation and Laplace equation. [L5].

UNIT – I **10 LECTURES**

FUNCTIONS OF A COMPLEX VARIABLE AND COMPLEX INTEGRATION: Introduction-Continuity -Differentiability-Analyticity- Cauchy-Reimann Equations in Cartesian and polar coordinates - Analytic Functions- Harmonic and Conjugate functions- Milne-Thompson Method-Applications to flow problems-Integration of complex functions- Cauchy's theorem (without proof) - Cauchy's integral formula and problems on above theorems.
(Sections: 20.1-20.6, 20.12-20.14 of Textbook)

UNIT – II **10 LECTURES**

SERIES EXPANSIONS AND RESIDUE THEOREM: Taylor's, Maclaurin's and Laurent's series (without proofs)-Zero's and Singularities – Types of Singularities - Residues and Calculations of residues -Cauchy's Residue Theorem (without proof)-Evaluation of real definite Integrals of the types $\int_{-\infty}^{\infty} f(x)dx$ and $\int_{0}^{2\pi} f(cos\theta, sin\theta)d\theta$. (without having poles on real axis) (Sections: 20.16-20.20 of Text Book)

UNIT -III **10 LECTURES**

FOURIER SERIES: Introduction – Periodic functions - Euler's Formulae – Dirichlet Conditions for a Fourier Expansion - Functions having points of discontinuity - Expansions of Odd or Even Periodic Functions - Half-Range Series - Parseval's Formula (Sections: 10.1-10.7, 10.9 of Textbook).

UNIT -IV **08 LECTURES**

FOURIER TRANSFORMS : Introduction- Fourier integrals- Sine and Cosine integrals- Complex form of Fourier integral- Fourier transform-Fourier Sine and Cosine transforms- – Finite Fourier Sine and Cosine Transforms - Properties of Fourier Transforms - Convolution theorem- Parseval's identity for Fourier transforms.

(Sections: 22.1-22.7 of Textbook).

UNIT -V **10 LECTURES**

APPLICATIONS OF FOURIER SERIES: Introduction to Partial Differential Equations – Method of Separation of Variables – One dimensional Wave Equation – One Dimensional Heat Equation – Laplace Equation (Cartesian Form only).

(Sections:18.1 - 18.7 of Textbook).

TEXT BOOKS:

1. **B. S. Grewal**, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2024.

REFERENCE BOOKS:

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, 2011.
2. **N.P. Bali and Dr. Manish Goyal**, A Text book of Engineering Mathematics, 9th Edition, Lakshmi Publications.
3. **R K Jain and SRK Iyengar**, Advanced Engineering Mathematics, Narosa Publishers, 5th Edition, 2016.
4. **J. W. Brown and R. V. Churchill**, Complex Variables and Applications, 9th edition, Mc-Graw Hill, 2013.

DATA STRUCTURES

II Year B. Tech. I Semester

[Common to CSE, CSE (AI&ML), IT, ECE]

L	T	P	C
3	0	0	3

Course Code: 24CT11RC09

Course Outcomes: At the end of the Course, the student shall be able to

CO1: **Outline** the concept of ADT, **identify** suitable data structures to solve problems, and experiment with different searching & sorting techniques using arrays. (L2,L3)

CO2: **Develop** and **analyse** algorithms for stacks, queues, and priority queues. (L3,L4)

CO3: **Model** linked list representations for various applications. (L3)

CO4: **Develop** and **analyse** algorithms for Binary Trees and Binary Search Trees. (L3,L4)

CO5: **Summarize** the concepts of Graph representation, graph traversals and hashing. (L2)

UNIT-I **10 Lectures**

Data Structures: Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Introduction to array ADT.

Searching: Linear search, Binary search.

Sorting: Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort)

UNIT-II **10 Lectures**

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Applications-Infix to Postfix Conversion, Evaluating Postfix Expressions.

Queues: Introduction to Queues, Representation of Queues-using Arrays, Implementation of Queues-using Arrays, Circular Queues.

Priority Queue: model, simple implementation, Binary Heap-structure property, heap order property, heap operations, Heap sort.

UNIT-III **12 Lectures**

Linked List: Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal, Reversing Single Linked list, Double Linked list, Circular Linked list.

Applications on Single Linked list: Stacks and queues using linked list, Polynomial Expression Representation, Sparse Matrix Representation using Linked List

UNIT-IV **10 Lectures**

Introduction: Terminology, Representation of trees

Binary Trees: The ADT, Properties of binary trees, Binary tree Representations, Binary tree Traversals: in order traversal, preorder traversal, post order traversal

Binary Search Trees: Definition, Searching a BST, Insertion into a BST, Deletion from a BST

Efficient Binary Search Tree: AVL Trees.

UNIT-V **8 Lectures**

Graphs: Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Hashing-Introduction, static hashing, hashing functions, overflow handling techniques.

Text Books:

1. Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahin, Universities Press.
2. Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss.

Reference Books:

1. Data Structures Using C. 2nd Edition, ReemaThareja, Oxford.
2. Data Structures: A PseudoCode Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon, Cengage.

Web References (e-Resources):

1. https://onlinecourses.swayam2.ac.in/cec25_ma15/preview.

LINEAR ICs & APPLICATIONS

II Year B. Tech. I semester

[ECE]

Course Code: 24EC11RC09

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline basic operation and performance parameters of OP-AMPs.

CO2: Construct different linear and non-linear circuits using OP-AMPs

CO3: Design signal conditioning circuits and active filters using OP-AMPs

CO4: Construct different types of DAC's and ADC's using OP-AMP

CO5: Develop applications by making use of different analog ICs.

UNIT-I **10 Lectures**

Integrated Circuits: Classification, Chip size and circuit complexity, Monolithic IC Technology fundamentals

Operational Amplifiers: Introduction to Op-Amp IC 741, Ideal Op-Amp and its Characteristics, Practical OP-Amp Characteristics: DC and AC Characteristics, Frequency Compensation Techniques, Measurement of Op-Amp Parameters.

UNIT-II **11 Lectures**

Applications of Op-Amps: Basic Op-Amp Applications, Instrumentation Amplifiers, Inverting and Non-inverting Amplifiers, Voltage to Current and Current to Voltage Converters, Integrator, Differentiator, Log and Antilog Amplifiers, Phase Shift and Wein-bridge Oscillators.

UNIT-III **11 Lectures**

Signal Conditioning Circuits: Rectifiers, Comparator, Schmitt trigger, Wave form Generators, Multivibrators, Square Wave Generators.

Active Filters: Low Pass, High Pass, Narrow Band Pass, Wide Band Pass, Narrow Band Reject, Wide Band Reject, All-pass Filters

UNIT-IV **07 Lectures**

Digital to Analog and Analog to Digital Converters: DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs-parallel Comparator type ADC, Counter type ADC, Successive approximation ADC and dual type ADC, DAC and ADC specifications

UNIT-V **09 Lectures**

Special ICs: IC 555 Timer and its Applications as Monostable, Astable and Schmitt Trigger, IC 566 Voltage Controlled Oscillator, IC 565 PLL and its Applications, Three Terminal IC Regulators

Text Books:

1. OP-AMPs and Linear Integrated Circuits- Ramakant A. Gayakwad, Revised 4th Edition, Pearson Education, 2021.
2. Linear Integrated Circuits- D. Roy Chowdhury, New Age International(P) Ltd, 6th Edition, 2021
3. Design with Operational Amplifiers and Analog Integrated Circuits- Sergio Franco, 4th Edition, Tata Mc Graw-Hill, 2016

Reference Books:

1. Integrated Circuits- Botkar, Khanna Publications, Edition 2008.
2. Applications of Linear ICs- Clayton, Publisher: Macmillan Education UK, Year: 1978.
3. Linear Integrated Circuits- S.Salivahanan & V.S. Kanchana Bhaskaran, McGrawHill Education, 3rd Edition, 2018.
4. Operational Amplifiers & Linear Integrated Circuits: Theory and Application / 3E - James M. Fiore Version 3.2.6, 2021.

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ee73/preview
2. https://onlinecourses.nptel.ac.in/noc25_ee44/preview
3. https://www.udemy.com/course/opamp-and-linear-integrated-circuits/?srsltid=AfmBOor3RzOyodkPt4JoYJ-3sHurbwa14xegQxkIP8CUIoQ5amBi_imy

PULSE AND DIGITAL CIRCUITS

II Year B. Tech. I semester

[ECE]

Course Code: 24EC11RC10

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Analyze the response of linear waveshaping circuits to different non sinusoidal inputs.

CO2: Extend the applications of diodes and transistors to non-linear waveshaping circuits.

CO3: Construct and Analyze the Bistable Multivibrators using BJTs.

CO4: Construct and analyze Monostable and Astable Multivibrators using BJTs.

CO5: Explain the working of different time-base generators and implement logic gates using various logic families.

UNIT-I **12 Lectures**

Linear Waveshaping: High pass and Low pass RC circuits, Response of High pass and Low pass RC circuits to sinusoidal, step, pulse, square, exponential and Ramp inputs, High pass RC circuit as a differentiator, Low pass RC circuit as an integrator. Attenuators and its application as CRO probe, RL and RLC Circuits and their response for step input.

UNIT-II **10 Lectures**

Nonlinear Waveshaping: Diode clippers, Transistor Clippers, clipping at two independent levels, Comparator, Applications of voltage Comparators, Diode Comparator, Clamping Operation, Clamping Circuits using Diode with Different Inputs, Clamping Circuit Theorem.

UNIT-III **08 Lectures**

Bistable Multivibrators-I: Transistor as a switch, switching times of a transistor, Design and Analysis of Fixed-bias and self-bias transistor binary.

Bistable Multivibrators-II: Commutating capacitors, Triggering schemes of Binary, Transistor Schmitt trigger and its applications.

UNIT-IV **08 Lectures**

Monostable and Astable Multivibrators: Design and analysis of Collector coupled Monostable Multivibrator, Expression for the gate width and its waveforms. Design and analysis of Collector coupled

Astable Multivibrator, expression for the Time period and its waveforms, The Astable Multivibrator as a voltage to frequency converter.

UNIT-V **10 Lectures**

Time Base Generators: General features of a time-base signal, Methods of Generating time base waveform, Exponential voltage sweep circuit, Basic principles of Miller and Bootstrap time base generators, transistor Miller sweep generator, transistor Bootstrap sweep generator, Current Sweep circuit.
Logic Gates: Realization of gates using diodes and Transistors, RTL, DTL.

Text Books:

1. Pulse Digital and Switching Waveforms, J. Millman and H. Taub, McGraw-Hill, 2nd Edition 2017.

Reference Books:

1. Pulse and Digital Circuits, K. VenkatRao, Pearson Education India, 2nd Edition, 2010.
2. Pulse and Digital Circuits, A. Anand Kumar, PHI, second edition, 2005.

Web References:

1. https://www.youtube.com/watch?v=aO6tA1z933k

SIGNALS & SYSTEMS

II Year B. Tech. I semester

[ECE]

L	T	P	C
3	0	0	3

Course Code: 24EC11RC11

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand basic Signals and Systems including their properties and classifications.

CO2: Apply Fourier Series and Fourier Transform to analyze Continuous and Discrete Time signals.

CO3: Explain the techniques of convolution and correlation for signal processing.

CO4: Apply Laplace Transform for analysing and characterizing Linear Time-Invariant (LTI) systems.

CO5: Identify appropriate sampling rate to support signal reconstruction, and Make Use of Z-Transforms for discrete system analysis.

UNIT-I **10 Lectures**

Introduction to signals and systems: Basic signals, elementary signals in continuous and discrete domain, classification of signals, useful signal operations, discrete signal models, discrete signal operations, classification of systems, basic system properties, unit impulse response of a system, system response to external input, system stability.

UNIT-II **10 Lectures**

Frequency analysis of continuous and Discrete time signals: Fourier Series Representation of continuous time Periodic Signals, convergence of the Fourier Series, exponential Fourier series, power density spectrum of periodic signals, Discrete time Fourier series(DTFS), power density spectrum of discrete periodic signals, Representation of aperiodic signals, Fourier Transform, transform of some useful functions, Fourier Transform for periodic signals, theorems and properties of Fourier transforms. Discrete time Fourier transform (DTFT), Convergence of DTFT, DTFT theorems and properties.

UNIT-III **08 Lectures**

Convolution: Concept of convolution, Properties of convolution, Convolution theorems, Graphical procedure to perform convolution,

Correlation of signals: Concept of correlation-signal comparison, Cross correlation and its properties, Autocorrelation and its properties, relation between convolution and correlation.

UNIT-IV **10 Lectures**

Laplace Transform: Introduction, The Laplace Transform, the region of convergence for Laplace Transforms, Properties of Laplace Transforms, the initial and final value theorems, commonly used Laplace Transform pairs, The Inverse Laplace Transform, Analysis and characterization of LTI systems using the Laplace Transforms.

UNIT-V **10 Lectures**

Sampling Theorem and Z-transform: sampling theorem, reconstruction of a signal from its samples using interpolation, The effect of Under sampling, aliasing, unilateral and bilateral Z-Transforms, Properties of Z-Transform, relationship of the Fourier transform to the Z-transform, Inverse Z-Transform Methods, the initial and final value theorems, some common Z-transform pairs, causality and stability, Analysis and characterization of LTI systems using the Z-Transforms.

Text Books:

1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, Signals and Systems, PHI, 2ndEdn,1996.
2. B. P. Lathi, Signal Processing and Linear Systems, Berkeley Cambridge Press, 1998.
3. A. Anand Kumar, Signals and Systems, PHI, Third Edition, 2013.

Reference Books:

1. K. Raja Rajeswari and B. V. Rao, Signals and Systems, Prentice Hall India Learning Private Limited, Second edition, 2013.
2. P. Ramesh Babu and R. Ananda Natarajan, Signals and Systems, Scitech , Chennai,3rdEdn, 2009.

Web References:

1. https://youtube.com/playlist?list=PLyqSpQzTE6M8KJXQ1m2vl3nd2ZUqKEN8&si=NpJ6Dmx6cxGgChXt

DATA STRUCTURES LAB

II Year B. Tech. I semester

[Common to CSE, CSE (AI&ML), IT, ECE]

Course Code: 24CT11RC14

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Apply different Searching and Sorting Techniques using arrays. (L3)

CO2: Experiment with different linear data structure concepts using stacks and Queues. (L3)

CO3: Develop linear data structure models using various Linked lists. (L3)

CO4: Build Binary Search Tree & AVL tree and examine their traversals. (L3)

CO5: Apply DFS and BFS graph traversal techniques. (L3)

Implement the following programs with either C/C++/JAVA/Python

Module-1: Searching

1. Write a program that use non recursive functions to perform linear search for a Key value in a given list.
2. Write a program that use non recursive functions to perform Binary search for a Key value in a given list.

Module-2: Sorting

1. Write a program that implement Bubble sort, to sort a given list of integers in ascending order.
2. Write a program that implement Selection sort, to sort a given list of integers in ascending order.
3. Write a program that implement Insertion sort, to sort a given list of integers in ascending order.

Module-3: Efficient Sorting

1. Write a program that implement Quick sort, to sort a given list of integers in ascending order.

Module-4: Stack & Queue

1. Write a program that implement stack (its operations) using arrays.
2. Write a program that implement Queue (its operations) using arrays.

Module-5: Singly Linked List

1. Write a program that uses functions to create and perform operations on singly linked list.

Module-6: Double Linked List

1. Write a program that uses functions to create and perform operations on double linked list.

Module-7: Circular Linked List

1. Write a program that uses functions to create and perform operations on circular linked list.

Module-8: Binary Search Trees

1. Write a program to Create a Binary Search Tree and Perform insertion and deletion operations.

Module 9: AVL tree

1. Write a program to Build an AVL tree and perform insertions.

Module-10: Graphs

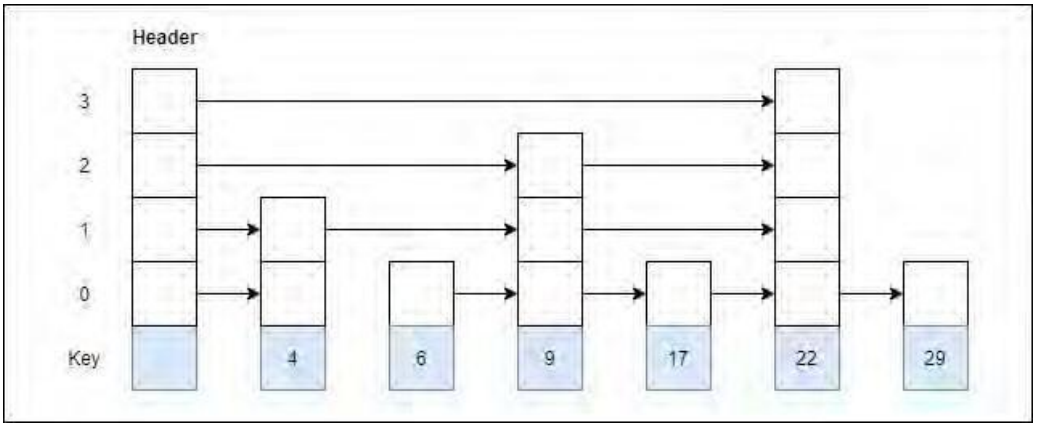
1. Write a program to implement Depth First Search
2. Write a program to implement Breadth First Search

Case Study: Select any five practical applications mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes requirements, design, coding, and output with testing results of a real example.

1. Demonstrate to convert an infix expression into a postfix expression and evaluate to find the result.
2. Demonstrate to convert an infix expression into a prefix expression
3. Demonstrate a queue using Linked List and Stack.
4. Demonstrate a sparse matrix using array and linked list
5. Create a skip list, to insert these following keys in the empty skip list.
    a. 6 with level 1.
    b. 29 with level 1.
    c. 22 with level 4.
    d. 9 with level 3.
    e. 17 with level 1.
    f. 4 with level 2.

Implement all basic operations of skip list and demonstrate with examples. Skip list structure is shown below for reference.



6. Given an array representation of min Heap, convert it to max Heap and then apply Heapsort concept to display the data in decreasing order.

Input: arr[ ] = {3, 5, 9, 6, 8, 20, 10, 12, 18, 9}

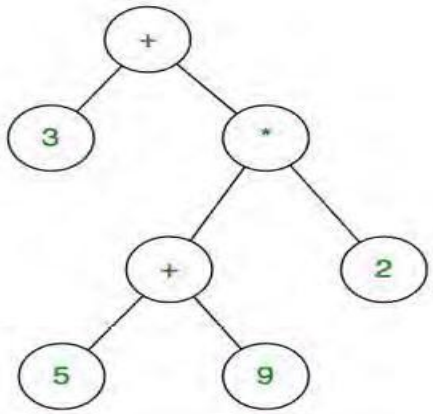
7. Make use of Radix sort algorithm to sort an array by individual digits, starting with the least significant digit.

8. Model a linked list data structure to add two polynomials.

9. Design a system to manage employee records {empID, empname, dept, salary}, and implement efficient basic operations based on employee ID.

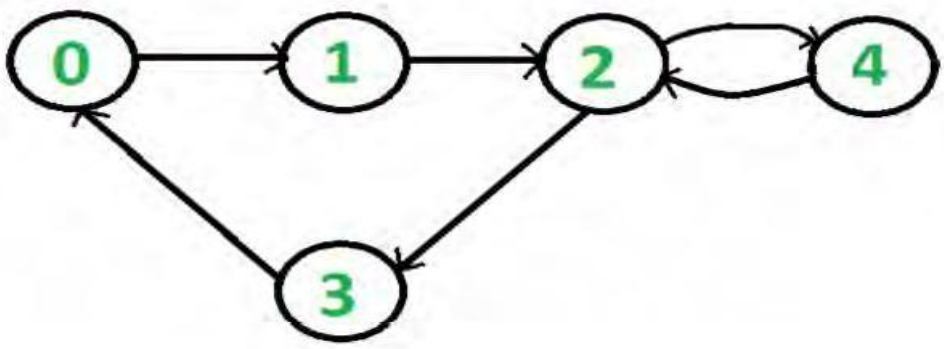
10. Construct an expression tree i.e. a binary tree in which each internal node corresponds to the operator and each leaf node corresponds to the operand.

For example: expression tree for 3 + ((5+9)*2) would be: Demonstrate with required operations to convert this above expression into corresponding prefix, and postfix expressions and evaluate the result of the expression.



11. Demonstrate topological sorting for a Directed Acyclic Graph (DAG) is a linear ordering of vertices such that for every directed edge u-v, vertex u comes before v in the increasing order a vertex with no. of incoming edges.

12. Given a directed graph, check whether the graph contains a cycle or not. Your function should return true if the given graph contains at least one cycle, else return false. For example, the following graph contains two cycles 0->1->2->3->0 and 2->4->2. Demonstrate with required operations to display the results in the form of true and the cyclic path if any. Make use of BFA concept to solve this problem.



13. Find the frequency of each character in a string using Hashing Data Structure

LINEAR ICs & PULSE CIRCUITS LAB

II Year B. Tech. I semester
[ECE]

L	T	P	C
0	0	3	1.5

Course Code: 24EC11RC12

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Analyze the working of linear and non-linear wave shaping circuits.

CO2: Develop multivibrators and oscillators using Transistors

CO3: Design various linear and non-linear applications using IC741 op-amp

CO4: Design waveform generators and data converters using IC741 op-amp

CO5: Design various applications using IC555 timer

List of the Experiments

Pulse and Digital Circuits

1) Linear Wave Shaping
   a) High Pass RC Circuit
   b) Low Pass RC Circuit
2) Non- Linear Wave Shaping -- Clippers
3) Non- Linear Wave Shaping -- Clampers
4) Bistable Multivibrator using BJT
5) UJT Relaxation Oscillator

Linear Integrated Circuits

6) Adder, Subtractor and Comparator using IC741 Op-Amp
7) Integrator and Differentiator using IC741 Op-Amp
8) Notch filter using IC741 Op-Amp
9) Function Generator using IC741 Op-Amp
10) 4-bit DAC using IC741 Op-Amp
11) Astable and Monostable Multivibrator using IC555 Timer
12) Schmitt Trigger using IC555 Timer

Virtual Lab References:

1. https://ade2-iitr.vlabs.ac.in/
2. https://ae-iitr.vlabs.ac.in/
3. https://aec-iitkgp.vlabs.ac.in/

SIGNALS & SYSTEMS LAB

II Year B. Tech. I semester
[ECE]

Course Code: 24EC11RC13

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Make use of MATLAB software for developing and debugging programs based on arrays and matrices.

CO2: Model various Signals and Sequences and perform operations on them, using MATLAB.

CO3: Verify various properties of a system and obtain the system response, using MATLAB.

CO4: Analyze the frequency domain representation of signals, using MATLAB.

CO5: Analyze sampling theorem and pole-zero maps in Z plane, using MATLAB.

List of the Experiments

1. Basic Operations on Matrices.
2. Write a program for Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp and sinc functions.
3. Write a program to perform operations like addition, multiplication, scaling, shifting, and folding on signals and sequences and computation of energy and average power.
4. Write a program for finding the even and odd parts of the signal / sequence and real and imaginary parts of the signal.
5. Write a program to perform convolution between signals.
6. Write a program to perform autocorrelation and cross correlation between signals.
7. Write a program for verification of linearity and time invariance properties of a given continuous/discrete system.
8. Write a program for computation of unit samples, unit step and sinusoidal response of the given LTI system.
9. Write a program to find trigonometric and exponential Fourier series coefficients of a rectangular periodic signal.
10. Write a program to find the Fourier transform of a given signal and plotting its magnitude and Phase spectrum.
11. Write a program for Sampling theorem and its verification.

12. (a)Write a program for locating the zeros and poles and plotting the pole-zero maps in S plane for the given transfer function.

    (b) Write a program for locating the zeros and poles and plotting the pole-zero maps in Z plane for the given transfer function.

PYTHON PROGRAMMING

II Year B. Tech. I semester

[Skill Course: ECE]

Course Code: 24EC11SC01

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand core programming basics and various Operators of Python.

CO2: Implement programs using conditional statements and loops and strings.

CO3: Develop functions and strings to perform simple tasks.

CO4: Make use of various data structures like lists, tuples, sets and dictionaries.

CO5: Implement Python programs with files, Classes and objects.

List of Experiments

Introduction to Python:

Identifiers and Keywords, Strings, Comparing Strings, Slicing and Striding Strings, String Operators and Methods, Tuples, Lists, Sets, dictionaries, Iterating and copying collections

Python Control Structures and Functions:

Conditional Branching, Looping, Exception Handling, Custom Functions

Python Library Modules: random, math, os, shutil, sys, creating a custom module

Module-1: Basics of Python

1. Write a program to display the statements.
2. Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types)
3. Write a Python program to demonstrate various type conversion functions.

Module-2: Operators in Python

1. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators
   iii) Assignment Operators iv) Logical Operators

v) Bit wise Operators vi) Ternary Operator

vii) Membership Operators viii) Identity Operators

Module-3: Conditional Branching & Looping/Iterative Statements

1. Write a program to check whether the given number is even or odd
2. Write a program to read marks of a student and display the corresponding grade
3. Write a program to find the largest element among the given numbers (multi-way if-elif-else statements.)
4. Implement the following programs using while loop and for loop

   i. Display all prime numbers up to n. ii. Print the nth multiplication table.

5. Demonstrate the following control transfer statements in Python with suitable examples.

   i. break ii. continue iii. Pass

Module-4: Strings

1. Write a program to manage and analyse customer feedback using string operations include:

   i. Create feedback with name, email, comment ii. Collecting feedback.

   iii. Normalizing feedback (e.g., removing extra spaces, converting to lowercase).

   iv. Extracting key in formation (e.g., names, email addresses, and comments).

   v. Searching for keywords. vi. Replacing certain words.

Module-5: Lists:

1. Write a program to create a list and perform the following operations:

   i. + ii. * iii. slicing iv. del

2. Inventory Management: You have a list of items in your warehouse along with their quantities. Write a program to find out which items are low in stock (quantity less than 10). (use only comprehensions)
3. Write a program to calculate the length of each element in a list using map function in python.

Module-6: Tuples

1. Write a program to return the top n's most frequently occurring chars and their respective counts. e.g. string=aaaaaabbbbcccc, n=2 should return [(a 6) (b 4)].
2. Write a program to create n iterables of varied sizes and group the values using zip function in python.
3. Student Information: Write a program to create a list of tuples where each tuple contains the student ID, name, and grade and find the student with the highest grade.

Module-7: Sets & Dictionaries

1. Write a program to create two sets and perform the following operations:

   i. Union ii. Intersection iii. Difference iv. Asymmetric Difference

2. Write a program to implement a shopping cart where you can add items with their prices and quantities, and then calculate the total cost.
3. Banking System: Write a program to create dictionary with customer name and balance and retrieve the balance for a given customer, deposit a specified amount into a customer's account, withdraw a specified amount from a customer's account if sufficient balance is available, transfer a specified amount from one customer's account to another's and remove a customer from the bank's system.

Module-8: Functions

1. Write a function to find the multiplication of two numbers and demonstrate the usage of parameters and arguments of a function.
2. Write a program to define a function using default arguments.
3. Demonstrate lambda functions in Python with suitable example programs.
4. Write a Python program that asks the user to input two numbers and divides the first number by the second. Your program should handle the following exceptions:

   - **ValueError**: if the user enters something that is not a number.
   - **ZeroDivisionError**: if the second number entered is zero.
   - Use a finally block to print "Program execution completed."

Module-9: Python Library

1. Write a Python program to generate and print a random number between 1 and 100.
2. Write a Python program to calculate and print the square root of a number, for example, 64.
3. Write a Python program to display the sine and cosine values of 45 degrees, and also print the value of π using the math module.
4. Write a Python program to list all the files and folders in the current working directory.
5. Write a Python program to create a new folder called test_folder. If it already exists, display a message saying the folder already exists.
6. Write a Python program to copy a file named source.txt to a new file called destination.txt.
7. Write a Python program to move a file named file_to_move.txt into a folder named new_folder.
8. Write a Python program to print the current Python version and the system path list using the sys module.

Module-10: Classes and objects

1. Create a class to represent menu items in a restaurant with attributes like name, price, and category. Implement methods to display menu details and calculate the total cost of a selected list of items.
2. Write a program to read 3 subject marks and display pass or failed using class and object.

Case Study:

Note: A report has to be submitted by every student at the end of the semester by choosing any one of the following case studies:

1. Student Management System

Build a program to add, view, update, and delete student records, calculate grades, search by name/ID, handle input errors, and save/load data using files.

2. Inventory and Billing System

Create an inventory manager to add products, check low stock, generate bills, calculate totals, and store bills using classes and file handling.

3. Feedback Analyzer

Design a tool to collect and clean customer feedback, search and replace keywords, count word/character frequency, and manage data through files.

4. Simple Banking System

Develop an application to create and manage accounts, handle deposits, withdrawals, transfers, and balance checks with proper validation and file support.

5. Daily Expense Tracker

A basic program where users can input daily expenses, view summaries by category, calculate totals, and store data in files for future use.

6. Contact Book

Create a contact manager to add, view, search, and delete contacts using names, phone numbers, and emails, with data stored in dictionaries and files.

7. To-Do List App

A simple application to manage tasks—add, mark as done, delete, and view tasks using lists and string operations, with optional save/load functionality.

8. Simple Calculator

Build a basic calculator that performs arithmetic operations, handles invalid inputs using exception handling, and provides a clean menu-driven interface.

9. Grade Calculator

Create a program that takes marks for multiple subjects, calculates total and average, determines grade using conditions, and supports multiple student entries.

10. Simple Password Generator

An application that generates strong random passwords based on user input for length and character types (letters, numbers, symbols), using built-in modules and string handling.

Reference Books:

1. Learning Python, 5th Edition, Mark Lutz, Orielly Publications

Web References:

1. https://archive.nptel.ac.in/courses/106/106/106106212/

PROFESSIONAL ETHICS AND HUMAN VALUES

II Year B. Tech. I
Semester
[Common to CSE(AI&ML), ECE, EEE]

L	T	P	C
2	0	0	0

Course Code: 24HM11MC01

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Make use of the human values, morals and ethical principles that ought to govern the engineering profession [L3]

CO2: Relate the importance of human values and professional/engineering ethics at work. [L1]

CO3: Cultivate the moral values and dispositions that engineers ought to instill and tackle ethical challenges and moral dilemmas in engineering by utilizing ethical theories and moral development concepts. [L3]

CO4: Outline the knowledge of risk assessment techniques, rights and maintain good Collegiality and loyalty to prevent occupational crime [L2].

CO5: Identify global issues and use ethical principles to navigate professional challenges [L3].

Unit - I **06 Lectures**

HUMAN VALUES: Values - Respect - Caring - Sharing - Honesty- Courage - Self-confidence-Self exploration- Self-awareness –Intentional competency - Communal Harmony-character- Spirituality.

Unit-II **06 Lectures**

PROFESSIONAL VALUES: Integrity - Discipline - Valuing time - Cooperation - Commitment - Empathy- Code of conduct - Challenges in the workplace.

Unit - III **06 Lectures**

PROFESSIONAL ETHICS: Overview - Engineering ethics –Theories of moral developments- Kohlberg Theory- Gilligan theory- Heinz dilemma.
Moral issues - Profession - Models of professional roles – Responsibility.

Unit - IV **06 Lectures**

RESPONSIBILITIES AND RIGHTS: Safety and risk - Collegiality and loyalty - Confidentiality - Occupational crime – Human rights - Employee rights - Intellectual property rights.

Unit - V **06 Lectures**

GLOBAL ISSUES: Globalization - Environmental ethics - Computer ethics - Code of ethics - Multinational corporations - Engineers as advisors in Planning and Policy making.

Text Books:

1. R.S. Nagarajan. A Textbook on Professional Ethics and Human Values. New Age International Publishers. 2006.
2. R. Subramanian. Professional Ethics. OUPIndia.2013.

Reference Books:

1. Premvir Kapoor. Professional Ethics and Human Values. Khanna Publishing House.2019.
2. B.S. Raghavan. Human Value and Professional Ethics. S. Chand Publications. 2012.
3. R.R. Gaur & Others. A Foundation Course in Human Values and Prof. Ethics. Excel Books. 2009.
4. A.N. Tripathi. Human Values. New Age International (P) Limited.2009

MANAGERIAL ECONOMICS

II Year B. Tech. II semester

[Common to CSE, ECE, IT, EEE]

Course Code: 24HM11RC01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand principles and concepts of managerial economics (L2)

CO2: Analyse concepts of demand and utility (L4)

CO3: Identify and recognize the production function and cost analysis (L3)

CO4: Classify the knowledge on market structures and pricing (L4)

CO5: Examine various business cycles (L4)

UNIT-I **08 Lectures**

Significance of Economics and Managerial Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions; Classification of Economics- Micro and Micro Economics. Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

UNIT-II **12 Lectures**

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand, Assumptions and limitations. Exceptional demand curve; Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand. Demand forecasting methods and its uses. Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

UNIT-III **10 Lectures**

Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making-CVP Analysis- Calculations (Simple problems) and Limitations.

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs.

Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs; Economies and Diseconomies of scale.

UNIT-IV **10 Lectures**

Market Structures and Pricing : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly, Oligopoly, Importance of kinked demand curve; Monopolistic Competition. Pricing Analysis: Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing, Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers.

UNIT-V **08 Lectures**

Business Cycles: Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles; Inflation and Deflation.

Textbooks:

1. Arya Sri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

2. Sankaran, S., Managerial Economics, Marghan Publications, 2015, Chennai.

3. J.V. Prabhakara Rao & P. Venkata Rao, Managerial Economics and Financial Analysis, Maruthi Publications

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House pvt. Ltd. 6th Edition, New Delhi,2004.

2. Dewett, K.K., Modern Economic Theory, S. Chand & Company Ltd., New Delhi, 2005.

3. Dr.B. Kuberudu & T.V. Ramana: Managerial Economics and Financial Analysis, Himalaya Publishing House

PROBABILITY THEORY AND RANDOM PROCESS

II Year B. Tech. II Semester

[ECE]

L	T	P	C
3	0	0	3

Course Code: 24EC11RC16

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Identify different types of random variables and compute statistical averages of them using probability density and distribution functions.

CO2: Make use of the concepts of single random variable to study the case of Multiple Random Variables.

CO3: Analyse the behaviour of multiple random variables by computing the moments before and after transformation.

CO4: Examine the behaviour of a random process by determining the stationarity, ergodicity and by computing the correlation and covariance of it.

CO5: Apply the concepts of random processes to analyse the behaviour of LTI systems in the presence of different types of noise.

UNIT-I **10 Lectures**

Fundamentals of Probability Theory: Mathematical model of experiments, Joint and conditional probability, Properties of joint probability and conditional probability, Total probability, Bayes' theorem, independent events, properties of independent events.

Random Variables and Operations on one random variable: Random variable concept, Distribution function, Density function, Gaussian random variable, Conditional distribution and density function, Expectation, Moments, Functions that give moment, Transformations of a random variable.

UNIT-II **10 Lectures**

Multiple random variables: Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density, statistical independence, Distribution and density of a sum of random variables, Central limit theorem.

UNIT-III **08 Lectures**

Operations on multiple random variables: Expected values of a function of random variables: Joint moments about the Origin, joint central moments, Joint characteristic functions,

Jointly Gaussian random variables: Two random variables, n-random variables, properties of Gaussian random variables, Transformations of multiple random variables: One function, Multiple functions, Inequalities of Chebyshev and Schwartz.

UNIT-IV **10 Lectures**

Random Processes: 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 Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, MeanErgodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Function and their properties, Weiner-Kin chine Theorem ,Gaussian Random Processes, Poisson Random Process.

UNIT-V **10 Lectures**

Linear Systems with Random Inputs: System Response – Convolution, Mean and Mean squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band-Limited and Narrowband Processes.

Text Books:

1. Peyton Z. Peebles, Probability Theory and Random Signal Principles, , Tata McGrew Hill Publishers, 4th edition 2002.
2. S. P. Eugene Xavier, Probability Theory and Random Processes, S. Chand and Co. New Delhi, 2nd Edition, 1998.

Reference Books:

1. Oliver Crib, Fundamentals of Applied Probability and Radom processes, Elsevier Publications, 2007.
2. Athanasios Papoulis and S. Unnikrishna Pillai, Probability, Random Variables and Stochastic Processes, PHI, 4th Edition, 2002.
3. B. PrabhakaraRao, T.S.R. Murthy, Probability theory and Stochastic Processes, BS Publications, Hyderabad, 2012.

Web References:

1. https://nptel.ac.in/courses/111102111

DIGITAL SYSTEM DESIGN

II Year B. Tech. II Semester

[ECE]

Course Code: 24EC11RC17

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand the concepts of verification methodologies and data types

CO2: Build Verilog Modules using Interfaces & packages

CO3: Make use of Procedural assignments & Functions for developing digital applications

CO4: Develop Finite state machines using system Verilog primitives

CO5: Analyze the behaviour of digital Modules using Verification and Understand the basics about Randomization and assertion statements

UNIT-I **10 Lectures**

Introduction to System Verilog: Concepts of top-down design, Overview of RTL models, Overview of gate/switch models, The RTL design flow with simulation and synthesis, writing verification testbenches in Verilog, running your preferred Verilog simulator, Debugging designs with simulation. Identifier names, Logic values and numbers, Data types and 2-state vs. 4-state guidelines for Verilog, Enumerated types, User-defined types, Casting (Static and Dynamic). Structure and unions declarations and their element access. Dynamic arrays, Associative arrays, Queues and Strings

UNIT-II **08 Lectures**

System Verilog Interfaces, Packages and Compound types: Using interfaces to simplify inter-module connections, Mod-ports in Interface, Transforming Verilog code into System Verilog using package, interface mod-port, Interfaces as an RTL modelling construct, Package declaration, Element access in package. System Verilog testbench using basic constructs, Program and Final block.

UNIT-III **12 Lectures**

System Verilog Procedural blocks and Assignments: Procedural blocks, System Verilog enhanced procedural blocks, Blocking and non-blocking assignments, Continuous assignments, Programming statements – if else, case, caseX, caseZ, unique if, priority if, unique case, priority case. Operators and language rules, Loops: forever, foreach, repeat, while do while and for loop.

Tasks & Functions: Implicit task and function statement grouping, Returning function values, Returning before the end of tasks and functions, Void functions, Passing task/function arguments by name, Enhanced function formal arguments, Functions with no formal arguments, Default formal argument direction and type, Default formal argument values, Arrays, structures and unions as formal arguments, Passing argument values by reference instead of copy, Named task and function ends, Empty tasks and functions.

UNIT-IV **08 Lectures**

Modeling Finite State Machines with System Verilog: Modelling state machines with enumerated types, Representing state encoding with enumerated types, Reversed case statements with enumerated types, Enumerated types and unique case statements, Specifying unused state values, Assigning state values to enumerated type variables, Performing operations on enumerated type variables, Using 2-state types in FSM models, Resetting FSMs with 2-state and enumerated types.

UNIT-V **10 Lectures**

Testbench using System Verilog: Introduction to System Verilog for Verification, Test-bench Architecture and Components, System Verilog Data Types and Constructs, Procedural Blocks and Control Statements, Interface and Clock/Reset Generation, Stimulus Generation (Without Randomization), Self-Checking Test-bench, Writing a Complete System Verilog Testbench, Introduction to Advanced Test bench Features like Randomization, Coverage, and Assertions - Concept Only

Text Books:

1. Stuart Sutherland, Simon Davidmann and Peter Flake, "System Verilog for Design", 2nd Ed., Springer, 2006.

Reference Books:

1. Chris Spears, “System Verilog for Verification”, 3rd Edition, Springer, 2012.
2. Mark Zwolinski, “Digital System Design with SystemVerilog”,Prentice Hall modern Semiconductor Design Series,2009.
3. Language reference Manual

Web References:

1. https://www.youtube.com/watch?v=_5PJMHmSfgc&list=PL_3xKnVkfI2iqScXBAhWhKvBKRWH6UWX-
2. https://www.youtube.com/watch?v=y_hEbgWWuQs&list=PLF4DeZAfqGSar69xWgw5TpFuszBd1FSJJ

ELECTROMAGNETIC FIELD THEORY AND TRANSMISSION LINES

II Year B. Tech. II semester

[ECE]

L	T	P	C
3	0	0	3

Course Code: 24EC11RC18

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Apply coulomb's law and gauss law to compute electric field intensity at a given point.

CO2: Make use of the Biot-Savart Law and amperes law for magnetic field intensity computations.

CO3: Examine the boundary conditions for electric and magnetic fields at different interfaces with the knowledge acquired from Maxwells equations.

CO4: Analyse the EM wave propagation in different scenarios.

CO5: Utilize the fundamentals concepts of transmission lines to compute its parameters in different cases.

UNIT-I **10 Lectures**

Electrostatics: Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy density, Convection and Conduction Currents, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance.

UNIT-II **10 Lectures**

Magneto statics: Biota-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Inductances and Magnetic Energy.

UNIT-III **08 Lectures**

Maxwell's Equations: Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements.

Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces. Related Problems.

UNIT-IV **10 Lectures**

Electromagnetic Waves: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Polarization, 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, Surface Impedance. Poynting Vector and Poynting Theorem

UNIT-V **10 Lectures**

Transmission Lines: Introduction to Transmission line equations, Primary & Secondary constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Loss lessness /Low Loss Characterization, Distortion, Loading, SC and OC Lines, Reflection Coefficient, VSWR, λ/8, λ/4, λ/2-line impedance Transformations, Smith Chart – Configuration and Applications.

Text Books:

1. Gottapu Sasibhushana Rao, Electromagnetic Field Theory and Transmission Lines, Wiley India Pvt. Ltd., 1st edition, New Delhi, 2012.
2. Matthew N.O. Sadiku, Elements of Electromagnetics, Oxford Univ. Press, 4th ed., 2009.
3. Kraus and Flesch, Electromagnetics with Applications, McGraw Hill, 5th edition, 2017.
4. G.S.N. Raju, Electromagnetic Field Theory and Transmission Lines, Pearson Education , Pvt., Ltd., New Delhi, 2005.

Reference Books:

1. W. H. Hayt Jr., Engineering Electromagnetics, McGraw Hill – New York.
2. E. C. Jordan, EM Waves and Radiating Systems, PHI, 1997.

Web References:

1. https://nptel.ac.in/courses/108/104/108104087

MICROPROCESSORS AND MICROCONTROLLERS

II Year B. Tech. II semester

[ECE]

Course Code: 24EC11RC19

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Interpret the architecture, memory segmentation, and bus operations of the 8086 microprocessor.

CO2: Develop assembly language programs utilizing different addressing modes and instruction sets of 8086.

CO3: Interface 8086 with semiconductor memory, PIO 8255, interrupt controllers, and communication devices.

CO4: Outline the architecture, memory organization, and instruction set of the 8051 microcontroller.

CO5: Outline the features and architecture of Arduino UNO, Raspberry Pi, and ARM-based embedded systems.

UNIT-I **10 Lectures**

8086 Microprocessor: Register organization of 8086, Architecture, memory segmentation of 8086, signal description of 8086, physical memory organization, general bus operation, Minimum mode, maximum mode of 8086 system and timings, introduction to stack, stack structure of 8086, interrupts and interrupt cycle of 8086

UNIT-II **08 Lectures**

Programming With 8086 Microprocessors: addressing mode of 8086, instruction set 8086, assembler directives and operators, Basic Assembly language programs.

UNIT-III **10 Lectures**

Interfacing With 8086-I: Semiconductor memory interfacing-Static memory, PIO 8255 architecture, modes of operation of 8255.

Interfacing With 8086-II: Programmable interrupt controller 8259A, programmable communication interface 8251 USART, DMA Controller 8257.

UNIT-IV **10 Lectures**

8051 Microcontrollers: Introduction to microcontrollers, 8051Microcontrollers, 8051pin description, connections, I/O ports and memory organization, addressing modes and instruction set.

UNIT-V **10 Lectures**

Embedded Development boards: Features, Pin configuration and Architecture of Arduino UNO board, Architecture and features of ATMega 328, features, Pin configuration of Raspberry Pi, ARM architecture and organization.

Text Books:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 2017
2. ” Advanced Microprocessors and Peripherals”, A.K. Ray, K.M. Bhurchandi, Tata McGraw Hill Publications, 2000.
3. The 8051 Microcontroller & Embedded Systems Using Assembly and C by Kenneth J.Ayala, Dhananjay V.Gadre,Cengage Learning , 1st edition, 2010.

Reference Books:

1. The Intel Microprocessors-Architecture, Programming, and Interfacing by Barry B.Brey, Pearson, Eighth Edition-2012.
2. The 8051 Microcontroller and Embedded Systems by Mazidi, Mazidi, McKinlay, Pearson New International Edition, Second Edition, 2014.
3. ARM System Developer’s Guide: Designing and Optimizing System Software- Andrew N. Sloss, Dominic Symes, Chris Wright, Elsevier Inc., 2007
4. “The AVR Microcontroller and Embedded Systems: Using Assembly and C”, M.A. Mazidi, S. Naimi, S. Naimi, Prentice Hall, 2011.

Web References:

1. https://nptel.ac.in/courses/106105166

DIGITAL SYSTEM DESIGN LAB

II Year B. Tech. II semester
[ECE]

Course Code: 24EC11RC20

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand the concepts of verification methodologies and data types

CO2: Build Verilog Modules using Interfaces & packages

CO3: Make use of Procedural assignments & Functions for developing digital applications

CO4: Develop Finite state machines using system Verilog primitives

CO5: Analyze the behaviour of digital Modules using Verification and Understand the basics about Randomization and assertion statements

List of the Experiments

1) Verify the following operations using System Verilog
   a) Test all the 2-state and 4-state Data types.
   b) Declare different arrays, assign values and test different access methods using test-bench.
   c) Declare structure and union, assign different values to the elements of structure and union, access the variables of the elements of the structure and unions using test-bench.
   d) Declare a queue, assign values and test different access methods using test-bench.
2) Design and verify half adder and Full adder using always block and always_comb
3) Design a 1010, 1011, 1110, and 1111 overlapped finite sequence, use enumerated data type, user defined data type and verify using system Verilog test-bench
4) Transform a Verilog RTL code to System Verilog code using packages, user defined data types, interface, mod port.
5) Design, verify and Synthesize D-latch, D-flipflop using always_latch and always_ff respectively
6) Design and verify the fixed priority arbiters using the following
   i) If – else ii) Case iii) Priority If iv) Priority Case
7) Design and verify generic decoder using the following
   i) If – else ii) Case iii) Priority If iv) Priority Case

8) Design a Fibonacci series using loops and verify the same using test bench
9) Implementation of Priority based scheduler using System Verilog
10) Design and verify single-port RAM of size 1kbyte

MICROPROCESSORS AND MICROCONTROLLERS LAB

II Year B. Tech. II semester
[ECE]

Course Code: 24EC11RC21

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Develop and execute assembly language programs for microprocessors and microcontrollers, including interfacing with peripherals.

CO2: Implement 8086 programs using MASM for arithmetic operations, data manipulation, and string processing.

CO3: Interface switches, LEDs, and stepper motors with the 8086-trainer kit for real-time applications.

CO4: Test 8051 microcontroller programs using Keil for bitwise operations, arithmetic computations, waveform generation, and serial communication.

CO5: Develop embedded system applications using Arduino Uno by interfacing LEDs and IR sensors.

List of the Experiments

8086 Programming using MASM assembler

1. Addition and Subtraction of 16-bit numbers
2. Multiplication and Division of 16-bit numbers
3. Count even and odd numbers in a block of data
4. Sorting a block of data
5. Move a String to a different address
6. Find whether the given string is a palindrome or not

8086 Programming using trainer kit

7. Interfacing Switches and LEDs
8. Interfacing Stepper Motor

8051 Programming using Keil assembler

9. Finding number of 1's and number of 0's in a given 8-bit number
10. Average of a block of numbers
11. Generate a square wave using Timer
12. Send a message on serial port

Arduino Programming using Arduino Uno

13. Interfacing LEDs

14. Interfacing IR Sensor

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

II Year B. Tech. II semester

[Skill Course: ECE]

Course Code: 24IT11SC02

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Implement programs for solving real world problems using java collection framework.

CO2: Develop programs using abstract classes.

CO3: Build multithreaded programs.

CO4: Develop GUI programs using swing controls in Java.

CO5: Apply validation techniques to build a reliable solution to a given problem.

List of the Programs

1. Use Eclipse or Net bean platform and acquaint with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.

2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.

3. a) Develop an applet in Java that displays a simple message.

b) Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named “Compute” is clicked.

4. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.

5. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.

6. Write a Java program for the following:

i) Create a doubly linked list of elements.

ii) Delete a given element from the above list.

iii) Display the contents of the list after deletion.

7. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially, there is no message shown.

8. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.

9. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout.

10. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).

ENVIRONMENT SCIENCE

II Year B. Tech. II Semester

[Common to CSE (AI&ML), ECE, EEE]

Course Code: 24BC11MC01

L	T	P	C
2	0	0	0

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understanding the impacts of developmental activities and mitigation measures for sustainable environment.

CO2: Categorize the importance of natural resources management for the sustenance of the life and the society.

CO3: Differentiate various forms of pollutions and their impact on the environment

CO4: Discuss elements of Sustainable Development, energy and environmental management.

CO5 : Develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT-I

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems. Salient features of international conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC)

UNIT-II

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-

watershed management. **Forest resources:** Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings. **Water resources:** Exploitation of surface and groundwater, Floods, droughts, Dams: benefits a nd costs. **Mineral Resources**: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals. Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

UNIT-III

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems. Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment, Marine pollution and its impact on blue economy. Noise pollution. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986. Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary.

UNIT-IV

Sustainable Development: Population and its explosion Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management. **Energy and Environment:** Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. **Renewable Energy:** Production of Hydrogen via Water Splitting Using Photocatalytic and Photo electrocatalytic Route process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. **Biomass energy:** Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

UNIT-V

Solid waste management: Important elements in solid waste management- Waste to energy concepts. **Management of plastic waste and E-waste:** Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Environmental Studies by R. Rajagopalan, Oxford University Press

2. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.

3. Base, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India 67

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications

2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB) 2018.

ANALOG COMMUNICATION

III Year B. Tech. I Semester

[ECE]

Course Code: 24EC11RC22

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Apply the concepts of linear modulation techniques and analyze their spectral characteristics and power calculations.

CO2: Analyse the effects of modulation index and bandwidth on the performance of frequency and phase modulation systems.

CO3: Evaluate the impact of noise in AM and FM systems.

CO4: Describe the working principles of AM and FM transmitters and receivers.

CO5: Explain the working of pulse analog modulation techniques.

UNIT-I **10 Lectures**

Linear Modulation Systems: Need for Modulation, Frequency Translation, Method of Frequency Translation, Amplitude Modulation, Modulation Index, over, under and critical Modulation, Spectrum of AM Signal, Modulators and Demodulators (Diode detector), DSB-SC Signal and its Spectrum, Balanced Modulator, Synchronous Detector, SSB Signal, SSB Generation by filtering,

SSB Generation by phase shift, Power Calculations in DSB-FC, DSB-SC, SSB Systems, Application of AM System- FDM.

UNIT-II **10 Lectures**

Angle Modulation Systems: Angle Modulation, Mathematical expression for Phase and Frequency Modulation, Relationship between FM and PM, Phase and Frequency Deviation, Spectrum of an NB- FM Signal and WB-FM Signal, Bandwidth of Sinusoidally Modulated FM Signal, Effect of the Modulation Index on Bandwidth, FM Generation: Parameter variation method, principle working of Reactance Modulator, Varactor Diode Modulator, Indirect method of Frequency Modulation

(Armstrong Method), PLL FM Demodulator, Comparison of FM and AM techniques.

UNIT-III **10 Lectures**

Noise in AM and FM Systems: Sources of Noise, Effect of filtering on Power Spectral density of Noise, Noise figure, Noise in AM System, Noise in DSB & SSB System.

Noise in Angle Modulation Systems, Threshold effect in Angle Modulation System, Pre – emphasis and De – emphasis, Compare various aspects of AM and FM systems.

UNIT-IV **10 Lectures**

Radio Transmitters: Classification of Radio Transmitters, elements of AM Low Level modulation, AM High Level modulation, Directly Modulated FM Transmitter.

Radio Receivers: Types, Elements of TRF Receiver, Elements of Superheterodyne Receiver, AM Receivers – RF Section, characteristics of RF section- Sensitivity, Selectivity, Fidelity, Image frequency and rejection, double spotting, Automatic Gain Control (AGC): Simple AGC and Delayed AGC, FM Receivers – block diagram, Need for Amplitude Limiting, FM Demodulators - Ratio Detectors.

UNIT-V **08 Lectures**

Pulse Analog Modulation methods: Pulse Amplitude Modulation, Demodulator, PAM-Time division Multiplexing, Pulse Time Modulation: Generation & Demodulation of Pulse Width Modulation, Pulse position modulation. Pulse Code Modulation: Sampling, Quantization, Types of Quantization, Companding.

Text Books:

1. Principles of Communication Systems, H. Taub, D. L. Schilling and Goutam Saha, Mc Graw Hill, 4th edition, 2017.
2. Communication systems, R.P. Singh and S.D. Sapre, Mc Graw Hill, 3rd edition, 2012
3. Electronic Communication Systems, G. Kennedy, McGraw Hill, 6th Edition, 2017.
4. Analog Communication Systems, Dr. Sanjay Sharma, S.K.Kataria & Sons, 2016

Reference Books:

1. Modern Digital and Analog Communication Systems, B. P. Lathi (2nd Edition).
2. Principle of Communication Systems, Simon Haykins (2nd Edition).
3. Electronic Communications Modulation and Transmission, Robert J. Schoenbeck, PHI N. Delhi, 1999.

Web References:

1. https://nptel.ac.in/courses/117105143

ANTENNAS AND WAVE PROPAGATION

III Year B. Tech. I Semester

[ECE]

L	T	P	C
3	0	0	3

Course Code: 24EC11RC23

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand the radiation mechanism of an antenna and identify basic antenna parameters.

CO2: Design and analyze various types of antenna Arrays.

CO3: Construct and Analyze HF, VHF and UHF Antennas.

CO4: Analyze Microwave antennas and summarize the antenna measurement techniques.

CO5: Outline the characteristics of radio wave propagation.

UNIT-I 10 Lectures

Radiation and Antennas: Antenna definition and Functions, Network theorems, Properties of antennas, Antenna parameters, Polarization, Basic antenna elements, Different current distributions in linear antennas.

Radiation mechanism : Radiation fields of alternating current element, Radiated power and radiation resistance of current element, Radiation, induction and electrostatic fields, Hertzian dipole, Radiation from half-wave dipole, Radiation from quarter wave monopole, Radiation characteristics of dipoles. Directional characteristics of dipole antennas, Radiation pattern of alternating current element.

UNIT-II 08 Lectures

Analysis of Linear Arrays: Two-element uniform array, Uniform linear arrays, Field strength of a uniform linear array, First side lobe ratio (SLR), Broadside and End-fire arrays, Patterns of array of non-isotropic radiators, Multiplication of patterns, Generalized expression for principle of pattern multiplication, Radiation pattern characteristics, Binomial arrays.

Transmission loss between transmitting and receiving antennas – FRIIS formula,

Array Synthesis, Synthesis methods, Linear array design by Woodward-Lawson method, Dolph- chebychev method (Tschebyscheff distribution), Standard amplitude distributions.

UNIT-III 12 Lectures

HF, VHF and UHF Antennas: Introduction, Isotropic radiators, Directional antennas, Omnidirectional antennas, Resonant antennas, Non resonant antennas, LF antennas, Antennas for HF, VHF and UHF, Dipole arrays, Folded dipole, V-Antennas, Inverted V-antennas, Rhombic antenna.

Yagi-Uda antenna, Log-periodic antennas, Loop antenna, Helical antenna

UNIT-IV **10 Lectures**

Microwave Antennas: Introduction, Rod reflector, Plane reflector, Corner reflector, Parabolic reflector, Types of parabolic reflectors, Feed systems for parabolic reflectors, Shaped beam antennas, Horn antennas, Corrugated horns, Lens antennas, Micro strip antennas.

Antenna Measurements: Antenna impedance measurements, Measurement of radiation resistance, Gain measurements, Measurement of antenna bandwidth, Directivity measurement, Measurement of side lobe ratio, Measurement of radiation efficiency, Measurement of antenna aperture efficiency , Phase measurement.

UNIT-V **08 Lectures**

Wave Propagation: Wave Propagation: Propagation characteristics of EM Waves, Factors involved in the propagation of radio waves, Ground wave propagation, Reflection factors of earth, Wave tilt of the ground wave, Tropospheric wave propagation, Atmospheric effects in space wave propagation, Duct propagation, Radio horizon, Line of sight (LOS), Ionospheric propagation, Characteristics of ionosphere, Refractive index of ionosphere, Phase and group velocities, Mechanism of Ionospheric propagation, reflection and refraction, Characteristic parameters of Ionospheric propagation.

Text Books:

1. Antennas and Wave Propagation, G.S.N. Raju, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2013.
2. Antenna theory, C.A. Balanis, John Wiley & Sons, NY, Fourth edition, 2020.

Reference Books:

1. Antennas, J.D. Kraus, McGraw Hill, NY. fifth edition, 2017.
2. Antennas and wave propagation by K D Prasad, Tech India Publications, 2017.

Web References:

1. https://archive.nptel.ac.in/courses/108/101/108101092/
2. https://www.udemy.com/course/antennas-and-wave-propagation-a-core-of-antenna-design

V L S I D E S I G N

III Year B. Tech. I Semester

[ECE]

Course Code: 24EC11RC24

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand NMOS, CMOS and Bi-CMOS technologies

CO2: Outline the electrical properties of MOS transistor

CO3: Make use of MOS layers for implementation of Layout and Symbolic diagrams and Model MOS circuits using scaling Parameters

CO4: Build Combinational and Sequential digital applications by following the subsystem design process and Summarize design techniques for Testability

CO5: Outline the low power based design methodologies

UNIT-I **08 Lectures**

Review of microelectronics and an introduction to MOS technology: Introduction to IC technology, MOS and related VLSI technology, Basic MOS transistors, Enhancement and Depletion mode Transistor action. NMOS, CMOS, Bi-CMOS Technologies, Thermal aspects of processing, P r oduction of E beam marks.

UNIT-II **10 Lectures**

Basic Electrical Properties of MOS Circuits:

Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, MOS Transistor circuit model, Latch-up in CMOS circuits, Bi- CMOS Inverter, Fin FET manufacturing technology, Bulk-Fin FET fabrication

UNIT-III **10 Lectures**

MOS and BiCMOS circuit design processes: MOS layers, Stick diagrams, Design rules, and layout, 2 & 1.2 micro meter CMOS rules, Layout diagrams, Symbolic diagram.

Basic Circuit concepts - Sheet resistance, Area capacitances of layers, Delay unit, Wiring Capacitances, Choice of layers. Scaling of MOS Circuits -Scaling models, Scaling function for device parameters, Limitations of scaling.

UNIT-IV **10 Lectures**

Sub system design and Layout: Architectural issues, Switch logic, Examples of Structural design (Combinational logic)- Parity Generator, Multiplexers. Clocked sequential circuits-Two phase clocking, Charge Storage, Dynamic Shift register. Sub system design process, Design of ALU subsystem, some commonly used storage elements.

Design for Testability: Fault types and Models, Controllability and Observability, Ad Hoc Testable Design Techniques, Scan Based Techniques and Built-In Self Test techniques.

UNIT-V **10 Lectures**

Introduction to Low Power VLSI Design: Over view of power consumption, Low –power design through voltage scaling, Estimation and optimization of switching activity, Reduction of switching capacitance, Comparison between different technologies- High–k, Metal Gate Technology, TFET.

Text Books:

1. Essentials of VLSI Circuits and Systems by Kamran Eshraghian, Douglas A, Pucknell, and Sholeh Eshraghian, PHI, 3rd Edition, 2005.
2. CMOS Digital Integrated Circuits Analysis and Design- Sung-Mo Kang, Yusuf Leblebici, Tata McGraw- Hill Education, 2003.

Reference Books:

1. Mead, C.A and Conway, LA, “Introduction to VLSI Systems”, Addison-Wesley, Reading, Massachusetts, l980.
2. Digital Integrated Circuits, Jan M.Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd edition, 2016.
3. FinFET Devices for VLSI Circuits and Systems, Samar K Saha, Taylor & Francis, CRC Press, First Edition, 2021.

Web references:

1. https://www.youtube.com/watch?v=9SnR3M3CIm4&list=PL018645397D9487AF
2. https://www.youtube.com/watch?v=Dvwq2eueNZk&list=PL5PDqJ5saHRIrtX-hGiAZzNrjX1MiU3q

ANALOG COMMUNICATION LAB

III Year B. Tech. I Semester

[ECE]

Course Code: 24EC11RC25

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Generate, detect and analyse different amplitude modulation techniques.

CO2: Generate, detect and analyse frequency modulation technique.

CO3: Analyse signal processing in various modules of RF Transmitter and Receiver.

CO4: Design a T-Type attenuator and analyse the signal characteristics.

CO5: Demonstrate the generation and detection of various pulse modulation techniques.

List of the Experiments

1. AM Modulation & Demodulation
2. DSBSC Modulation & Demodulation
3. SSBSC Modulation & Demodulation
4. Frequency Modulation & Demodulation
5. Design a T-Type attenuator
6. Pre-emphasis & De-emphasis
7. Automatic Gain Control Circuits
8. Verification of Sampling Theorem
9. Pulse Amplitude Modulation & Demodulation
10. PWM, PPM – Modulation & Demodulation

V L S I L A B

III Year B. Tech. I Semester

[ECE]

Course Code: 24EC11RC26

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Construct Combinational digital applications using basic gates

CO2: Build Sequential digital applications using Flip Flops

CO3: Verify the functional behaviour of Analog applications

CO4: Develop layout implementation of basic digital circuits

CO5: Model inverter using Fin FET technology

List of the Experiments

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the following experiments using Industry standard EDA Tools.

1. Verify the characteristics of CMOS inverter.
2. Design and Implementation of Universal gates.
3. Design and Implementation of Full Adder using CMOS logic
4. Design and Implementation of multiplexer using basic gates.
5. Design and Implement Synchronous and asynchronous counters.
6. Design and Implement 6T SRAM cell
7. Verify the functional behaviour of Common Source/Drain Amplifier
8. Verify the functional behaviour of Current Mirror Circuit
9. Verify the functional behaviour of Differential Amplifier.
10. Layout Implementation of CMOS Inverter
11. Layout Implementation of Universal gates
12. Verify the characteristics of FinFET based inverter.

SOFT SKILLS

III Year B. Tech. I semester

[Skill Course: Common to ECE, CSE(AI&ML) & EEE]

Course Code: 24HE11SC01

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, the student shall be able to

CO1: **Apply** effective communication skills in personal and professional settings. (L3)

CO2: **Develop** and implement effective goal setting and time management strategies. (L3)

CO3: **Function** as a leader and a member of a team. (L4)

CO4: **Analyze** data to write concise technical reports (L4), **Organize** Effective meetings and record minutes of the meeting. (L3)

CO5: **Take part** in group discussions (L4), **Build** resumes to successfully navigate job interviews. (L3)

UNIT-I

Communication skills: Verbal & Non-verbal communication- Personal grooming (Etiquette, Attitude, Body Language), Posture, Gestures, Facial Expressions, Eye contact, Space Distancing, Interpersonal communication- Presentation skills, Public speaking, - Cross Cultural communication.

UNIT-II

Goal Setting and Time Management: Immediate, Short term, Long term, SMART Goals, Strategies to Achieve goals, Time Management Skills, Identifying Time Wasters, Stress Busters.

UNIT-III

Leadership and Team Management: Qualities of a Good Leader, Team Dynamics, Leadership Styles, Decision Making, Problem Solving, Negotiation Skills.

UNIT - IV

Business communication: Types of reports- Technical report writing, Proposals, SOP; Planning for effective meetings, Minutes of the Meetings.

UNIT-V

Interview Skills: Group Discussions, Resume preparation and Mock interviews.

Reference Books:

1. Krannich, Caryl, and Krannich, Ronald L. Nail the Resume! Great Tips for Creating Dynamite Resumes. United States, Impact Publications, 2005.
2. Hasson, Gill. Brilliant Communication Skills. Great Britain: Pearson Education, 2012
3. Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Education, 2001.
4. Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.
5. Rizvi, Ashraf M. Effective Technical Communication: India, McGraw-Hill Education. 2010
6. Thorpe, Edgar &Showick Thorpe. Winning at Interviews. 2nd Edition. Delhi: Dorling Kindersley, 2006.
7. N.L.Gupta. Cross cultural Communication: Global perspectives. Concept Publishing Company, 1998.
8. Peter Hartley and Clive G. Bruckmann. Business communication. 2002.

Web References:

1. https://www.hbr.org
2. A step-by-step guide to writing a technical report | Indeed.com UK
3. https://www.grammarly.com/blog/business-writing/meeting-minutes/
4. http://www.youtube.com/@PebblesLanguageLearning
5. https://www.onlinecourses.nptel.ac.in/noc20_hs60/preview

IPR & PATENTS

III Year B. Tech. I Semester
[Common to ECE, CSE(AI&ML) & EEE]

L	T	P	C
2	0	0	0

Course Code: 24HM11MC02

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand basic concepts of Intellectual property rights, IPR tool kit and its importance in the global scenario. (L2)

CO2: Apply the knowledge on patents for registration process and understand recent developments in patent system. (L3)

CO3: Demonstrate an understanding about copyright protection, the registration process and legal remedies available in case of infringement (L2)

CO4: Integrate and understand the concept of Trademarks and industrial design, their registration, infringement and related laws (L3)

CO5: Identify principles of trade secrets, Semi conductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers' right and emerging areas of IP (L4)

Unit-I: Introduction and Evolution of IP system **6 Lectures**

Concept of property, Intellectual Property Rights (IPR), Importance of IP, Value creation through IP, Advantages of IP protection, Competitive advantage, History and rationale behind development of IP system, WTO and TRIPS agreement, Role of WIPO. Major forms of IP in India and globally.

TextBook-1: Chapter 1, 2, 3, 11 & 12, Text Book -2: Chapter1, 2 3 & 4 Text Book -4: Chapter 41

Unit-II: Patent, Patent filing and prosecution **6 Lectures**

Concept, Life of patent, Rights of Patentee, Criteria of patentability- novelty, non- obviousness, and utility, Non-patentable inventions. Prior art search, Process of obtaining a patent in India, Convention application, Patent Cooperation Treaty (PCT), Patent Infringement, IP commercialization: Licensing & Royalty; Technology Transfer, Compulsory License, Pat informatics. Case studies on patenting of life saving drugs and their implications. TextBook-1: Chapter 3 & 4, Text Book -2: Chapter 4,5,6 &10

Unit-III: Trademarks and Industrial Design **6 Lectures**

Types of trademarks, Trademark Registration process, Trademark Infringement, Post registration procedures & Trade Mark maintenance, Genericide Concept of Industrial design, Design registration, Design infringement. TextBook-1: Chapter 7, 8 & 10

Unit-IV: Copyrights and related rights **6 Lectures**

Subject Matters of Copyright, Copyright registration, Copyright infringement, Section 52 of Indian Copyright Act– Rights Afforded by Copyright Law, Fair use –Right to Prepare Derivative Works - Plagiarism vs Copyright infringement- Copyright pertaining to Software/Internet and other Digital media. TextBook-1: Chapter 5 & 6

Unit-V: Other forms of IP and Emerging areas of IP **6 Lectures**

Trade Secret- Maintaining Trade Secret –Employee Confidentiality Agreement – Semiconductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers' rights, Traditional knowledge- **Case studies on biopiracy.** IP in bank loan, and insurance, Use of artificial intelligence in IP enforcement. TextBook-1: Chapter 9, 10 Text Book - 2 Chapter 11

Text Books

1. Kompal Bansal &Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
2. Prabhuddha Ganguli: ' Intellectual Property Rights" Tata Mc-Graw Hill, New Delhi
3. Deborah E.Bouchoux: "Intellectual Property". Cengage learning , New Delhi
4. M. Ashok Kumar and Mohd. Iqbal Ali: "Intellectual Property Right" Serials Pub.

Reference Materials

1. The Indian Patents Act 1970 (as amended in 2005)
2. The Indian Copyright Act 1950 (as amended in 2017)
3. Indian Trademarks Act 1999
4. The Indian Industrial Designs Act 2000
5. The Protection of Plant Varieties and Farmers' Right Act 2001
6. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
7. Geographical Indications of Goods Act 1990

Web References (e-Resources):

1. https://www.wipo.int/en/web/wipo-academy/
2. Inventing the Future: An Introduction to Patents for small and medium sized enterprises, WIPO publication No 917 www.wipo.int/ebookshop
3. Looking Good: An Introduction to Industrial Designs for Small and Medium sized Enterprises; WIPO publication No.498 www.wipo.int/ebookshopGanguli Prabuddha
4. "Geographical Indications-its evolving contours accessible in http ips. nminsoda/files/2012/05/ main book pdf (2009)

DIGITAL COMMUNICATION

III Year B. Tech. II Semester

[ECE]

Course Code: 24EC11RC27

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Apply analog to digital conversion techniques and assess their impact on signal quality.

CO2: Analyze bandpass modulation schemes and evaluate their performance.

CO3: Implement baseband signal detection methods and assess error probabilities.

CO4: Explain information theory concepts and source coding techniques.

CO5: Apply channel encoding algorithms for error detection and correction.

UNIT-I **10 Lectures**

Analog-to-Digital Conversion: Elements of Digital Communication systems, advantages of Digital Communication systems, Pulse Code Modulation, Signal to Noise ratio of PCM, Differential Pulse Code Modulation, Delta Modulation, Noise in DM, Signal to Noise ratio of DM, Adaptive Delta Modulation, Compare PCM, DPCM, DM, ADM.

UNIT-II **10 Lectures**

Bandpass Transmission: Line codes, Concept of Inter Symbol Interference, Inter Channel Interference, Gram-Schmidt Orthogonalization of signals, Binary Amplitude Shift Keying, Binary Phase-Shift Keying, Differential Phase-Shift Keying, Differentially-Encoded PSK (DEPSK), Quadrature Phase- Shift Keying (QPSK), M-ary PSK, Binary Frequency Shift-Keying, M-ary FSK, Compare of BFSK andBPSK.

UNIT-III **10 Lectures**

Data Transmission: A Base-band Signal Receiver, Output signal to noise ratio, Probability of Error, the Optimum Filter, White Noise: The Matched Filter, Probability of Error of the Matched Filter

Coherent Reception: Correlation, Amplitude-Shift Keying, Phase-Shift Keying, Frequency-Shift Keying, Quadrature Phase Shift Keying, Error Probability for ASK, FSK, PSK, QPSK, Noncoherent Detection of ASK, FSK.

UNIT-IV **10 Lectures**

Information Theory:

Discrete messages, representation of DMS, concept of amount of information and its properties, Average information content (Entropy) of symbols in Long Independent Sequences, Entropy and its properties, Information rate, Mutual information, and its properties

Source coding:

Introduction, Advantages, Shannon's Source encoding limit, Shanon Fano-coding, Huffman coding, efficiency calculations, Discrete Communication Channels, Binary Communication Channel, Binary Symmetric Channel, Rate of Information over DMS, Capacity of DMC.

UNIT-V **08 Lectures**

Linear Block Codes: Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes, Binary cyclic codes, Algebraic structure, encoding, syndrome calculation.

Convolution Codes: Introduction, encoding of convolution codes, transformer domain approach. Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm.

Text Books:

1. Principles of Communication Systems, H. Taub, D. L. Schilling and Goutam Saha, Mc Graw Hill, 4th edition, 2017.
2. Communication Systems by Simon haykin 5th edition, John Wiley & Sons, 2009.
3. Digital and Analog Communication systems by Samshanmugam, As per AICTE, John Wiley, 2019.
4. Information Theory, Coding and Cryptography, Ranjan Bose, Mc Graw Hill, 2016.

Reference Books:

1. Modern Analog and Digital Communications by B.P.Lathi, 3rd Edition, Oxford reprint, 2004.
2. Principles of Digital Communications- J.Das, SK.Mullick, P.K.Chatterjee.
3. Analog and Digital Communication Systems by Martin S. Roden, 3rd edition, Prentice Hall, 1994.

Web References:

1. https://nptel.ac.in/courses/117101051

DIGITAL SIGNAL PROCESSING

III Year B. Tech. II Semester

[ECE]

L	T	P	C
3	0	0	3

Course Code: 24EC11RC28

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Apply the concepts of difference equations to Analyze the discrete time systems

CO2: Understand the applications of Z-Transform in analysis and realization of digital systems

CO3: Make use of the FFT algorithm for solving the DFT of a given signal.

CO4: Analyze the Digital IIR filter design for different specifications.

CO5: Analyze the Digital FIR filter design for different specifications, and understand the signal Processing concepts in various applications.

UNIT-I **11 Lectures**

Discrete - Time Signals and Systems: Discrete - Time Signals – Sequences, Linear Shift – Invariant Systems, Stability and Causality, Linear Constants – Coefficient Difference Equations, Frequency Domain Representation of Discrete – Time Signals and Systems.

UNIT-II **10 Lectures**

Applications of Z – Transforms: System Functions H(z) of Digital Systems, Stability Analysis, Structure and Realization of Digital Filters, Finite Word Length Effects - basic quantization effects, rounding and truncation errors, and their impact on digital filters, finite precision affects on system stability and performance.

UNIT-III **11 Lectures**

Discrete Fourier Transform (DFT): Properties of the DFS, DFS Representation of Periodic Sequences, Properties of DFT, Convolution of Sequences.

Fast – Fourier Transforms (FFT): Radix – 2 Decimation – In – Time (DIT) and Decimation – In – Frequency (DIF), FFT Algorithms, Inverse FFT.

UNIT-IV **08 Lectures**

IIR Digital Filter Design Techniques: Design of IIR Filters from Analog Filters, Analog Filters Approximations (Butterworth and Chebyshev Approximations), Frequency Transformations, General Considerations in Digital Filter Design, Bilinear Transformation Method, Step and Impulse Invariance Technique.

UNIT-V **08 Lectures**

Design of FIR Filters: Fourier series Method, Window Function Techniques, Comparison of IIR and FIR Filters. Applications of FFT in Spectrum Analysis and Filtering, Application of DSP in Speech Processing.

Text Books:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 4th Edition, 2014.
2. Discrete Time Signal Processing – A.V. Oppenheim and R.W. Schaffer, PHI, 3rd Edition, 2009.

Reference Books:

1. Digital Signal Processing "A – Computer Based Approach", Sanjit K. Mitra, Tata Mc Graw Hill, 4th Edition, 2013.
2. Digital Signal Processing: Signals, Systems and Filters, Andreas Antoniou, TATA McGraw Hill , 1st Edition, 2005
3. Digital signal Processing, Tarun Kumar Rawat, Oxford University Press, 1st Edition, 2015.

Web References:

1. https://archive.nptel.ac.in/courses/108/101/108101174/
2. https://nptel.ac.in/courses/117102060

MICROWAVE ENGINEERING

III Year B. Tech. II Semester

[ECE]

L	T	P	C
3	0	0	3

Course Code: 24EC11RC29

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Analyze the microwave components.

CO2: Illustrate microwave signal generators and amplifiers

CO3: Understand the operation of various microwave circuits.

CO4: Infer various microwave integrated circuits.

CO5: Illustrate various microwave parameter measurements.

UNIT-I **10 Lectures**

Waveguides: Introduction, Rectangular Waveguides, electric and magnetic field patterns in TE10 and TE11 mode configuration, modes of TE wave in rectangular waveguide, field equations, impossibility of TEM wave propagation in waveguides, cutoff frequency of rectangular waveguide, propagation constant, wave impedance, phase velocity, group velocity, dominant mode and degenerate modes, related problems.

Microwave Components: Introduction to Microwaves and their applications, Coaxial Line Components, Wave-guide Components, Attenuators, Ferrite Devices, Isolators, Circulators, Cavity Resonators, Re-entrant Cavities, Wave-meters, Microwave Filters, Detectors, Mixers.

UNIT-II **08 Lectures**

Microwave Signal Generators and Amplifiers: Vacuum Tube Triodes, Resonant Cavity Devices, Reflex Klystron, two – Cavity Klystron, Multi – Cavity Klystron, Slow – Wave Devices, TWT, Crossed Field Devices, Magnetrons,

Semiconductor Devices: Microwave BJTs, FETs, Tunnel Diodes, Gunn Diode, IMPATT, TRAPATT Diodes.

UNIT-III **12 Lectures**

Microwave Circuits: T junctions, E Plane Tee, H plane Tee and Magic Tee. Directional Couplers, Ring Tee Junction

Scattering Matrix: Scattering Matrix and its Properties, Scattering Matrix of directional coupler, circulator, E Plane Tee, H plane Tee and Magic Tee.

UNIT-IV **10 Lectures**

Microwave Integrated Circuits: Materials, Substrate, Conductor, Dielectric and Resistive Materials, MMIC Growth, Fabrication Techniques, MOSFET Fabrication, NMOS Growth and CMOS Development, Thin Film Formation.

UNIT-V **08 Lectures**

Microwave Measurements: VSWR, Frequency, Guide Wavelength, power Coupling and Directivity measurements.

Text Books:

1. Microwave Devices and Circuits, S. Y. Liao, PHI. Third Edition 1994.
2. Microwave and Radar Engineering, M Kulkarni. Umesh publications, fifth edition 2016.

Reference Books:

1. Microwave Engineering, G.S.N. Raju, IK International Publishers.2013.
2. Microwave Communications – Components and Circuits, E. Hund, McGraw Hill.1989.

Web References:

1. https://archive.nptel.ac.in/courses/108/103/108103141
2. https://www.coursera.org/learn/microwave-antenna.

DIGITAL COMMUNICATION LAB

III Year B. Tech. II Semester

[ECE]

Course Code: 24EC11RC30

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Demonstrate signal transmission with Time Division Multiplexing (TDM) and Sampling.

CO2: Generate, detect and analyse different digital signal encoding systems.

CO3: Analyse different digital data transmission techniques.

CO4: Demonstrate the process of companding using A-law and μ-law.

CO5: Implement various channel error detection and correction codes to enhance data reliability.

List of the Experiments

1. Time Division Multiplexing–Pulse Amplitude Modulation
2. Pulse Code Modulation and Demodulation System
3. Differential Pulse Code Modulation and Demodulation System
4. Delta Modulation and Demodulation System
5. Binary Frequency Shift Keying
6. Binary Phase Shift Keying
7. Differential Phase Shift Keying
8. A-law and μ-law Companding
9. Linear Block code generation and detection
10. Convolution Codes

DIGITAL SIGNAL PROCESSING LAB

III Year B. Tech. II Semester

[ECE]

L	T	P	C
0	0	3	1.5

Course Code: 24EC11RC31

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Implement and verify multirate signal processing systems using MATLAB

CO2: Implement various discrete time systems using MATLAB and study the architecture of Digital Signal Processors

CO3: Verification of Linear and Circular Convolution and correlation using MATLAB.

CO4: Analyze discrete signals and systems spectrally using MATLAB.

CO5: Design and simulate FIR and IIR filters with different techniques using MATLAB.

List of the Experiments

1. Sampling theorem, illustration of interpolation and up sampling in time and frequency domain.
2. Sampling theorem, illustration decimation and down sampling in time and frequency domain.
3. Implement: -a) Linear Convolution of Two Sequences.
   b) Circular Convolution of Two Sequences.
   c) Cross-Correlation and Auto-Correlation.
4. FFT of a given (8 point and 16 point) N-point Sequence using: -
   a) DIF-FFT b) DIT-FFT.
5. System Response of Discrete Time Sequences: -
   a) Impulse b) Step
6. Spectral Analysis of given Waveforms. And Plot Spectrogram (Frequency v/s Time): -
   a) Sine b) Square c) Audio file.
7. Design following IIR Digital Filters using i) Butterworth and ii) Chebyshev designs:
   (a) LPF (b) HPF (c) BPF (d) BSF
8. Design FIR Digital Filters using a) Rectangular window b) Hamming window:
   (a) LPF (b) HPF (c) BPF (d) BSF.
9. Addition of White Gaussian Noise to an Audio file and recover the Signal using Butterworth filters.
10. Perform various operations on Digital Images.
    (a) Cropping (b) rotation (c) histogram (d) binary image
    (e) RGB to Gray conversion (f) water marking (g) Adding noise to the image.
11. Study of Architecture of DSP Chip-TMS320C6713.

Reference Books:

1. Digital Signal Processing Using MATLAB®: A Problem-Solving Companion, Vinay K. Ingle John G. Proakis. Pearson, 3rd Edition, 2011.

2. Introduction to Digital Signal Processing Using MATLAB with Application to Digital Communications, K.S. Thyagarajan, Springer, 1st edition, 2019.

3. Digital Signal Processing Using Matlab For Students And Researchers John W. Leis, Wiley, 1st edition, 2011.

Antennas and Microwave Engineering Lab

III Year B. Tech. II Semester

[ECE]

Course Code: 24EC11RC32

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Design and understand wire antennas and micro strip patch antennas using HFSS.

CO2: Understand the different feeding technique used for antenna design.

CO3: Analyze the Characteristics of Microwave sources.

CO4: Determine the Parameters of various Microwave Waveguide Junctions

CO5: Practically experimenting and understand radiation pattern of Standard Antennas.

List of the Experiments

Part A: Antenna Simulation

1. Design and simulation of rectangular microstrip patch antenna with a particular operating frequency, dielectric constant and substrate thickness.
2. Design of microstrip patch antenna using a coaxial feeding technique.
3. Design and simulation of dual-band rectangular patch antenna using the inset feeding technique.
4. Design and simulation of rectangular microstrip patch antenna using CPW feeding with slot for bandwidth enhancement.
5. Design of aperture coupled rectangular microstrip patch antenna with two different substrates.
6. Design of proximity coupled rectangular microstrip patch antennas

Part B: Microwave Engineering

7. Verify the Reflex Klystron Characteristics.
8. Measurement of Microwave frequency and VSWR,
9. Measurement of Coupling Factor and Directivity of a 4-Port directional coupler
10. Measurement of Scattering Matrix of Magic Tee junction.
11. Measurement of Scattering Matrix of Circulator.
12. Measure and Plot the Radiation Pattern of Horn Antenna and Parabolic reflector Antenna.

Reference Books:

1. Introduction to Monopole Antenna Design with Ansys HFSS (High Frequency Structure Simulation): Demystifying the HFSS setup and analysis process by Dr. Alex N Jensen.
2. An Introduction to HFSS: Fundamental Principles, Concepts, and Use by ANSYS INC

Web References:

1. https://www.ansys.com/en-in/applications/antenna-design-and-placement.

IOT APPLICATIONS

III Year B. Tech. II Semester

[ECE]

Course Code: 24EC11SC02

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline the architecture, features, and pin configuration of Raspberry Pi/ Node MCU, and develop programs for IoT applications.

CO2: Interface and control digital and analog sensors using Raspberry Pi/Node MCU.

CO3: Implement motor control applications by interfacing and operating servo and stepper motors with Raspberry Pi/Node MCU.

CO4: Establish IoT communication by setting up Raspberry Pi/Node MCU as a web server, integrating with cloud platforms

CO5: Design and develop IoT-based mini-projects using Raspberry Pi/Node MCU.

SYLLABUS

Introduction to IoT and architecture, edge IoT, Raspberry Pi/ Node MCU and IoT Concepts: Features and Pin configuration and Programming. Communicating with web servers: HTTP, HTML, Raspberry Pi/ Node MCU as a web server, Web controllers, calling of web services using Thing Speak.

List of Experiments:

Cycle 01

1. Interacting Digital Outputs with Raspberry PI/Node MCU
2. Interfacing IR sensor to Raspberry PI/Node MCU.
3. Measuring temperature and humidity with a digital sensor using Raspberry PI/Node MCU
4. Interfacing and Controlling Servo Motor using Raspberry PI/Node MCU
5. Interfacing with Stepper Motor using Raspberry PI/Node MCU
6. Interfacing with Magnetometer using Raspberry PI/Node MCU
7. Integrate a cloud platform to Log data using Raspberry PI/Node MCU and upload to the cloud platform.

Cycle 02

Mini Project

1. Implementing Smart Home Systems using Raspberry Pl/Node MCU 2
2. Implementing Smart Soil Monitoring System Raspberry Pl/Node MCU
3. Design any IOT based system.

Web References:

1. https://www.raspberrypi.org/documentation/
2. https://nodemcu.readthedocs.io/en/latest/
3. https://thingspeak.com/
4. https://learn.adafruit.com/
5. https://randomnerdtutorials.com/

DESIGN THINKING, INNOVATION & ENTREPRENEURSHIP

III Year B. Tech. II Semester

(ECE)

Course Code: 24EC11MC01

L	T	P	C
2	0	0	0

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline a problem, apply methods of Empathy on user groups

CO2: Describe and Define the problem specific to the user group

CO3: Apply Ideation tools to generate Ideas to solve the problem

CO4: Develop prototypes for the selected Ideas

CO5: Test the ideas and demonstrate Storytelling ability to present the Ideas

Activity

Students shall form into groups and identify a problem (preferably societal problem with engineering orientation to solve) suitable for the design thinking and go through the process week- wise. At the end of each phase, brief documentation shall be submitted and a final report covering all phases has to be submitted at the end of the semester.

Weeks 1-3:

Introduction to Design Thinking: A primer on design thinking - Traditional approach, The new design thinking approach. Stages in Design Thinking: Empathize, Define, Ideate, Prototype, Test. Mindset for design thinking, Design thinking for product and process innovation, Difference between engineering design and design thinking.

Establishing Startups: Opportunity Scanning and Identification, Market Survey and assessment, Choice of technology and selection of business sites.

Case Studies: General, Engineering and Service applications.

Activities: Identify an Opportunity and Scope of the Project Explore the possibilities and Prepare design brief

Weeks 4-6:

Methods and Tools for Empathize and Define phases:

Empathize - Methods of Empathize Phase: Ask 5 Why / 5W+H questions, Stakeholder map, Empathy Map, Peer observation, Trend analysis

Define - Methods of Define Phase: Storytelling, Critical items diagram, Define success

Activities: Apply the methods of empathize and Define Phases Finalize the problem statement

Weeks 7-8:

Methods and Tools for Ideate phase:

Ideate - Brainstorming, 2X2 matrix, 6-3-5 method, NABC method;

Activities: Apply the methods of Ideate Phase: Generate lots of Ideas

Weeks 9-11:

Methods and Tools for Prototype Phase:

Prototype - Types of prototypes - Methods of prototyping - Focused experiments, Exploration map, Minimum Viable Product;

Activities: Apply the methods of Prototype Phase: Create prototypes for selected ideas

Weeks 12-13:

Methods and Tools for Test Phase:

Test - Methods of Testing: Feedback capture grid, A/B testing

Activities: Collect feedback; iterate and improve the ideas

Weeks 14-15:

Solution Overview - Create a Pitch - Plan for scaling up - Road map for implementation

Activities: Present your solution using Storytelling method

Week 16:

Project Submission: Fine tuning and submission of project report

Reference Books:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books, 2009.
2. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Toolbox, John Wiley & Sons, 2020.
3. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Playbook, John Wiley & Sons, 2018.
4. Kristin Fontichiaro, Design Thinking, Cherry Lake Publishing, USA, 2015.
5. Walter Brenner, Falk Uebernickel, Design Thinking for Innovation - Research and Practice, Springer Series, 2016.
6. Gavin Ambrose, Paul Harris, Design Thinking, AVA Publishing, 2010.
7. Muhammad Mashhood Alam, Transforming an Idea into Business with Design Thinking, First Edition, Taylor and Francis Group, 2019.
8. S.Balaram, Thinking Design, Sage Publications, 2011.

Web References:

1. https://designthinking.ideo.com/
2. https://thinkibility.com/2018/12/01/engineering-vs-design-thinking/
3. https://www.coursera.org/learn/design-thinking-innovation
4. https://swayam.gov.in/nd1_noc20_mg38/preview

ADVANCED MICROPROCESSORS

(Professional Elective)

Course Code: 24EC11PE01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Describe the architecture and memory management features of 80386, 80486, and Pentium processors.

CO2: Explain the internal operations of the Pentium CPU including pipelining, multitasking, and exception handling.

CO3: Outline the components and structure of ARM architecture including its instruction set and processor family.

CO4: Summarize the process of ARM assembly programming and instruction timing for code optimization.

CO5: Interpret various memory interfacing techniques used in Intel processors from 8086 to Core2 series.

UNIT-I **10 Lectures**

80386 Architecture: Instruction set - Addressing modes - Real mode - Protected mode - 80386 Architecture - Address segmentation - Paging - Segment registers. Basic 486 Architecture - 486 memory system and memory management - Features of Pentium memory and I/O systems - Pentium
memory management - Introduction to Pentium Pro features.

UNIT-II **09 Lectures**

High Performance CISC Architecture – Pentium: CPU Architecture- Bus Operations – Pipelining – Branch prediction – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.

UNIT- III **10 Lectures**

High Performance RISC Architecture – ARM Acron RISC Machine – Architectural Inheritance – Core & Architectures - Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors - ARM instruction set- Thumb Instruction set, RISC 5 ISA.

UNIT-IV **10 Lectures**

Instruction cycle timings: The ARM Programmer's model – ARM Development tools – ARM Assembly Language Programming – Optimizing ARM Assembly Code – Optimized Primitives, RISC 5 - five stage pipelining architecture.

UNIT-V **09 Lectures**

Memory Interface: Memory Devices, Address Decoding, 8086, 80186,80286,80386SX Memory Interface, 80286DX and 80486 Memory Interface, Pentium through core2 Memory Interface

Text Books:

1. The Intel Microprocessors 8086 / 8088, 80186, 80188, 80286, 80386, 80486, Pentium and Pentium – Pro Processor Architecture, Programming and Interface by Barray B. Berry, Pearson prentice hall, 4th Edition, 2009.
2. ARM System Developer's Guide: Designing and Optimizing System Software- Andrew N. Sloss, Dominic Symes, Chris Wright, Elsevier Inc., 2007.

Reference Books:

1. Microprocessors Principles and Applications by Gilmore, TMH, 2nd Edition,1995
2. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 2017
3. Microprocessors / Microcomputers Architecture, Software and Systems by A.J. Khambata, John Wiely & Sons, 1988.
4. Advanced Microprocessors by Daniel Tabak, Mc Graw Hill, 1995.

ANALOG AND DIGITAL IC DESIGN

(Professional Elective)

Course Code: 24EC11PE02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline the performance metrics and behaviour of MOS structure

CO2: Build Combinational digital applications using different digital design methodologies

CO3: Model clock based Sequential digital applications

CO4: Analyze modeling of single stage MOSFET amplifiers with current mirrors

CO5: Design Two stage operational Amplifiers

UNIT-I **10 Lectures**

Design of Amplifiers: Small signal Model of MOSFET, CS stage with resistance load, Diode connected load, Current source load, Triode load,CS stage with source degeneration, Source follower, Common gate stage, Cascode stage, Choice of device models. Basic differential amplifier.

UNIT-II **09 Lectures**

Current mirrors and OP-Amps: Basic current mirrors, Cascade mirrors, Active current mirrors. Operational amplifiers- Cascode OPAMP One stage OPAMP, Two stage OPAMP

UNIT- III **10 Lectures**

MOS Structures and its performance evaluation-I: Basic MOS structure and its static behavior- Threshold voltage, Channel length Modulation, Velocity saturation, Sub threshold conduction.

MOS Structures and its performance evaluation-II: Wire Models-Capacitance, Resistance, Inductance, Lumped wire Model and Distributed wire model, Quality metrics of a digital design-Cost, Functionality and Robustness, Power and Delay.

UNIT-IV **10 Lectures**

Combinational Logic Design Methodologies: Ratioed Logic, Differential Cascode Voltage Switch Logic, Pass Transistor Logic, Transmission gate Logic, Dynamic CMOS Design- Basic Dynamic Logic, Issues, Cascading Dynamic gates, Domino Logic

UNIT-V **09 Lectures**

Sequential Logic Design Methodologies: Introduction, Static Latches and Registers-SR Flip-Flops, MUX based latches, Master-slave edge-triggered register, Low Voltage Static Latches

Dynamic latches and registers-Dynamic Transmission-Gate Edge-triggered Registers, C2MOS Register, Dual-edge Registers, True Single-Phase Clocked Register (TSPCR),Pulse Registers

Text Books:

1. Digital integrated circuits: A design Perspective Rabaey, Jan M., Anantha P. Chandrakasan, and Borivoje Nikolic. Englewood Cliffs: Prentice hall, 2nd Edition. 2016.
2. Design of Analog CMOS Integrated Circuits, Behzad Razavi TMH, 2007.

Reference Books:

1. Digital Integrated circuits, J.Rabaey PH. N.J 1996.
2. CMOS Digital Integrated circuit Analysis design sung-moKang and yusufleblebici ,TMH, 3rd edition, 2003.

Web references:

1. https://www.youtube.com/watch?v=9g9dowLjmCA&list=PLp6ek2hDcoNDAw1BehPFazZ5ogPV8UlQa
2. http://youtube.com/watch?v=qDjGlqV6KOU&list=PLFW6lRTa1g812-_ynYGn1J_4df5lM8muZ
3. https://www.youtube.com/playlist?list=PLHO2NKv71TvsSqYwVvUCZwNkY-jUyUHdS
4. https://www.youtube.com/watch?v=oL8SKNxEaHs&list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM

CELLULAR MOBILE COMMUNICATION

(Professional Elective)

Course Code: 24EC11PE03

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Illustrate evolutions in wireless technologies.

CO2: Compare different modulation techniques used in mobile communications.

CO3: Outline the fundamental concepts of cellular radio system.

CO4: Analyse various mobile radio propagation models.

CO5: Summarise system architecture of GSM and features of 5G

UNIT-I **09 Lectures**

Introduction: Evolution of Mobile Communications, Mobile Radio Systems around the world, Generations of wireless mobile systems, Wireless Local Loop (WLL), Wireless LANs, Bluetooth, Personal Area Networks (PANs), Examples of Wireless Communication Systems: Paging systems, Cardless telephone systems, Cellular Telephone systems

UNIT-II **10 Lectures**

Wireless Transmission Techniques: Frequencies for radio transmission, omnidirectional and directional antennas, Signal Propagation, Propagation attenuation, fading, Multiplexing: FDM,TDM,CDM,SDM Modulation Techniques: overview of digital modulation techniques, Advanced ASK, Advanced PSK, Multicarrier, Spread Spectrum: Direct sequence and Frequency hopping, Multiple access techniques: SDMA, FDMA, TDMA, CDMA, Comparison of S/F/T/CDMA.

UNIT-III **10 Lectures**

Cellular Concept: Introduction , Frequency reuse, Handoff strategies, Trunking and Grade of Service, Cell Splitting, Sectoring, Repeaters for Range extension, A microcell zone concept.

Interference and System Capacity: Co- Channel Interference, Channel Planning, Adjacent Channel Interference, Power control for reducing interference.

UNIT-IV **10 Lectures**

Mobile Radio Propagation: Introduction, Free space propagation model, The three basic propagation models-Reflection: Reflection from dielectrics, perfect conductors, Two-ray model, Diffraction and Scattering, Outdoor propagation models, Indoor propagation models, Signal Penetration into building, Small scale multipath Propagation, Parameters of Mobile multipath channels, Types of small scale fading.

UNIT-V **09 Lectures**

Telecommunication Systems: GSM: Services and features of GSM, System Architecture, GSM Radio Subsystem, GSM channels, Protocols, UMTS and IMT-2000: UMTSNetwork architecture, Air interface in UMTS, 5G-Principle of operation of 5G Technology, features of 5G.

Text Books:

1. Wireless Communications: Principles and Practice-Theodore. S. Rapport, Pearson education, 2nd Edn, 2002.
2. Mobile and Cellular Communication (Including 5G & beyond and Microstrip Antenna) by Prof. G. Sasibhushana Rao, Raj Kumar Goswami and MNVSS Kumar, Paramount Publishers, 2024.

Reference Books:

1. Mobile Cellular Telecommunications-W.C.Y. Lee, Tata McGraw Hill, 2nd Edn, 2006.
2. Wireless Communications and Networks-William Stallings, Pearson Education, 2004.
3. 5G Mobile and wireless communications Technology-Afif Osseiran, Jose.F.Monserrat, Patrick Marsch," Cambridge University Press, 2016.
4. Mobile Communications-Jochen Schiller, Pearson education, 2nd Edn, 2004.

Web References:

1. https://archive.nptel.ac.in/courses/117/102/117102062/
2. https://archive.nptel.ac.in/courses/108/106/106106167/#

COMPUTER ARCHITECTURE & ORGANIZATION

(Professional Elective)

Course Code: 24EC11PE04

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand data representation techniques and perform basic register-level arithmetic, logic, and shift operations..

CO2: Interpret the fundamental organization of a computer system including instruction cycles, control units, and interrupts.

CO3: Analyze CPU architecture, instruction formats, addressing modes, and microprogrammed control.

CO4: Explore the various pipelining, parallel processing, and vector processing techniques.

CO5: Understand memory hierarchy, cache mapping, I/O organization, and DMA operations.

UNIT-I **10 Lectures**

Digital Computer and Data Representation: Introduction, Fixed-Point and Floating Point Representation.

Register Transfer & Micro Operations: Register Transfer Language, Register Transfer, Arithmetic, Logic and Shift Micro Operations, Arithmetic Logic Shift Unit.

UNIT-II **09 Lectures**

Basic Computer Organization: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Interrupt cycle, Complete Computer Description.

UNIT-III **10 Lectures**

Central Processing Unit: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC vs. CISC

Micro programmed Control: Control Memory, Address Sequencing, Microinstruction Format, Design of Control Unit.

UNIT-IV **09 Lectures**

Pipeline and Vector Processing: CPU architectures- Von Neumann, Harvard Architecture, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing,
Array Processors.

UNIT-V **10 Lectures**

Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Cache Memory – Mapping Functions.

Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, Direct memory access.

Text Books:

1. M. Morris Mano, Computer System Architecture, Revised Pearson/PHI, 3rd Edition, 2017.
2. Carl Hamacher, Zvonks Vranesic, Safea Zaky, Computer Organization, McGraw Hill, 5th Edition, 2011.

Reference Books:

1. John. P. Hayes, Computer Architecture and Organization, McGraw Hill, 3rd Edition,2002.
2. William Stallings, Computer Organization and Architecture, Pearson /PHI, 6th Edition, 2003.

Web References:

1. https://archive.nptel.ac.in/courses/106/105/106105163/

DATA NETWORKS

(Professional Elective)

L	T	P	C
3	0	0	3

Course Code: 24EC11PE05

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand the basics of computer networks, network models, and transmission media.

CO2: Acquire the knowledge on error handling techniques, data link layer and medium access control protocols.

CO3: Interpret network layer design, congestion control, and IP addressing.

CO4: Outline the transport layer services and protocols, including TCP and UDP functionalities.

CO5: Explore the application layer protocols such as DNS, HTTP, FTP, and email communication protocols.

UNIT-I **10 Lectures**

Introduction: Uses of Computer Networks, Network Hardware and Software, Network Models-OSI &TCP/IP and its comparison, Network examples.

Physical layer: Transmission Media - Guided Transmission Media – Twisted Pairs, Coaxial Cable and Fiber Optics, Wireless Transmission – Radio, Microwave, Infrared and Light Transmission.

UNIT-II **10 Lectures**

Data Link layer: Design Issues, Error Detection and Correction, Elementary Data Link Protocols - A simplex protocol, A simplex stop and wait protocol for an error-free channel and noisy channel, Sliding Window Protocols - A one-bit sliding window protocol, A protocol using Go-Back-N and Selective Repeat, Example data link protocols.

Medium Access Sub-layer: Channel Allocation Problem, Multiple Access Protocols - ALOHA, IEEE Standard 802 for LANs – Ethernet, Comparison of 802.11, 802.15 and 802.16.

UNIT-III **10 Lectures**

Network layer: Design Issues, Network Devices and their Functions, Congestion Control – Approaches, Traffic Throttling, Load Shedding and Traffic Shaping, Internetworking, Internet Protocol- Comparison of IPV4 and IPV6 ,Classes of IP address.

UNIT-IV **09 Lectures**

The Transport Layer: The Transport Service, Elements of Transport Protocols – Connection Management, The Internet Transport Protocols: UDP and TCP – TCP Segment Header, TCP Connection Management, TCP Congestion Control.

UNIT-V **09 Lectures**

The Application Layer: The Domain Name System (DNS), Electronic Mail - Simple Mail Transfer Protocol (SMTP), Internet Message Access Protocol (IMAP), The World Wide Web – Hyper-Text Transfer Protocol (HTTP), Protocols: Simple Network Management Protocol (SNMP), File Transfer Protocol (FTP), Telnet.

Text Books:

1. A. S. Tanenbaum, Computer Networks, 5th Edition, Pearson, 2013.
2. Behrouz A. Forouzan, Data Communications and Networking, 4th Edition, Tata McGraw Hill, 2007.

Reference Books:

1. R. P. Suri and J. K.Jain, Computer Networking Terminology Products and Standards, Tata McGraw Hill, 1995.

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1. https://youtube.com/playlist?list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up&si=9grw7webJA_wgeTU
2. https://www.youtube.com/watch?v=sG6WGvzmVaw
3. https://youtube.com/playlist?list=PLBlnK6fEyqRgMCUAG0XRw78UA8qnv6jEx&si=GwbA1NsObgOgq-kr
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-263j-data-communication-networks-fall-2002/lecture-notes/

DIGITAL IMAGE PROCESSING

(Professional Elective)

Course Code: 24EC11PE06

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Illustrate the fundamental concepts of Digital Image Processing.

CO2: Perform basic Image transforms on an image.

CO3: Analyze the effect of spatial and frequency domain filtering of images.

CO4: Evaluate the methodologies for image restoration and reconstruction, and illustrate the fundamental concepts of image compression.

CO5: Categorize and illustrate different image segmentation techniques and morphological image operations.

UNIT-I **10 Lectures**

Introduction: Uses of digital image processing, fundamental steps in digital image processing, components of an image processing system, digital image fundamentals, imaging sensing and acquisition, image sampling and quantization. Some basic relationships between pixels, and
introduction to the mathematical tools used in digital image processing, color image fundamentals.

UNIT-II **10 Lectures**

Image Transforms: Need for image transforms, introduction to discrete Fourier transform (DFT) of two variables, some properties of the 2-D Discrete Fourier transform.. Discrete sine transforms. Walsh Transform. Hadamard transform, Haar Transform. Slant transforms, SVD and KL Transforms, or
Hotelling Transform

UNIT-III **08 Lectures**

Intensity Transformations and Spatial Filtering: Background, some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods.

Filtering in the frequency domain: Preliminary concepts, The Basic of filtering in the
frequency domain, image smoothing using frequency domain filters, Selective filtering, Implementation.

UNIT-IV **10 Lectures**

Image restoration and Reconstruction: A model of the image degradation/Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering,
Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations,
Estimation the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering,

constrained least squares filtering, geometric mean filtering

Image compression: Fundamentals, redundancies and their removal methods, image compression model, lossy compression, lossless compression

UNIT-V **10 Lectures**

Image segmentation: Fundamentals, point, line, edge detection, thresholding, region –based segmentation, **Image Morphology:** Morphological image processing: preliminaries Erosion and dilation, opening and closing, some Basic Morphological algorithms for boundary extraction, thinning.

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Prentice Hall, 3rd edition, 2008.
2. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, Indian Reprint, 9th Edition,2002.
3. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGraw- Hill Education.

Reference Books:

1. B.Chanda, D.Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009.

Web References:

1. https://archive.nptel.ac.in/courses/117/105/117105135/
2. https://archive.nptel.ac.in/courses/117/105/117105079/

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(Professional Elective)

Course Code: 24EC11PE07

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Explain fundamental measurement concepts and analyze various types of meters used for accurate measurements.

CO2: Utilize AC voltmeters, Electronic multimeters, and Digital voltmeters to measure and interpret electrical parameters effectively.

CO3: Operate instruments like Signal generators, Signal analyzers and Oscilloscopes for signal measurement and analysis.

CO4: Examine various bridge measurement techniques and their applications for precise measurements.

CO5: Classify various types of transducers and evaluate their advantages and disadvantages in practical measurement systems.

UNIT-I **10 Lectures**

Basic Measurement Concepts: Performance Characteristics- Error in measurement- Types of errors in measurements and their analysis- Moving coil meters - Construction, Expression for the deflecting torque and control torque, DC ammeters, DC voltmeters, Series type ohmmeter, Shunt type ohmmeter, Extension of range using shunts and series resistance- Multimeter.

UNIT-II **08 Lectures**

Basic Electronic Measurements: AC voltmeters using rectifiers, True RMS responding voltmeter, Electronic multimeter – Comparison of analog and digital Instruments – Digital voltmeter - Ramp, Stair case ramp, Dual Slope Integrating, Continuous balance, Successive approximation.

UNIT-III **12 Lectures**

Signal Generators - Standard, AF sine and square wave signal generators, Function Generator, Random noise Generator, Arbitrary waveform generators. Signal analyzers- Wave Analyzers, Harmonic Distortion Analyzer, and Spectrum Analyzer.

Cathode ray oscilloscopes – block schematic, applications –Special oscilloscopes – analog storage oscilloscope, digital storage oscilloscope and sampling oscilloscopes.

UNIT-IV **09 Lectures**

Bridge measurements – Measurement of low, medium and high resistance- Kelvin bridge, Wheat- stone's bridge- Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson bridge- Measurement of capacitance-Schering's bridge - Measurement of frequency- Wien bridge.

Q meter- principle of operation, measurement methods and sources of errors. .

UNIT-V **09 Lectures**

Transducers: Introduction-Classification of transducers- Resistive transducers- Strain Gauges- Thermistors- Thermocouples- Inductive Transducer- Linear variable differential transformer- Rotary variable differential transformer- Capacitive transducers- Piezo-electric transducers- Digital transducers

Text Books:

1. Electronic instrumentation, second edition- H.S.Kalsi, Tata McGrawHill, 2017.
2. Albert D. Helfrick and William D. Cooper – Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 2003.

Reference Books:

1. Electrical and Electronics Measurement and Instrumentation, A K Sawahney, Dhanpat Rai,2000
2. Digital and Analogue Instrumentation, Nihal Kularatna, IET Publishers, 2003.
3. Electronic Measurements & Instrumentation - Oliver B.M. & Cage – Tata McGraw Hill, 1975

Web References:

1. https://www.youtube.com/playlist?list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio
2. https://www.youtube.com/playlist?list=PLC7B26029C4E955FA

EMBEDDED SYSTEMS

(Professional Elective)

Course Code: 24EC11PE08

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Recognize the main parts of an embedded system like memory, firmware, sensors, and interfaces.

CO2: Illustrate the key features and design methods of embedded systems, showing how hardware and software work together.

CO3: Explain how to write firmware and understand the basics of real-time operating systems like task handling and synchronization

CO4: Explore tools used in embedded system development, such as IDEs, debuggers, and hardware connections.

CO5: Summarize how embedded systems are used in real life, such as in cars, hospitals, robots, and wireless networks.

UNIT-I **10 Lectures**

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components.

UNIT-II **09 Lectures**

Characteristics and Program Modelling: Characteristics and Quality Attributes of Embedded Systems, Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Hardware Software Co-Design, Hardware Software Trade-offs.

UNIT-III **12 Lectures**

Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages

Real-Time Operating System (RTOS): Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS

UNIT-IV **08 Lectures**

The Embedded System Development Environment: The Integrated Development Environment (IDE), Types of Files Generated on Cross compilation, Disassembler/DE compiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

UNIT-V **09 Lectures**

Applications of Embedded Systems: Mobile phone, Automotive Electronics, RFID, Wireless Sensor Networks, Robotics, Biomedical application, Brain Machine Interface.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.

Reference Books:

1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2. Das, Lyla B, Embedded Systems: An Integrated Approach . Pearson Education India, 1st Edition,2013.

FIBRE OPTIC COMMUNICATION

(Professional Elective)

Course Code: 24EC11PE09

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Illustrate the constructional parameters of optical fibres.

CO2: Summarize the various losses due to attenuation, absorption, scattering and bending.

CO3: Understanding the various materials, fiber connectors and fiber splicing.

CO4: Differentiate various optical sources and detectors and choose suitable one for different applications.

CO5: Outline different techniques to improve the capacity of the optical link design system

UNIT-I **10 Lectures**

Overview of optical fibre communication - Historical development, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, **Cylindrical fibers**- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers,

Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems.

UNIT-II **10 Lectures**

Fiber materials:- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay.

Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, Related problems.

UNIT-III **08 Lectures**

Optical fiber connectors and Fiber splicing -Connector types, Single mode fiber connectors, Connector return loss, Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints

Fiber optics Concentrators - Introduction to concentrators, Types of concentrators and applications of concentrators

UNIT-IV **10 Lectures**

Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies, Reliability of LED&ILD.

Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors, Related problems.

UNIT-V **10 Lectures**

Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit, Analog receivers.

Optical system design - Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples, Line coding in Optical links, WDM, Necessity, Principles,
Measurement of Attenuation and Dispersion, Eye pattern.

Text Books:

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.

Reference Books:

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005.
2. Fiber Optic Communications – Joseph C. Palais, Pearson Education, 4th Edition, 2004.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_ee79/preview

FPGA DESIGN

(Professional Elective)

Course Code: 24EC11PE10

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand the basics about FPGA and Programmable devices

CO2: Build design examples like Universal block, Memory, Floating point multiplier and Barrel shifter using PLDs

CO3: Model Xilinx , Vertex , Altera FPGAs and CPLDs

CO4: Make use of FPGA building blocks for measuring performance metrics

CO5: Utilize routing terminology for architectural measures in FPGA

UNIT-I **08 Lectures**

Introduction to FPGAs: Evolution of programmable devices, FPGA Design flow, Applications of FPGA.

UNIT-II **08 Lectures**

Design Examples Using PLDs: Design of Universal block, Memory, Floating point multiplier, Barrel shifter.

UNIT-III **10 Lectures**

FPGAs/CPLDs: Programming Technologies, architectures of FPGAs -Xilinx's Vertex and Spartan, Actel's FPGA, Altera's FPGA/CPLD.

UNIT-IV **10 Lectures**

Building blocks of FPGAs/CPLDs: Configurable Logic block functionality, Routing structures, Input/output Block, Impact of logic block functionality on FPGA performance, Model for measuring delay.

UNIT-V **12 Lectures**

Routing Architectures: Routing terminology, general strategy for routing in FPGAs, routing for row – based FPGAs, introduction to segmented channel routing, routing for symmetrical FPGAs, example of routing in a symmetrical FPGA, general approach to routing in symmetrical FPGAs, independence from FPGA routing architectures, FPGA routing structures. FPGA architectural assumptions, the logic block, the connection block, connection block topology, the switch block, switch block topology, architectural assumptions for the FPGA

Text Books:

1. Stephen D.Brown, Robert J. Francis, Jonathan Rose, Zvonko G. Vranesic, Field Programmable Gate Arrays, Springer, 2nd Edition, 1992.
2. Data sheets of Artix-7, Kintex-7, Virtex-7.

Reference Books:

1. John V. Old Field, Richrad C. Dorf, Field Programmable Gate Arrays, Wiley, 2008.

Web References:

1. https://www.youtube.com/playlist?list=PL301FC12E3E501514

GLOBAL POSITIONING SYSTEM

(Professional Elective)

Course Code: 24EC11PE11

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Explain the history, evolution and development of the GPS system.

CO2: Describe the working principles of GPS.

CO3: Compare GPS with other global satellite constellations like GLONASS and GALILEO.

CO4: Illustrate the GPS system segments, signal structure and navigation data components.

CO5: Interpret different coordinate systems used in GPS.

UNIT-I **10 Lectures**

Introduction to GPS: Global Position System, the History of GPS, the Evolution of GPS, Development of NAVSTAR GPS, Block I, Block II satellites, Block IIA, Block IIR and Block II R- M satellites.

UNIT-II **10 Lectures**

GPS Working: Principal Trilateration, Determination of where the satellites are, Determination of how far the satellites are, Determining the receiver position in 2D or X-Y Plane, Determining the receiver position in 3D or X-Y-Z Plane, basic equations for finding user position, user position determination with least squares estimator

UNIT-III **10 Lectures**

GPS Satellite constellation and Signal Structure: GPS system segments, Space segment, Control segment, User segment, GPS Signals.

Pseudorandom noise (PRN) code, C/A code, P code Navigation data, Signal structure of GPS.

UNIT-IV **10 Lectures**

Other Global Satellite Constellation: GLONASS, GALILEO, Comparison of 3GNSS (GPS, GALILEO, GLONASS) in terms of constellation and services provided.

UNIT-V **08 Lectures**

Coordinate Systems: Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 system.

Text Books:

1. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010.
2. Pratap Mishra, Global positioning system: signals, measurements, and performance, Ganga- Jamuna Press, 2010

Reference Books:

1. Scott Gleason and Demoz Gebre-Egziabher, GNSS Applications and Methods, Artech House, 685 Canton Street, Norwood, MA 02062, 2009.
2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).
3. B.Hoffmann- Wellenhof, GPS theory and practice, Springer, 5th Edition, 2001

Web References:

1. https://archive.nptel.ac.in/courses/105/107/105107194/

LOW POWER VLSI DESIGN

(Professional Elective)

Course Code: 24EC11PE12

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand the basics about Low power VLSI design

CO2: Build MOS, Bi-CMOS, Deep Sub-micron processes and Lateral BJT on SOI processes

CO3: Develop Advanced MOSFET models and characterization of sub-half micron MOS devices

CO4: Make use of CMOS and Bi-CMOS logic gates for Merged CMOS digital circuits and performance evaluation.

CO5: Analyse the behaviour of Low voltage Low power digital circuits and quality measures for Latches and Flip-Flops

UNIT-I **08 Lectures**

Low Power Design, An Over View: Introduction to low- voltage low power design, limitations, Silicon-on-Insulator.

UNIT-II **10 Lectures**

MOS/ Bi CMOS Processes: Bi CMOS processes, Integration and Isolation considerations, Deep submicron processes, SOI CMOS, lateral BJT on SOI, future trends and directions of CMOS/ Bi CMOS processes.

UNIT-III **10 Lectures**

Device Behavior and Modeling: Advanced MOSFET models, limitations of MOSFET models, bipolar models.

Analytical and Experimental characterization of sub-half micron MOS devices, MOSFET in a Hybrid mode environment.

UNIT-IV **10 Lectures**

CMOS and Bi-CMOS Logic Gates: Conventional CMOS and Bi CMOS logic gates. Merged BiCMOS digital circuits-Circuit construction and analysis, Performance evaluation and comparison.

UNIT-V **10 Lectures**

Low- Voltage Low Power Logic Circuits: ESD-free Bi CMOS, Digital circuit operation and comparative Evaluation. Low Power Latches and Flip Flops, Evolution of Latches and Flip flops- quality measures for latches and Flip flops.

Text Books:

1. CMOS/BiCMOS ULSI low voltage, low power by Yeo Rofail / Goh (3 Authors)-Pearson Education ,2011.

Reference Books:

1. Digital Integrated circuits, J.Rabaey PH. N.J 1996
2. CMOS Digital ICs, sung-moKang and yusufleblebici, TMH, 3rd edition, 2003

Web References:

1. https://www.youtube.com/watch?v=9SnR3M3CIm4&list=PL018645397D9487AF

RADAR ENGINEERING

(Professional Elective)

Course Code: 24EC11PE13

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Summarize the basic concepts of Radar, equation and factors influencing radar range equation.

CO2: Illustrate the different types of radars and understand the detection criteria for different parameters.

CO3: Identify the fixed and moving targets using different types of radar systems. Analyze Tracking Radar.

CO4: Assess the block diagrams of Synthetic Aperture Radar (SAR), Phased array Radars and others.

CO5: Categorize the different radar transmitters and receivers and identify the different types of display devices & duplexers used in radar receivers.

UNIT-I **10 Lectures**

Introduction to Radar: Introduction Nature of Radar, Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Related Problems.

Radar Equation: Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise and SNR, Integration of Radar Pulses, Radar Cross Section of Targets (simple targe ts -sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, Radar Antenna Parameters, System Losses and Propogation Effects (qualitative treatment). Related Problems

UNIT-II **10 Lectures**

CW and Frequency Modulated Radar: Doppler Effect, CW Radar Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Measurement Errors, Multiple Frequency CW Radar.

UNIT-III **10 Lectures**

MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter,

Delay Line Cancellers - Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance. Non-coherent MTI, MTI versus Pulse Doppler Radar.

UNIT-IV **08 Lectures**

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar - Amplitude Comparison Monopulse (one- and two- coordinates), Low angle tracking, Pulse compression, Block diagram of Synthetic Aperture Radar (SAR), Phased array radars, MST Radars, ECM, ECCM.

UNIT-V **10 Lectures**

Detection of Radar Signals in Noise: Introduction, Matched Filter Receiver, Detection criteria, Constant False Alarm Rate Receiver, Information from RADAR Signals, Basic Radar Measurements, Pulse Compression, Target Recognition.

Radar Receivers: Noise Figure and Noise Temperature, Displays-types, Receiver Duplexers and Receiver Proctectors, Circulators as Duplexers.

Text Books:

1. Introduction to Radar Systems – Skolnik, McGraw Hill 2007
2. Radar Engeneering and Fundamentals of Navigation Aids,G.S.N Raju,IK International Publishers,2008

Reference Books:

1. Principles of Modern Radar: Basic Principles – Mark A. Richards, James A. Scheer, William A. Holm, Yesdee.
2. Radar Principles – Peebles, Jr., P.Z., Wiley, New York, 1998.

Web References:

1. Principles and Techniques of Modern Radar Systems - Course

RTL DESIGN VERIFICATION

(Professional Elective)

Course Code: 24EC11PE14

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand the verification flow, Simulations and language Subsets

CO2: Construct Queues, Strings, Blocks, Arrays using test bench components

CO3: Make use of Test bench to realize mail box, semaphores and Inter Process communication

CO4: Develop test bench using Object Oriented Programming

CO5: Build Functional coverage, Coverage sampling, Assertions, Randomization using testbench

UNIT-I **08 Lectures**

Introduction to Verification: Verification flow, define and differentiate between verification and testing, simulation-cycle based, event-based simulations, directed test case and random test case generation, Synthesis and verification language subsets

UNIT-II **08 Lectures**

Test bench Architecture: Review of Packages and $unit, Interface, Mod-port, casting-static and dynamic casting, Configurable test benches, Structured tests, Reading and Writing data files, Program blocks, Clocking domains in Interface, Final blocks, Dynamic Arrays, Associative arrays, Queues and Strings, test bench architecture and test bench components

UNIT-III **10 Lectures**

System Verilog Process Synchronization: Fork—join variants for dynamic processes, Built-in mailbox classes, Built-in semaphore classes, Enhanced event data types, Test-bench using mailbox, semaphores and event, basic Testbench using Inter process communication

UNIT-IV **12 Lectures**

System Verilog OOPs: System Verilog's class data type, defining class objects, Class methods, Class inheritance, Aggregate class, Abstraction class, Polymorphism, Virtual methods, Virtual classes, Encapsulation, Public and private classes, Extending class definitions (inheritance), Virtual methods, Virtual classes, Public and private classes, Test bench using object oriented programming

UNIT-V **10 Lectures**

System Verilog Constrained Random Value Generation, Functional Coverage and Assertions: Built-in System Verilog random classes, defining constrained random values, constrained random verification methodologies, system Verilog code coverage and functional coverage, Defining and constructing cover groups, Defining cover points and coverage bins, Coverage sampling, Cross

coverage. Assertion concepts, Immediate and concurrent assertions, Assertion sequence definitions Test-bench using constrained randomization, coverage. and Assertions.

Text Books:

1. Chris Spears, "System Verilog for Verification", 3rd Edition, Springer, 2012.
2. Practical guide for system Verilog assertions srikanth vijayaraghvan and mayappan ramanadhan

Reference Books:

1. System Verilog assertions bencohan
2. System Verilog assertions and functional coverage Ashok B Mehta

SATELLITE COMMUNICATION

(Professional Elective)

Course Code: 24EC11PE15

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand the orbital aspects and sub systems used in satellite communication.

CO2: Analyze the satellite propagation characteristics and understand the basic subsystems of satellite communications.

CO3: Understand the concepts of launch vehicles and designing of satellite uplink and downlinks.

CO4: Analyse coding and spread spectrum techniques used in satellite communication systems.

CO5: Choose appropriate multiple access technique for a given satellite communication application.

UNIT-I **10 Lectures**

Introduction and orbital aspects of satellite communications: A brief history of satellite communications, Orbital mechanics, Kepler's laws of planetary motion, Locating the satellite in the orbit, Locating the Satellite with respect to the earth, Orbital elements, look angle determination, Orbital perturbations, launches and launch vehicles, Orbital effects in communication System performance.

UNIT-II **10 Lectures**

Satellite Subsystems: AOCS, TT&C, power system, spacecraft antenna, transponder, Friis transmission equation.

Propagation Characteristics: Attenuation and Noise, Frequency Bands, Satellite Transponders

UNIT-III **09 Lectures**

Satellite link design: Introduction, Basic transmission theory, System noise temperature and G / T ratio. Design of uplink and down link models, Design of satellite links for specified C / N ratio.

Earth stations: Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power, test methods.

UNIT-IV **09 Lectures**

Low earth orbit and non-geo stationary satellite systems: Introduction, Orbit consideration, coverage and frequency considerations, Delay and Throughput considerations, System considerations, Operational NGSO constellation Designs

UNIT-V **10 Lectures**

Multiple Access: Frequency Division Multiple Access (FDMA), Intermodulation, Calculation of C/N. Time Division Multiple Access (TDMA), Frame structure, burst structure, Satellite Switched TDMA on board processing, Demand Assignment Multiple Access (DAMA) – Types of Demand Assignment, Characteristics, CDMA Spread Spectrum Transmission and Reception.

Text Books:

1. Satellite Communications- Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE,Wiley Publications, John Wiley & Sons, 3rd Edition, 2021.
2. Satellite Communications- Dennis Roddy, McGraw Hill, 4th Edition, 2017.

Reference Books:

1. Satellite Communications: Design Principles- M. Richharia, BS Publications, 2nd Edition, 2003.
2. Digital Satellite Communications-Tri. T. Ha, MGH, 2nd Ed.,1990.
3. Satellite Communication Engineering- Wilbur L. Pritchand, Robert A Nelson and Henri G.Suyderhoud, Pearson Publications, 2nd Edition, 1993.

Web References:

1. https://archive.nptel.ac.in/courses/117/105/117105131/
2. http://acl.digimat.in/nptel/courses/video/117105131/L29.html

STATISTICAL DATA ANALYSIS

(Professional Elective)

Course Code: 24EC11PE16

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Analyze the statistical data using various graphical techniques and compute the key descriptive measures to interpret the distribution, spread, and shape of a dataset.

CO2: Analyze the distribution functions and estimate the parameters to make a decision in real time applications.

CO3: Compute the sampling distribution of means, variance, and the difference of two means and construct a confidence interval to estimate population mean.

CO4: Draw inference by a test of hypothesis concerning means, variances, and proportions.

CO5: Utilize the method least squares to fit a curve like straight line, parabola, exponential function and interpret the coefficient of correlation to find the relationship between the variables.

UNIT-I **08 Lectures**

DESCRIPTIVE STATISTICS: Introduction to Statistics – Populations and Samples – Data Analysis – Graphical Representation – Scatter Plot – Stem and Leaf plot – Histograms - Box plot – Measures of Central tendency – Measures of Dispersion - Coefficient of variation - Standard Deviation of combination of two groups – Moments - Skewness - Kurtosis.

Application: Statistical Descriptors of an image-invariant moments, statistical descriptors of a time series and analysis.

(Sections: 1 and 6 of Chapter 1 of Text Book 1, 25.5 – 25.11 of Text Book 2)

UNIT-II **12 Lectures**

PROBABILITY DISTRIBUTIONS IN PRACTICAL SCENARIOS: Random variable, Distribution function, Density function, Mathematical Expectation and Variance of random variables, Types of Distributions and applications: Uniform distribution-Product dispensed by a machine, Exponential distribution-Time to failure of electrical system, Normal distribution-Academic issue of assessing the class performance, Binomial distribution-Proportion defective in industrial processes, Poisson distribution-Call connection issue in telecommunications, Gamma Distributions-survival rate in biomedical experiments, Weibull Distribution-Failure rate of an electronic component, Lognormal Distribution-Concentration of pollutants produced by chemical plant, Beta Distribution- Estimating completion times in project management (PERT analysis), More examples.

(Chapters 5 and 6 of Book 1, Chapter 3 and 4 of Reference Book 2)

UNIT-III **10 Lectures**

SAMPLING DISTRIBUTIONS AND ESTIMATION: Populations and Samples – Statistic, Parameter - Sampling Distributions – Sampling Distribution of means – Central Limit Theorem – Sampling Distribution of Difference of Two means.

t- Distribution - Sampling Distribution of Variance - χ^2- distribution – F- Distribution. Estimation: Point Estimation – Unbiased Estimator – Standard Error of Point Estimate - Interval Estimation – Estimating the mean, Proportion (Single Sample).

(Sections: 1 - 7 of Chapter 8 of Text Book 1, 1 – 7, 10 of Chapter 9 of Text Book 1)

UNIT-IV **10 Lectures**

TESTS OF HYPOTHESIS: Statistical Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning single mean – Test concerning Two means – Paired t- test – Tests Concerning Single and Two Proportions – Tests Concerning Variances – Goodness of Fit test.

(Sections: 1 – 5, 8 – 11 of Chapter 10 of Text Book 1)

UNIT-V **08 Lectures**

CURVE FITTING AND CORRELATION: Curve Fitting - Method of Least Squares – Straight Line - Parabola – Exponential – Power curves. Correlation – Correlation coefficient – Lines of Regression.

(Sections: 24.4 – 24.6, 25.12 – 25.14 of Text Book 2)

Text Books:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineers and Scientists, 9th Edition, Pearson Publications, 2023.
2. B. S. Grewal, Higher Engineering Mathematics, 45th Edition, Khanna Publishers, 2024.

Reference Books:

1. Richard A. Johnson, “Miller I. & Freund’s J. E., Probability and Statistics for Engineers”, 8th Edition, PHI Learning India Private Limited, 2011.
2. Douglas C Montgomery and George C Runger, Applied statistics and probability for engineers, 5th edition, John Wiley & sons,2010.

Web References:

1. https://archive.nptel.ac.in/courses/111/105/111105090/
2. https://nptel.ac.in/courses/111102160
3. http://nptel.ac.in/courses/110106064

BASIC VLSI DESIGN

(Open Elective)

Course Code: 24EC11EL01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand the behaviour and characteristics of MOS transistor

CO2: Outline the electrical properties of MOS transistor

CO3: Make use of MOS layers for implementation of Layout and Symbolic diagrams

CO4: Build MOS circuits based on circuit parameters like Resistance, Capacitance, Delay and Model MOS circuits using scaling Parameters

CO5: Develop Combinational and sequential digital applications using Sub system design approach

UNIT-I **08 Lectures**

Review of microelectronics and an introduction to MOS technology: Introduction to IC technology, MOS and related VLSI technology, Basic MOS transistors, Enhancement and Depletion mode Transistor action. NMOS, CMOS and BiCMOS fabrication.

UNIT-II **10 Lectures**

Basic Electrical Properties of MOS Circuits: Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, MOS Transistor
circuit model,Latch-up in CMOS circuits, Bi-CMOS Inverter.

UNIT-III **10 Lectures**

MOS and BiCMOS circuit design processes: MOS layers, Stick diagrams, Design rules and layout2μm Double Metal, Double Poly, CMOS rules, 1.2μm Double Metal, Single Poly CMOS rules. Layout Diagrams of CMOS inverter, NAND and NOR gates, Symbolic diagrams.

UNIT-IV **10 Lectures**

Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Choice of layers.

Scaling Of MOS Circuits: Scaling models, Scaling factors for device parameters, Limitations of scaling.

UNIT-V **10 Lectures**

Sub system design and Layout: Architectural issues, Switch logic, Gate logic, Examples of Structural design (Combinational logic): Parity Generator, Multiplexers. Clocked sequential circuits-
Two phase clocking, Dynamic Shift register. Sub system design process, Design of ALU subsystem, some commonly used storage elements.

Text Books:

1. Essentials of VLSI Circuits and Systems by Kamran Eshraghian,Douglas A, Pucknell, and Sholeh Eshraghian, PHI, 3rd Edition, 2005.

Reference Books:

1. Mead, C.A and Conway, LA, “Introduction to VLSI Systems”, Addison-Wesley, Reading, Massachusetts, l980.
2. Digital Integrated Circuits, Jan M.Rabaey, AnanthaChandrakasan and Borivoje Nikolic, 2nd edition, 2016.

Web References:

1. https://www.youtube.com/watch?v=9SnR3M3CIm4&list=PL018645397D9487AF
2. https://www.youtube.com/watch?v=Dvwq2eueNZk&list=PL5PDqJ5saHRIrtX-hGiAZzNrjX1MiU3q

BASICS OF SIGNAL PROCESSING

(Open Elective)

Course Code: 24EC11EL02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Explain the fundamentals of signal processing and classify signals and systems.

CO2: Apply Fourier, Laplace, and Z-transforms to analyze signals and systems.

CO3: Illustrate the concepts of sampling, aliasing, and quantization in signal processing.

CO4: Interpret the response of Linear Time-Invariant (LTI) systems using convolution and transfer functions.

CO5: Develop and implement filters for analog and digital systems.

UNIT-I **11 Lectures**

Basics of signal processing: Introduction to signal processing, Applications of Signal processing in different domains, Signal and System classification, Discrete - Time Signals – Sequences, Linear Shift – Invariant Systems, Stability and Causality, Linear Constants – Coefficient Difference Equations.

UNIT-II **12 Lectures**

Fourier Analysis - Continuous-time Fourier Transform (CTFT), Discrete-time Fourier Transform (DTFT), Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Frequency response of systems.

Laplace and Z-Transforms: Laplace transform for continuous-time signals and systems, Z-transform for discrete-time signals and systems, Relationship between Laplace and Z-transforms, Analysis of discrete-time systems using Z-transform, Stability analysis of discrete-time systems.

UNIT-III **09 Lectures**

Sampling and Reconstruction: Sampling Theorem: Nyquist-Shannon sampling theorem, Aliasing: Understanding and avoiding aliasing,

Quantization: Effects of quantization on signal representation, Reconstruction: Techniques for reconstructing signals from samples.

UNIT-IV **08 Lectures**

Linear Time-Invariant (LTI) Systems: - Convolution: Convolution in time domain, Convolution in frequency domain, System Response: Impulse response and step response. Frequency response and transfer function.

UNIT-V **08 Lectures**

Basics of Filtering: Filter types (e.g., low-pass, high-pass, band-pass, band-stop), Filter characteristics (e.g., cutoff frequency, gain, phase), Filter Structures: Direct form, cascade form, parallel form.

Text Books:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Will sky and Hamid Nawab.,Pearson, 2nd Edn. 2015.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI, 3rd Edition, 2009.

Reference Books:

1. Signals and Systems- Simon Haykin and Van Veen, Wiley 2nd Edn. 2007.
2. Signals and Systems-A.Anand Kumar, PHI, Third Edition, 2013.
3. Signals and Systems – P. Ramesh Babu and R. Ananda Natarajan 4th Edn, 2011.
4. Digital Signal Processing "A – Computer Based Approach", Sanjit K. Mitra, Tata Mc Graw Hill, 4th Edition, 2013.

Web References:

1. https://youtube.com/playlist?list=PLyqSpQzTE6M8KJXQ1m2vl3nd2ZUqKEN8&si=NpJ6Dm x6cxGgChXt
2. https://archive.nptel.ac.in/courses/108/101/108101174/
3. https://nptel.ac.in/courses/117102060

DATA COMMUNICATION

(Open Elective)

Course Code: 24EC11EL03

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand the functions of Data communication Networks and Protocol Suites

CO2: Identify and classify different types of Transmission Media in data communication

CO3: Analyze Various Types of Multiplexing techniques

CO4: Emphasizes Basic Principles of Wireless Communications Systems

CO5: Explore various Data Communication devices and their functions

UNIT-I **12 Lectures**

INTRODUCTION TO DATACOMMUNICATION AND NETWORKING: Standards Organizations for Data Communication, Layered Network Architecture, Open Systems Interconnection, Data Communication Circuits, Serial and parallel Data Transmission, Data Communication Networks, Alternate Protocol Suites

UNIT-II **10 Lectures**

TRANSMISSION MEDIA: Metallic Transmission Lines, Guided Media Twisted-Pair Cable Coaxial Cable Fiber-Optic Cable , Unguided Media: Wireless Radio Waves , Microwaves, Infrared

UNIT-III **08 Lectures**

ANALOG AND DIGITAL TRANSMISSION METHODS: Amplitude Modulation, Frequency Modulation, Phase Modulation , Pulse Code Modulation (PCM), Amplitude Shift Keying , Frequency Shift Keying , Phase Shift Keying, Quadrature Amplitude Modulation

MULTIPLEXING SYSTEMS: Time Division Multiplexing, Frequency Division Multiplexing, Wavelength-Division Multiplexing Network. Information Capacity, Bits, Bit Rate, Baud rate

UNIT-IV **10 Lectures**

WIRELESS COMMUNICATIONS SYSTEMS: Electromagnetic Radiation, Optical Properties of Radio Waves, Terrestrial Propagation of Electromagnetic Waves, Skip Distance, Free-Space Path Loss, wireless channels for Communications

UNIT-V **08 Lectures**

DATA COMMUNICATION EQUIPMENT: Introduction To DCE, DTE , Difference Between DTE and DCE, Types of Data Communication Equipment's : Modems, Network Switches, Routers, Bridges, Gateways and Hubs

Text Books:

1. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education First Edition, 2024.
2. Data Communications and Networking, Behrouz A. Forouzan, McGraw Hill, Sixth Edition, 2022.

Reference Books:

1. Data and Computer communications,8/e,William Stallings, Prentice Hall, 2007
2. Computer Communications and Networking Technologies, Michael Gallo, William Hancock, Brooks/Cole, 2001.

Web References:

1. https://youtu.be/QY6K1G_UypM
2. https://youtu.be/eFiEKu8gl_w

MICROPROCESSOR & CONTROLLERS WITH INTERFACING

(Open Elective)

Course Code: 24EC11EL04

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Course Outcomes: At the end of the Course, the student shall be able to

CO1: Comprehend the architecture and working of 16 bit microprocessor 8086.

CO2: Apply assembly language programming skills to perform arithmetic, logical and string operations with 8086.

CO3: Develop applications involving interfacing of various peripherals with 8086 microprocessor.

CO4: Analyze the architecture and working of 8-bit microcontroller 8051

CO5: Develop 8051 microcontroller based standalone applications for societal needs.

UNIT-I **09 Lectures**

Introduction: Difference between Microprocessor and Microcontroller, Features of a Microprocessor, Von Neumann and Harvard Architecture, RISC and CISC Instruction Set

8086 Microprocessor: Main features, internal architecture, register organization, pin diagram/ description, Memory Organization, Deriving the System Bus, minimum mode and maximum mode configuration

UNIT-II **09 Lectures**

8086 Programming: Addressing Modes, Instruction Set, Assembler Directives, simple programs with an assembler, interrupts and interrupt response

UNIT-III **12 Lectures**

8086 Interfacing: Semiconductor memory interfacing, Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, Interfacing Stepper Motor. Interfacing 8251 USART, Interfacing DMA Controller, Interfacing 8259 PIC

UNIT-IV **09 Lectures**

8051 Architecture: Introduction to microcontrollers, Architecture, Register Organization, 8051 pin description, basic connections, I/O ports, memory organization, Interrupt Control, Power Control, Timers/Counters, Serial Communication.

UNIT-V **09 Lectures**

8051 Programming and Interfacing: Addressing modes, Instruction Set, Programs using Interrupts, Timers and Serial Communication, Interfacing switches and LEDS, Interfacing seven segment displays, Interfacing Stepper Motor.

Text Books:

1. A.K Ray, K.M.Bhurchandhi," Advanced Microprocessor and Peripherals", Tata McGraw Hill Publications, 2000
2. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay; Pearson 2-Edition, 2011

Reference Books:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 2017
2. The 8051 Microcontroller & Embedded Systems Using Assembly and C by Kenneth J.Ayala, Dhananjay V.Gadre, Cengage Learning , 1st edition, 2010.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_ee11/preview (Microprocessors and Interfacing)
2. https://onlinecourses.nptel.ac.in/noc22_ee12/preview (Microprocessors and Microcontrollers)