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 ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech Electrical and Electronics 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
24BC11RC01	BS	Green Chemistry	3	0	30	70	100	3
24EC11RC03	ES	Basic Electronics Engineering	3	0	30	70	100	3
24EE11RC01	ES	Fundamentals of Electrical Engineering	3	0	30	70	100	3
24BP11RC02	BS	Engineering Physics Lab	0	3	50	50	100	1.5
24BC11RC02	BS	Green Chemistry Lab	0	3	50	50	100	1.5
24CT11RC05	ES	IT Essentials 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
24HE11RC01	HSS	English	3	0	30	70	100	3
24CT11RC02	ES	Problem Solving Using C	3	0	30	70	100	3
24EE11RC03	ES	Electrical Circuits – 1	3	0	30	70	100	3
24EE11RC04	ES	Thermal & Hydro Prime Movers	3	0	30	70	100	3
24HE11RC02	HSS	Communication Skills Lab	0	3	50	50	100	1.5
24CT11RC04	ES	Problem Solving Using C Lab	0	3	50	50	100	1.5
24EE11RC05	ES	Electrical Engineering Workshop	0	3	50	50	100	1.5
							Total Credits	**19.5**

COURSE STRUCTURE

(Applicable for the Academic Year 2024-25 onwards)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech Electrical and Electronics Engineering

SCHEME AND SYLLABI

(With effect from 2024-25 admitted batch

II Year - I Semester

Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24BM11RC03	BS	Complex Variables and Statistical Methods	3	0	30	70	100	3
24CT11RC06	ES	Python Programming	3	0	30	70	100	3
24EC11RC14	PC	Analog and Digital Circuits	3	0	30	70	100	3
24EE11RC06	PC	Electrical Circuits 2	3	0	30	70	100	3
24EE11RC07	PC	Electrical Machines 1	3	0	30	70	100	3
24CT11RC07	ES	Python Programming Lab	0	3	50	50	100	1.5
24EC11RC15	PC	Analog and Digital Circuits Lab	0	3	50	50	100	1.5
24EE11RC08	PC	Electrical Circuits Lab	0	3	50	50	100	1.5
24EE11SC01	SC	Skill Oriented Course 1 Design of Electrical Circuits using Software Tools	1	2	50	50	100	2
24HM11MC01	MC	Professional Ethics and Human Values	2	0	-	100	100	0
24EE11SW01	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
24EE11RC09	PC	Electrical Machines 2	3	0	30	70	100	3
24EE11RC10	PC	Electrical Measurements	3	0	30	70	100	3
24EE11RC11	PC	EMF Theory	3	0	30	70	100	3
24EE11RC12	PC	Power Systems 1	3	0	30	70	100	3
24EE11RC13	PC	Electrical Machines 1 Lab	0	3	50	50	100	1.5
24EE11RC14	PC	Electrical Measurements Lab	0	3	50	50	100	1.5
24EE11SC02	SC	Skill Oriented Course 2 - Electrical CAD	1	2	50	50	100	2
24BC11MC01	MC	Environmental Science	2	0	-	100	100	0
							Total Credits	**20**

III Year - I Semester

Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24EE11RC15	PC	Control Systems	3	0	30	70	100	3
24EE11RC16	PC	Power Electronics	3	0	30	70	100	3
24EE11RC17	PC	Power Systems 2	3	0	30	70	100	3
	PE	Professional Elective 1	3	0	30	70	100	3
	OE	Open Elective 1	3	0	30	70	100	3
24EE11RC18	PC	Controls Systems Lab	0	3	50	50	100	1.5
24EE11RC19	PC	Electrical Machines 2 Lab	0	3	50	50	100	1.5
24HE11SC01	SC	Skill Oriented Course 3- Soft Skills	1	2	50	50	100	2
24HM11MC02	MC	IPR & Patents	2	0	-	100	100	0
24EE11IN01	INT	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				
24EC11RC19	PC	Microprocessors and Microcontrollers	3	0	30	70	100	3
24EE11RC20	PC	Electric Drives	3	0	30	70	100	3
24EE11RC21	PC	Power Systems Analysis and Stability	3	0	30	70	100	3
	PE	Professional Elective 2 - MOOCS Course	3	0	30	70	100	3
	OE	Open Elective 2	3	0	30	70	100	3
24EC11RC21	PC	Microprocessors and Microcontrollers Lab	0	3	50	50	100	1.5
24EE11RC22	PC	Power Electronics Lab	0	3	50	50	100	1.5
24EE11RC23	PC	Power Systems Simulation Lab	0	3	50	50	100	1.5
	SC	Skill Oriented Course 4	1	2	50	50	100	2
24EE11SC03		Fundamentals of PLC Programming						
24CS11SC02		Data Structures using Python						
24EE11MC01	MC	Design Thinking, Innovation & Entrepreneurship	2	0	-	100	100	0
							Total Credits	**21.5**

IV Year - I Semester								
Course Code	**Category**	**Course Title**	**Hours per Week**		**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
			L	**P**				
24HM11EL01	HSS	HSS Elective	**3**	0	30	70	100	**3**
	PE	Professional Elective 3	**3**	0	30	70	100	**3**
	PE	Professional Elective 4	**3**	0	30	70	100	**3**
	PE	Professional Elective 5	**3**	0	30	70	100	**3**
	OE	Open Elective 3	**3**	0	30	70	100	**3**
	OE	Open Elective 4	**3**	0	30	70	100	**3**
	SC	Skill Oriented Course 5	**1**	**2**	50	50	100	**2**
24EE11SC04		IOT and its Applications						
24AI11SC03		Machine Learning using Python						
24EE11IN02	INT	Internship II			-	100	100	**2**
							Total Credits	**22**

IV Year - II Semester						
Course Code	**Category**	**Course Title**	**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
24EE11PR01	PROJ	Project Work	100	100	200	**14**
					Total Credits	**14**

Professional Electives for EEE	
Course Code	**Course Title**
24EE11PE01	Artificial Intelligence Applications in Power Systems
24EE11PE02	Digital Control Systems
24EE11PE03	Electrical Distribution Systems
24EE11PE04	Electrical Energy Audit and Management
24EE11PE05	Flexible AC Transmission Systems
24EE11PE06	HVDC Transmission
24EE11PE07	Hybrid Electric Vehicles
24EE11PE08	Machine Learning Applications in Electrical Engineering
24EE11PE09	Power System Operation and Control
24EE11PE10	Power System Protection
24EE11PE11	Renewable Energy Sources
24EE11PE12	Smart Grids
24EE11PE13	Special Electrical Machines
24EE11PE14	Utilization of Electrical Energy
24EC11PE16	Basics of Signals and Systems

Open Electives (OE) for EEE	
Course Code	**Course Title**
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
24EC11EL01	Basic VLSI Design
24EC11EL02	Basics of Signal Processing
24EC11EL03	Data Communication

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

Minor Engineering Courses offered by EEE Department

(Except EEE Branch)

Subjects for Minor Degree	
Course Code	**Course Title**
24EE11MN01	Basics of Smart Grids
24EE11MN02	Concepts of Power System Engineering
24EE11MN03	Electrical Vehicle Technology
24EE11MN04	Energy Conservation, Audit and Management
24EE11MN05	Power Electronics
24EE11MN06	Power Electronics Lab
24EE11MN07	Power Systems Simulation Lab

Honors Engineering Courses offered for EEE Branch Students

Subjects for Honors Degree	
Course Code	**Course Title**
Compulsory Subject	
24EE11HN11	Digital Protection of Power Systems
POOL1	
24EE11HN01	Electrical Vehicle Motor Drives
24EE11HN02	Energy Management Strategies and Communication Protocols for EV/HEV
24EE11HN03	Energy Storage Systems
24EE11HN04	EV Charging Technologies
24EE11HN05	Switched Mode Power Conversion
POOL2	
24EE11HN06	Evolutionary Algorithms Applications in Power Engineering
24EE11HN07	Power Converters for Microgrid
24EE11HN08	Power Quality
24EE11HN09	Power Systems Reliability
24EE11HN10	Restructured Power Systems
24EE11HN12	Digital Protection of Power Systems

- 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)]

Course Code: 24BM11RC01

L	T	P	C
3	0	0	3

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)

GREEN CHEMISTRY

I Year B. Tech. I semester
[Common to CSE, EEE, IT]

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

BASIC ELECTRONICS ENGINEERING

I Year B. Tech I semester

[EEE]

Course Code: 24EC11RC03

L	T	P	C
3	0	0	3

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

CO1: Brief evolution and impact of electronics. (L2)

CO2: Comprehend the characteristics of semiconductors, devices, and their applications. (L2)

CO3: Analyze the transistor operation with different biasing techniques. (L4)

CO4: Understand the characteristics of FET. (L2)

CO5: Outline the basic concepts and applications of op-amps. (L2)

UNIT-I — 10 Lectures

Introduction: Evolution and Impact of Electronics in industries and in society, Familiarization of Resistors, Capacitors, Inductors, Transformers and Cathode ray oscilloscope. [TB3: Chapter -1, RB1: Chapter -1]

Learning Outcomes:

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

1. Explain the importance of Electronics. (L2)
2. Illustrate the basic elements of Electronics. (L1)
3. Understand the basic construction and working operation of CRO. (L1)

UNIT-II — 10 Lectures

Semiconductor Diodes: Semiconductor materials- intrinsic and extrinsic types, Ideal Diode, Terminal characteristics of diodes: p-n junction under open circuit condition p-n junction under forward bias and reverse bias conditions p-n junction in breakdown region, Diode small signal model, Zener diode and applications, Rectifier Circuits. [TB1: Chapter -4,5,6]

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. (L1)

2. Describe the transport phenomena in semiconductors. (L1)
3. Understand the band structure representation of PN junction, interpret the Volt-Ampere characteristics along with the temperature effects. (L2)

UNIT-III **10 Lectures**

Bipolar Junction Transistors (BJTs): Physical structure and operation modes, Active region operation of transistor, D.C. analysis of transistor circuits, Transistor as an amplifier, Transistor as a switch: cut-off and saturation modes.

Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias. Basic BJT amplifier configuration: common emitter, common base and common collector amplifiers. [TB1: Chapter -7, Chapter -8]

Learning Outcomes:

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

1. List the various amplifier configurations. (L1)
2. Interpret the frequency response and relationship between gain and bandwidth in amplifiers. (L2)
3. Design and analyze different amplifier configurations. (L4)

UNIT-IV **10 Lectures**

Field Effect Transistor (FET): Junction Field-Effect Transistor (JFET), structure and physical operation, current-voltage characteristics, Enhance type MOSFET, Depletion-type MOSFET, D.C. operation of MOSFET circuits, Biasing in MOSFET amplifiers, Basic JFET amplifier configuration: common source, common gate and common drain types. [TB1: Chapter -12]

Learning Outcomes:

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

1. Comprehend the characteristics of BJT and FET. (L1)
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)

UNIT-V **8 Lectures**

Operation Amplifier (Op-amps): Ideal Op-amp, Differential amplifier: differential and common mode operation common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non -inverting amplifier, weighted summer, integrator, differentiator. [RB 3: Chapter -1,2]

Learning Outcomes:

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

1. Understand the basic parameters of Op-amp. (L1)
2. Illustrate the applications of Operation Amplifiers. (L2)

Text Books:

1. Integrated Electronics, Jacob Millman and C.C.Halkias, McGraw Hill, 1972.
2. Bell, D. A., Electronic Devices and Circuits, Oxford University Press.20013.

Reference Books:

1. Electronic Devices and Circuits by Salivahanan, N.Suresh Kumar andA.Vallava Raj, TMH, 2nd Edition, 1998.
2. Electronic Devices and Circuits – G.K.Mithal, Khanna Publishers, 23rd Edition, 2004.
3. Linear integrated circuit 2nd edition D. Roy Choudhary, 2017.
4. Principles of Electronics, V.K.Mehta, S.Chand Publications, 2022.

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ee143/preview
2. https://onlinecourses.nptel.ac.in/noc24_ee73/preview

FUNDAMENTALS OF ELECTRICAL ENGINEERING

I Year B. Tech. I semester

[EEE]

Course Code: 24EE11RC01

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 in electric circuits.(L2)

CO2: Apply the fundamental laws in Electrical Engineering. (L3)

CO3: Summarize the operation of various measuring instruments. (L2)

CO4: Summarize the concepts of various magnetic and dielectric materials.(L2)

CO5: Design the wiring schemes for house hold appliances using appropriate wiring components. (L2)

UNIT-I 10 Lectures

Electrical Engineering Fundamentals: Electrical circuit elements, DC sources (independent and dependent), Ohm's law, effect of temperature on resistance, temperature coefficient, Kirchhoff's laws, Power and Energy Calculations for DC circuits, Series-parallel connection of elements, Concept of Potential difference, Star - Delta conversion with R only. [TextBook-1: Chapter 1 (Pg. 1-31), Chapter 2 (Pg. 32-75), Chapter 4 (Pg. 130-147)]

Learning Outcomes:

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

1. Understand the concepts of active and passive elements. (L2)
2. Determine the power and energy for the given electrical elements. (L2)

UNIT-II 10 Lectures

Fundamental Laws of Electrical Engineering: Coulombs law of Electrostatics (1st and 2nd laws), Faradays laws of Electromagnetic induction, Concepts of self and mutual induced emfs, Fleming Left hand and Right-hand rules, Lenz's law, Biot - Savart's law, Ampere circuital law, Maxwell's corkscrew rule. [TextBook-1: Chapter 5 (Pg. 151), Chapter 7 (Pg. 217-219, 224-225), Chapter 9 (Pg. 255-270)]

Learning Outcomes:

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

1. Summarize the Basic Laws of electrostatics. (L2)

2. Understand the concepts of self and mutual induced emfs. (L2)
3. Summarize the Basic Laws of electromagnetic induction. (L2)
4. Analyse the Basic Electric Circuits. (L3)

UNIT-III **10 Lectures**

Fundamentals of Electrical Measurements (no need to explain types of errors and compensations): Classification of measuring instruments, various forces in indicating instruments (deflection, control and damping), construction and operation of MC and MI type instruments for voltage and current measurement, Construction and operation of single-phase electro dynamometer type wattmeter, Construction and operation of single-phase induction type energy meter, basic concept of digital energy meter. [TextBook-1: Chapter 25 (Pg. 670-718)]

Learning Outcomes:

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

1. Summarize different types of the Measuring Instruments. (L2)
2. Understand the operation of Measuring Instruments. (L2)
3. Summarize the various operating forces involved in the Measuring instruments. (L2)

UNIT-IV **10 Lectures**

Dielectric and Magnetic Materials: Dielectric as an electric field medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, effects of breakdown, Ferroelectric materials, properties of ferroelectric materials, spontaneous polarization, piezoelectric materials, pyroelectric materials. classification of magnetic materials, properties of ferromagnetic materials, spontaneous magnetization, magnetic anisotropy, characteristics of soft and hard magnetic materials, ageing of magnets. [TextBook-2: Chapter 5 (S-5.1-5.4), Chapter 7 (S-7.4-7.18)]

Learning Outcomes:

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

1. Understand the dielectric materials and their properties. (L2)
2. Understand the magnetic materials and their properties. (L2)
3. Summarize the knowledge on materials used in electrical applications. (L2)

UNIT-V **8 Lectures**

Electric Wiring: Symbols of various electrical equipment, Various types of conductors, conductor sizes and current ratings, Service mains, meter board and distribution board,

Types of wirings and their Installations, House wiring (one lamp-one switch, Stair case, Corridor wiring, Power wiring), Basic LT panel wiring diagram, Elementary discussion on Circuit protective devices: fuse and Miniature Circuit Breaker (MCB's). [TextBook-3: Chapter 2 (Pg.19-102), Chapter 7 (Pg. 181-220)]

Learning Outcomes:

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

1. Identify and interpret various electrical wiring symbols. (L2)
2. Acquire knowledge on different types of wiring and their installations. (L2)
3. Learn about various types of protective devices. (L2)

Text Books:

1. V. K. Mehta, Rohit Mehta, Principle of electrical Engineering and electronics, 3rd edition, S. Chand Publishing, New Delhi, 2016.
2. R.K. Rajput, A course in Electrical Engineering Materials, Laxmi Publications 2009.
3. S L Uppal and G C Garg, "Electrical Wiring, Estimating & Costing", Khanna Publishers, 2015.

Reference Books:

1. Fundamentals of Electrical Engineering Rajendra Prasad PHI Third Edition 2014.
2. V. N. Mittal and Arvind Mittal, "Basic Electrical Engineering" McGraw Hill.
3. A.K. Sawhney, A Course in Electrical and Electronics Measurements and Instruments Dhanpat Rai and Sons, Delhi, 2005.

Web References:

1. https://archive.nptel.ac.in/courses/108/105/108105153/
2. https://archive.nptel.ac.in/courses/108/105/108105112/
3. http://182.160.97.198:8080/xmlui/handle/123456789/853?show=full

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

GREEN CHEMISTRY LAB

I Year B. Tech I semester

[EEE]

Course Code: 24BC11RC02

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 experimental skills for quantitatively with accuracy analysis in acid-base titrations using suitable indicators. (L3)

CO2: Apply the principals of redox titrations Chromium (VI) by Mohr's Salt Solution in different samples. (L3)

CO3: Utilize with complex metric titrations to determine hardness of water and estimate the amount of impurities present in the samples. (L3)

CO4: Perform experiments with instrument novel materials to be used as zeolite for removal of hardness of water to acquire skills of different methods of chemical analysis. (L3)

CO5: Develop the skills of green synthesis through the preparation of a polymer/ drug. (L3)

TITLE OF THE EXPERIMENTS

1. Determination of Sodium Hydroxide with HCl (Na2CO3)Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Chromium (VI) by Mohr's Salt Solution
4. Determination of Hardness of Water sample by EDTA method
5. Zeolite column for removal of hardness of water/ Ion exchange-Method
6. Green Synthesis of Polymer/ drug
7. Determination of Oxalic Acid by Permanganometry
8. Determination of the concentration of strong acid vs strong base (by conductometric method)
9. Determination of Fe(II)/Mohr's Salt by Potassium dichromate (by redox-method)
10. Determination of Cu+2using standard hypo solution (Iodometry)
11. Estimation of chorine by using bleaching powder
12. Estimation of vitamin-C

Of the above experiments at-least 10 assessment experiments should be completed in a semester.

Text Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sirita Rattan – S. K. Kataria & Sons, New Delhi.

IT ESSENTIALS LAB

I Year B. Tech I semester
[EEE]

Course Code: 24CT11RC05

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 the peripherals of a computer. (L3)

CO2: Demonstrate the installation process of operating systems like MS Windows, LINUX. (L3)

CO3: Make use of Office suite that comprises with various applications to create documents, and captivating presentations. (L3)

CO4: Make use of Office suite that comprises with various applications to organize & analyse data. (L3)

CO5: Categorize various UNIX/LINUX Commands to work on a modern operating system and Make use of LaTeX tool to prepare research articles. (L3)

Module-1: Hardware Concepts

1. Identify the peripherals of a computer, components in a CPU and its functions.
2. Draw the block diagram of the CPU along with the configuration of each peripheral.
3. Disassemble and assemble the PC back to working condition**.**

Module-2: Software Installations and configurations

1. Install operating systems like LINUX and MS windows on a personal computer.
2. The system should be configured as dual boot with both MS windows and LINUX.

Module-3: Word and PowerPoint

1. Creating Documents: Formatting Fonts/Texts, page layout, Applying Text effects, Character Spacing, Borders and Colors, Inserting Header and Footer, equation editor.
2. Creating Power Point: Student should work on basic power point utilities and tools to create basic power point presentation. PPT Orientation, Slide Layouts, Inserting Text, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting Images, Tables and charts.

Module-4: Spreadsheets

1. Spreadsheet Orientation: Accessing, overview of toolbars, saving spreadsheet files, Using help and resources. Creating a Scheduler, Gridlines, Format Cells, Summation, auto fill, Formatting Text, Renaming and Inserting worksheets, Hyper linking.
2. Excel Calculation: Calculating Average, Cell Referencing, Excel Formula, std. deviation, Charts, Count Function, Sorting, Conditional formatting, Excel Advanced-sumif, VLOOKUP, and Pivot Table.
3. Software as a service (SaaS): Usage of online office suite.

Module-5: UNIX/LINUX Commands and LaTeX

1. Study and practice on file system, handling files with commands, syntax, usage, application.
2. Installation of LaTeX and preparation of research article.

Reference Books:

1. IT Essentials: PC Hardware and Software Companion Guide, Third Edition, David Anfinson, Ken Quamme.
2. UNIX concepts and applications by Sumitabha Das, TMH Publications.

Web References:

1. https://www.javatpoint.com/

LINEAR ALGEBRA AND VECTOR CALCULUS

I Year B. Tech. II Semester

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

L	T	P	C
3	0	0	3

Course Code: 24BM11RC02

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: **9 Lectures**

Vector Differentiation: 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: **10 Lectures**

Vector Integration : 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

ENGLISH

I Year B. Tech II Semester

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

Course Code: 24HE11RC01

L	T	P	C
3	0	0	3

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

PROBLEM SOLVING USING C

I Year B. Tech. II semester

[EEE]

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_01384323703937433634517_shared/overview
4. https://cse02-iiith.vlabs.ac.in/List%20of%20experiments.html

ELECTRICAL CIRCUITS-1

I Year B. Tech. II semester
[EEE]

Course Code: 24EE11RC03

L	T	P	C
3	0	0	3

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

CO1: Analyse the electrical networks using mesh and nodal analysis techniques. (L2)

CO2: Analyse Electrical circuits with AC excitation. (L2)

CO3: Summarize the applications of network theorems. (L2)

CO4: Summarize the concept of resonance and understand bandwidth, Q factor, and locus diagrams. (L2)

CO5: Analyze magnetic circuits and understand the concepts of graph theory. (L2)

UNIT-I **10 Lectures**

Introduction to Electrical Circuits: concepts of electrical circuit elements and their V-I relations; source transformation and Network Simplification Techniques (Series, Parallel, Series-Parallel, Star-delta transformations), Nodal analysis method, Mesh analysis method including super node and super mesh analysis. Concept of duality and dual networks. [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. Summarize the basic electrical elements and different fundamental laws. (L2)
2. Apply the Kirchhoff's Laws in solving series, parallel, non-series-parallel configurations in DC networks. (L2)
3. Understand the principle of duality and dual networks. (L2)

UNIT-II **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 – Complex and Polar Forms of Representations, j-Notation, 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 Examples. [TextBook-1: Chapter 11 (S-11.1 – S-11.7) , Chapter 9 (S-9.1 – S-9.7)]

Learning Outcomes:

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

1. Analyse the periodic and non-periodic waveforms. (L2)
2. Perform steady-state analysis of R, L, and C circuits with sinusoidal excitation. (L2)
3. Determine the power factor, reactance, impedance, and power types. (L2)

UNIT-III **10 Lectures**

Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorems, Maximum power transfer theorem, Tellegen's theorem, Compensation theorem, Milliman's theorem and Reciprocity theorem. (DC & AC with dependent and independent Excitations).

[TextBook-1: Chapter 4 (S-4.1 – S-4.8), Reference Book-2: Chapter 4 (S-4.1 – S-4.10)]

Learning Outcomes:

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

1. Analyse the circuits using theorems for DC Excitation. (L2)
2. Analyse the circuits using theorems for AC Excitation. (L2)
3. Summarize the applications of theorems. (L2)

UNIT-IV **10 Lectures**

Resonance and locus Diagrams: Series and parallel resonance circuits, concept of band width and Q factor.

Locus diagram: RL, RC, RLC with R, L and C variables. [TextBook-2: Chapter 16 (S-16.1– S-16.4)]

https://ggsestc.digimat.in/nptel/courses/video/108105065/L06.html

Learning Outcomes:

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

1. Understand the principles of series and parallel resonance in electrical circuits. (L1)
2. Apply the resonance concepts to analyse the electrical circuits. (L2)
3. Interpret the locus diagrams for RL, RC, and RLC circuits. (L2)

UNIT-V **8 Lectures**

Coupled circuits: Concept of self and mutual inductance, Dot convention, Coefficient of coupling, Analysis of Series and Parallel Magnetic Circuits with mutual inductance.

Network Topology: Basic concepts of Graph theory, incident matrix, tie-set matrix and cut-set matrix. [TextBook-1: Chapter 13 (S-13.1 – S-13.6), Reference Book-2: Chapter 9 (S-9.1 – S-9.6), Chapter 3 (S-3.1 – S-3.8)]

Learning Outcomes:

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

1. Understand the self and mutual inductance and apply the dot convention in coupled circuits. (L1)
2. Analyse series and parallel magnetic circuits with mutual inductance. (L2)
3. Apply Graph Theory to solve the electrical circuits. (L2)

Text Books:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 6th Edition, 2017.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 8th Edition, 2012.

Reference Books:

1. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition.
2. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018.
3. Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and K. Rao, Mc Graw Hill Education, 2010, Fifth Edition.

Web References:

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

THERMAL AND HYDRO PRIME MOVERS

I Year B. Tech. II semester
[EEE]

Course Code: 24EE11RC04

L	T	P	C
3	0	0	3

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

CO1: Classify internal combustion engines& boilers and assess the performance. (L2)

CO2: Analyse the various Vapour Power Cycles. (L3)

CO3: Analyze the different methods for improving the efficiency of gas turbines. (L4)

CO4: Determine the forces acting on the stationary & moving vanes and summarize the operation of pumps. (L3)

CO5: Summarize the working of various types of hydraulic turbines. (L2)

UNIT-I **10 Lectures**

I.C Engines: Classification, Basic idea of IC engine, Parts in IC engine, working principle of 2-stroke & 4-Stroke engines, Valve Timing Diagram, Port Timing Diagram, Comparison of 4 Stroke & 2 Stroke engine, Petrol Engine and Diesel Engine, Engine performance evaluation.

Boilers: Classification of Boilers, Simple Vertical Boiler, Cochran Boiler, Babcockand Wilcox Boiler, Benson Boiler. Difference between Fire Tube and Water Tube Boilers, Boiler Mountings and Accessories. [Text Book-1: Chapter 23 (S-23.1 – S-23.14, S-23.39), Chapter 11 (S-11.1 – S-11.3, S-11.6-11.8), Chapter 12 (S-12.1 – S-12.3)]

Learning Outcomes:

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

1. Understand the construction and working principles of 2 stroke and 4 stroke I. C engines using petrol and diesel. (L2)
2. Evaluate the performance parameters of I. C. engines. (L3)
3. Summarize the construction and working principles of fire tube and water tube boilers. (L2)

UNIT-II **10 Lectures**

Properties of Steam and use of Steam Table: T-S and H-S Diagrams. Analysis of Various Thermodynamic Processes under gone by Steam.

Vapour Power Cycles: Carnot Cycle-Rankine Cycle- Thermodynamic Variables Effecting Efficiency and output of Rankine Cycle-. Analysis of simple Rankine Cycle.

Schematic layout of steam power plant. [Text Book-1: Chapter 2 (S-2.1 – S-2.18), Chapter 15 (S-15.1 – S-15.2)]

Learning Outcomes:

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

1. Analyse the properties of Steam by using Steam Tables- T-S and H-S Diagrams. (L3)
2. Understand the working of various vapour power cycles, layout of steam power plant. (L2)
3. Summarize the variables effecting the efficiency and output of rankine cycle (L3)

UNIT-III **10 Lectures**

Gas Turbines: Simple gas turbine plant-ideal cycle, closed cycle, open cycle-. Efficiency, Work ratio and optimum pressure ratio for simple gas turbine cycle. Actual cycle, analysis of simple cycles & cycles with inter cooling, reheating and Regeneration. [Text Book-1: Chapter 25 (S-25.1 – S-25.6)]

Learning Outcomes:

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

1. Understand the working of various gas turbine plant cycles. (L2)
2. Analyse the performance parameters for gas turbine cycle. (L3)
3. Summarize the different methods for improving the efficiency of gas turbines. (L4)

UNIT-IV **10 Lectures**

Impact of Jets on Vanes: Impulse momentum equation, Impact of Jet on stationary and moving vanes (flat and curved).

Pumps: Types of pumps, Centrifugal pumps: Main components, Working principle, Multi stage pumps, Performance and Characteristic curves. [Text Book-2: Chapter 17 (S-17.1 – S-17.4.4), Chapter 19 (S-19.1 – S-19.2, S-19.6, S-19.10)]

Learning Outcomes:

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

1. Apply impulse momentum equations to find the forces acting on the vanes. (L3)
2. Understand the working of centrifugal pump and its types. (L2)
3. Summarize the Performance Characteristics of the pumps. (L2)

UNIT-V **8 Lectures**

Hydraulic Turbines: Classifications of turbines; Working principle of Pelton turbine, Francis turbine, Kaplan turbine, Efficiency calculation, Governing of turbines, Performance and characteristic curves, working of hydroelectric power plant. [Text Book-2: Chapter 18 (S-18.1 – S-18.9, S-18.13 – S-18.14)]

Learning Outcomes:

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

1. Understand the working of hydroelectric power plant, hydraulic turbines. (L2)
2. Evaluate the performance parameters of hydraulic turbine. (L3)
3. Summarize the performance characteristics of hydraulic turbine. (L2)

Text Books:

1. Thermal Engineering by Rajput, Lakshmi publications.
2. R.K. Bansal, Fluid Mechanics and Hydraulic Machines, 10th Edition, Laxmi Publications, 2018.

Reference Books:

1. A Textbook of Thermal Engineering By RS Khurmi | JK Gupta.
2. “Hydraulics & Fluid Mechanics”, P.N. Modi and S.M. Seth, text books House, Delhi.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_me33/
2. https://archive.nptel.ac.in/courses/112/103/112103249/

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

PROBLEM SOLVING USING C LAB

I Year B. Tech. II semester

[EEE]

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_0138432370393 7433634517_shared/overview
4. https://cse02-iiith.vlabs.ac.in/List%20of%20experiments.html

ELECTRICAL ENGINEERING WORKSHOP

I Year B. Tech. II semester
[EEE]

Course Code: 24EE11RC05

L	T	P	C
0	0	3	1.5

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

CO1: Identity, select, and troubleshoots the house wiring components. (L3)

CO2: Troubleshoot electrical appliances such as tube light, fan and domestic pump. (L3)

CO3: Develop house wiring schemes using protective equipment like MCB and ELCBs. (L3)

CO4: Design Go-down wiring /Tunnel wiring and hospital wiring schemes. (L3)

CO5: Measure the Basic Electrical Parameters using suitable instruments. (L3)

List of experiments:

1. Demonstration of electrical safety measures
2. Identification of various electrical tools and symbols
3. Identification of various electrical cables/wires, switches, fuses, fuse carriers, MCB, ELCB, RCCB, and MCCB with their specifications and use.
4. Wiring of lighting circuit using two-way control (Stair case wiring)
5. Godown wiring / tunnel wiring.
6. Hospital wiring
7. Measurement of voltage, current, power in DC circuits.
8. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and energy meter for calculating power and power factor.
9. Wiring of backup power supply for domestic installation including inverter, battery and load.
10. Troubleshooting of domestic electrical equipment's (tube light, fan)
11. Wiring and troubleshooting of domestic pump motor with DOL starter.
12. Demonstration of moving iron, moving coil, dynamometer, and induction type measuring instruments.
13. Identification of various types of resistors, and capacitors and understand the usage of digital multi-meter.

COMPLEX VARIABLES AND STATISTICAL METHODS

II Year B. Tech. I Semester

[EEE]

L	T	P	C
3	0	0	3

Course Code: 24BM11RC03

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: Determine the mean and variance of discrete and continuous random variables and identify various types of discrete and continuous distributions like Binomial, Poisson and Normal [L5].

CO4: Compute the sampling distribution of means, variance, and the difference of two means and construct a confidence interval to estimate population mean [L3].

CO5: Draw inference by a test of hypothesis concerning means, variances, and proportions [L4].

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 1)

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 1)

UNIT–III **10 LECTURES**

RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS : Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions. (Sections: 3.7, 4.1, 4.2, 4.6, 5.1, 5.2, 5.5 of Text Book 2)

UNIT – IV **08 LECTURES**

SAMPLING THEORY: Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Introduction to t, χ^2 and F-distributions.

Estimation – Point and Interval estimations – Maximum error of estimate.

(Sections: 6.1-6.4, 7.1 -7.2, 10.1 of Text Book 2)

UNIT – V **10 LECTURES**

TESTS OF HYPOTHESIS : Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – paired t- test - Tests Concerning Variances – Tests on proportions.

(Sections: 7.4 – 7.6, 8.1 – 8.4, 9.2 -9.3, 10.2 – 10.3 of Text Book 2)

TEXT BOOKS:

1. **B. S. Grewal**, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2024.
2. **Miller and Freund's,** Probability and Statistics for Engineers, Pearson, 7th edition, 2015.

REFERENCE BOOKS:

1. **R K Jain and SRK Iyengar**, Advanced Engineering Mathematics, Narosa Publishers, 5th Edition, 2016.
2. **J. W. Brown and R. V. Churchill**, Complex Variables and Applications, 9th edition, Mc-Graw Hill, 2013.
3. **S.C. Gupta and V.K. Kapoor**, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons Publications, 2012.
4. **Shron L.Myers, Keying Ye, Ronald E Walpole**, Probability and Statistics Engineers and the Scientists, 8th Edition, Pearson 2007.
5. **Sheldon, M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4thEdition, Academic Foundation,2011

PYTHON PROGRAMMING

II Year B. Tech. I Semester

[EEE]

Course Code: 24CT11RC06

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 historical development, necessity, applications, and basic concepts of python programming. (L2)
- **CO2:** Identify and implement appropriate control structures to solve a particular programming problem. (L3)
- **CO3:** Examine various data structures and apply to solve real world problems. (L3)
- **CO4:** Build simple functions and packages used in python for solving real world problems. (L3)
- **CO5:** Outline Object Oriented concepts in python and illustrate Exception handling. (L2)

UNIT-I **8 Lectures**

Introduction: History of Python, Need of Python Programming, Applications of Python, Variables, Assignment, Comments, Keywords, Data types, Input-Output, Indentation. [TextBook-1: Chapter 3 (S-3.1 – S-3.12)]

UNIT-II **10 Lectures**

Operators and Expressions: Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations, Control Flow- if, if-elif-else, for, while, break, continue, pass [TextBook-1: Chapter 3 (S-3.12), Chapter 4 (S-4.1 – S-4.7)]

UNIT-III **10 Lectures**

Data Structures: Strings, Lists, Tuples, Sets, Dictionaries. Data Structures manipulations - create, Index, Negative indexing, Slicing, update, add elements, delete or remove elements, operations, Comprehension, Membership Test, Iteration. [TextBook-1: Chapter 6 (S-6.1 – S-6.9), Chapter 8 (S-8.1 – S-8.6)]

UNIT-IV **10 Lectures**

Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Lambda Functions, Function Returning Values, Built-in functions, Scope of the Variables in a Function - Global and Local Variables.

Modules: Creating modules, import statement, from…import statement, namespaces. Python packages: Introduction to PIP, Installing Packages via PIP [TextBook-1: Chapter 5 (S-5.1 – S-5.8,5.12)]

UNIT-V **10 Lectures**

Object Oriented Programming (OOP) in Python: Classes and Objects, Class Method and self-Argument, The __init() Method (The Class Constructor), Class Variables and Object Variables, Public and Private Data Members, Inheritance, Overriding Methods.

Error and Exceptions: Introduction to Errors and Exceptions, Handling Exception, try except block, finally block, Raising Exceptions.

File Handling: Type of files, Opening and Closing files, Reading and Writing files.

TextBook-1: Chapter 9 (S-9.1 – S-9.8), Chapter 10 (S-10.1 – S-10.3)

TextBook-1: Chapter 7 (S-7.1 – S-7.5), Chapter 12 (S-12.1 – S-12.10)

Textbooks:

1. Reema Thareja, “Python Programming: Using Problems Solving Approach”, Oxford University Press, 2017
2. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.

Reference Books:

1. Fundamentals of Data Structures using Python, P Lalitha Surya Kumari, P. S. Avadhani, Lambert Academic Publishing
2. Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Web References:

1. https://www.tutorialspoint.com/python3/python_tutorial.pdf
2. https://www.python.org/doc/

ANALOG AND DIGITAL CIRCUITS

II Year B. Tech. I semester

[EEE]

L	T	P	C
3	0	0	3

Course Code: 24EC11RC14

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

CO1: Extend the applications of diode to nonlinear wave shaping and applications of transistors (BJT) to multistage configuration.

CO2: Classify feedback amplifiers, oscillators and explain the functionality of those circuits.

CO3: Make Use of number systems, codes, Boolean algebra and minimization techniques to develop various combinational logic circuits using logic gates.

CO4: Utilize the concept of latches and flip-flops to Construct sequential logic circuits like counters, registers using flip-flops.

CO5: Construct various types of DAC and ADC circuits using op-amp.

UNIT-I **08 Lectures**

Simple Diode Circuits: Diode clippers, clipping at two independent levels, Clamping operation, clamping circuits using diode with different inputs.

Multistage Amplifiers: Need of cascading, coupling schemes: Direct, RC, Transformer coupling, Two stage RC Coupled Amplifier – Frequency Response. Calculation of Band Width of Single and Multistage Amplifiers.

UNIT-II **10 Lectures**

Feedback Amplifiers: Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies: Voltage Series, Current Series , Voltage Shunt and Current Shunt feedback Amplifiers diagrams and their characteristics

Sinusoidal & Non sinusoidal Oscillators: Condition for oscillations – RC Phase Shift**,** Hartley, Colpitts**,** Crystal Oscillator, OP-Amp based Square wave generator , triangular wave generator, Schmitt trigger.

UNIT-III **12 Lectures**

Review of Number systems: decimal, binary, octal , hexadecimal & conversion , BCD codes,

Graycode, Signed number representation ,binary subtraction using two's complement method. Logic gates, Boolean postulates, Demorgan's theorem, minterms, Maxterms , K-map up to 4 variables.

Combinational Logic Circuits: Half adder, full adder, half subtractor, full subtractor, Multiplexers, De multiplexers, Encoders, Decoders.

UNIT-IV **10 Lectures**

Sequential Circuits: SR-latch, Flip flops: RS, JK, D, T and Master slave flip flops. Shift registers-data transmission in shift registers-SISO, SIPO, PISO, PIPO, Asynchronous counters- 2-bit Ripple counters, Mod-6 counter, Synchronous counters- 3 bit up-down counter, Johnson counter, ring counter.

UNIT-V **08 Lectures**

D/A Conversion and A/D Conversion: Introduction, sample and hold circuit, basic DAC techniques- weighted resistor, R-2R ladder, inverted R-2R ladder, A-D converters- Flash type, the counter type, successive approximation, DAC/ADC specifications.

Text Books:

1. Milliman's Pulse Digital L And Switching Waveforms 3ED, McGraw Hill Education,2017.
2. Millman's Integrated Electronics - Analog and Digital Circuit and Systems | 2nd Edition,2017.
3. Anand Kumar, Switching Theory and Logic Design. PHI, 3rd Edition 2016.
4. Linear Integrated Circuits- D. Roy Chowdhury, New Age International(p) Ltd,7th Edition,2025.

Reference Books:

1. Pulse and Digital Circuits, A. Anand Kumar, PHI, second edition, 2005.
2. G.K.Mithal, Electronic Devices and Circuits, Khanna Publishers, 23rd Edition, 2004.
3. Fundamentals of Logic Design, Charles. R. Roth, Thomson Publications,5th Edition,2004.
4. Microelectronics, Jacob Millman, Arvin Grabel, McGraw Hill Education; 2nd edition, 2017.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_ee106.
2. https://onlinecourses.nptel.ac.in/noc24_ee140.
3. https://nptel.ac.in/courses/108105132 (Digital Electronic Circuits)
4. https://onlinecourses.nptel.ac.in/noc24_ee147/preview (Digital Circuits)
5. https://nptel.ac.in/courses/117105080 (Digital Systems Design)

ELECTRICAL CIRCUITS 2

II Year B. Tech. I Semester
[EEE]

L	T	P	C
3	0	0	3

Course Code: 24EE11RC06

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

CO1: Summarize various Two- Port Network parameters.

CO2: Analyse the transient behaviour of electrical networks for different excitations.

CO3: Analyse the balanced and unbalanced 3 phase circuits.

CO4: Apply the concept of Fourier analysis to electrical systems.

CO5: Design of various filter circuits.

UNIT-I **10 Lectures**

Two port network parameters: Concept of two port networks - Impedance parameters, Admittance parameters, Hybrid parameters, Transmission (ABCD), Inverse parameters - inter-relationships, Conditions for Reciprocity and Symmetry, Series, Parallel and Cascade connection of two port network**s** - Numerical problems

UNIT-II **10 Lectures**

Transient Analysis: Evaluation of Initial conditions, Transient response of R-L, R-C and R-L-C circuits (Series and parallel combinations) for D.C and sinusoidal excitations -- Solution using differential equation approach and Laplace transform approach**.**

UNIT-III **10 Lectures**

Polyphase circuits: Introduction- Balanced and unbalanced circuits

Balanced Three phase circuits: Phase sequence- Star and delta Connection - Relation between line and phase voltages and currents in balanced systems-Analysis of balanced three phase circuits - Measurement of Active and Reactive power - Single Wattmeter method.

Unbalanced Three phase circuits: Analysis of Three Phase unbalanced circuits - Loop Method, Star Delta Transformation Technique - Two Wattmeter Method for measurement of three phase power.

UNIT-IV **10 Lectures**

Fourier analysis: Fourier theorem- Trigonometric form and exponential form of Fourier series - conditions of symmetry- line spectra and phase angle spectra - Application to simple Electrical Circuits.

Fourier Transforms: Fourier Integrals and Fourier Transforms - properties of Fourier Transforms and Application to simple Electrical Circuits.

UNIT-V **10 Lectures**

Filters: Classification of filters - Low pass, High pass, Band pass and Band Elimination filters, Constant-k filters -Low pass and High Pass - Band Width, frequency response characteristics, quality factor, attenuation factor - Design of filters**.** (Qualitative treatment only)

Text Books:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 6th Edition, 2017.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 8th Edition, 2012.

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

Web References (e-Resources):

1. https://archive.nptel.ac.in/courses/117/106/117106108/
2. https://archive.nptel.ac.in/courses/108/105/108105159/

ELECTRICAL MACHINES 1

II Year B. Tech. I Semester
[EEE]

L	T	P	C
3	0	0	3

Course Code: 24EE11RC07

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

CO1: Summarize the construction, principle of operation and analyze the characteristics of DC generators.

CO2: Outline the principle of operation of DC motor and analyze the performance of DC machines.

CO3: Analyze losses and efficiency of DC machines and the operation of single-phase transformers.

CO4: Analyze the performance of transformers and autotransformers.

CO5: Summarize the three phase transformer connections and phase conversion methods.

UNIT-I **10 Lectures**

DC Generators: Constructional features of DC Machines - armature windings - Lap and wave windings - Simplex and multiplex windings - Principle of operation - E.M.F Equation. Armature reaction - Cross-magnetizing and de-magnetizing - Ampere-turns per pole - Compensating winding - Commutation - Reactance voltage - Methods of improving commutation - Types of DC Machines - Methods of excitation - Separately excited and self-excited generators - Build-up of E.M.F - Magnetizing Characteristics - Critical field resistance and critical speed - Causes for failure to self-excite and remedial measures. Load characteristics of shunt, series, and compound generators - Numerical problems

UNIT-II **10 Lectures**

DC MOTORS: Force on current carrying conductor - Torque Equation - Power developed by armature - Characteristics of DC motors - Separately excited motor - Shunt Motor - Series Motor - Compound Motor - Starting of DC motors - Starters - Speed control of DC motors -Shunt and Series Motor - Losses and efficiency of DC machine - Numerical problems

UNIT-III **10 Lectures**

TESTING OF DC MACHINES: Brake test - Swinburne's test - Hopkinson's test - Retardation test - Efficiency, Separation of iron and frictional losses - Numerical problems.

TRANSFORMERS: Principle of operation and constructional details of single-phase transformers - Equivalent circuit - Transformer on no-load and load - Phasor diagram - Losses, efficiency and voltage regulation - Numerical problems

UNIT-IV **10 Lectures**

TESTING OF TRANSFORMERS: Testing - open circuit and short circuit tests - polarity test - back to back test - separation of hysteresis and eddy current losses - transformer cooling - Parallel operation of single-phase transformers - Autotransformers - comparison with two winding transformers - Numerical problems.

UNIT-V **10 Lectures**

THREE-PHASE TRANSFORMERS: Construction - types of connection and their comparative features - Phase conversion - Three/Two phase conversion (Scott connection) - Numerical problems.

Text Books:

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.
3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.

Web References (e-Resources):

1. https://nptel.ac.in/courses/108/105/108105155/
2. https://nptel.ac.in/courses/108/102/108102146/
3. https://nptel.ac.in/courses/108/105/108105017/

PYTHON PROGRAMMING LAB

II Year B. Tech. I Semester

[EEE]

Course Code: 24CT11RC07

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 core programming basics and various Operators of Python. (L2)

CO2: Implement programs using conditional statements and loops and strings. (L3)

CO3: Develop functions and strings to perform simple tasks. (L3)

CO4: Make use of various data structures like lists, tuples, sets and dictionaries. (L3)

CO5: Implement Python programs with files, Classes and objects. (L3)

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.
4. Write a program to demonstrate the inbuilt Math function

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 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.)

Module-4: Looping/Iterative Statements

1. Implement the following programs using while loop and for loop

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

   iii. Print different patterns using loops:

2. Demonstrate the following control transfer statements in Python with suitable examples.
   i. break ii. continue iii. Pass

Module-5: 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.

Module-6: 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.
   vii. Formatting feedback for display. viii. Summarizing feedback.

Module-7: 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. Employee Performance: You have a list of employee names and their corresponding performance scores. Write a program to sort the list based on the performance scores in descending order.
4. Sales Analysis: you have a list of sales figures for the past week. Write a program to find the total sales, the highest sale, the lowest sale, and the average sale.
5. Write a program to calculate the length of each element in a list using map function in python.

Module-8: 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.

4. Course Enrolment: Write a program to create list of tuples where each tuple contains the course ID and the number of students enrolled and find the total number of students enrolled across all courses
5. Faculty Information: Write a program to create a list of tuples where each tuple contains the faculty ID, name, and department and find all faculty members in a given department.
6. Library Book Tracking: You have a list of tuples where each tuple contains the book ID, title, and number of copies available. Write a program to find all books with fewer than 5 copies available.

Module-9: 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 generate a dictionary that contains numbers (between 1 and n) in the form of (x,x*x).
3. Write a program to implement a shopping cart where you can add items with their prices and quantities, and then calculate the total cost.
4. 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-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.

Module-11: Files

1. Write a program to copy the contents of a file to another file.
2. Write a program to compute the number of characters, words and lines in a 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. Design a Python program to manage inventory, process orders, and handle customer information for an online store.

2. Create a library system to track books, manage member accounts, and handle book loans and returns.
3. Implement a personal finance management tool to track income, expenses, and generate monthly reports.
4. Create a system to manage student grades, calculate GPAs, and generate academic reports.
5. Develop a Python-based movie recommendation system using collaborative filtering.
6. Build a to-do list application that allows users to add, update, delete, and prioritize tasks..
7. Build a patient management system to handle appointments, medical records, and billing.
8. Design a digital menu for a restaurant with options for ordering, bill generation, and inventory management.
9. Implement a fitness tracking application to log workouts, track progress, and suggest exercise plans.
10. Build a secure online voting platform with user authentication and vote tallying.
11. Create a program to manage recipes, including ingredients, instructions, and nutritional information.
12. Build a travel planning application to manage itineraries, bookings, and budget tracking.
13. Develop an e-learning application with course creation, student enrolment, and progress tracking.
14. Build a car rental management system to handle bookings, returns, and vehicle maintenance.
15. Build a budget planning application to track expenses, income, and financial goals.
16. Develop a cryptocurrency tracking application to monitor prices, market trends, and portfolio performance.

Reference Books:

1. Python Programming: Using Problem Solving Approach by Reema Theraja , Oxford publications
2. Ashok N Kamthane, Amit Ashok Kamthane, Programming and Problem Solving with Python, 1st Edition, McGraw Hill Education (India), 2018.

Web References:

1. https://www.python.org/doc/
2. https://www.w3schools.com/python/python_reference.asp
3. https://thepythonguru.com/
4. https://www.programiz.com/python-programming

ANALOG AND DIGITAL CIRCUITS LAB

II Year B. Tech. I Semester
[EEE]

L	T	P	C
0	0	3	1.5

Course Code: 24EC11RC15

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

CO1: Develop applications of Diode and op-Amp IC 741

CO2: Design various amplifier circuits and oscillator circuits.

CO3: Verify the functional behavior of different logic gates and Flip-flops

CO4: Make use of Digital ICs to design combinational and sequential logic circuits.

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

List of the Experiments

I. Implement the following experiments using Hardware equipment

1. Design Clipper & Clamper circuits
2. Design Voltage shunt feedback amplifier.
3. Design RC-Phase shift oscillator
4. Design and verify Op-amp as Wave form generator.

II. Simulate the following experiments using any ECAD software tools

5. Design two stage RC-Coupled Amplifier to find frequency response characteristics
6. Design Colpitts oscillator.

III. Implement the following experiments using Hardware digital trainer kit

7. Experimentally verify truth tables of different Logic Gates.
8. Verify the functionality of Decoders & Multiplexers.
9. Experimental realization of Flip – flops.
10. Design of 4-bit Ripple counters.
11. Design and verify Up down counter.
12. Experimental verification of 4 - bit Shift-register

ELECTRICAL CIRCUITS LAB

II Year B. Tech. I Semester
[EEE]

Course Code: 24EE11RC08

L	T	P	C
0	0	3	1.5

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

CO1: Experiment with electrical circuits using Network Theorems
CO2: Evaluate two port network parameters
CO3: Examine the time response for first order circuits
CO4: Demonstrate the concept of resonance and determine the parameters of coupled coils
CO5: Determine three phase active & reactive powers for any type of loads

List of the Experiments

Note: Any 10 of the experiments are to be conducted

1. Verification of Kirchhoff's laws.
2. Verification of Thevenin's theorem and Norton's theorem
3. Verification of superposition theorem and reciprocity theorems.
4. Verification of Maximum Power Transfer theorem.
5. Verification of Millman's theorem
6. Two Port Network Parameters.
7. Time response of first order RC / RL network for periodic Signals / Inputs - Time constant and Steady state error determination.
8. Series and Parallel Resonance.
9. Measurement of Active Power for Star and Delta connected loads.
10. Measurement of reactive Power for Star and Delta connected loads.
11. Measurement of coefficient of coupling for a coupled coil.
12. Measurement of choke coil parameters.

DESIGN OF ELECTRICAL CIRCUITS USING ENGINEERING SOFTWARE

II Year B. Tech. I Semester
[Skill Course: EEE]

Course Code: 24EE11SC01

L	T	P	C
1	0	2	2

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

CO1: Acquire the knowledge of creating project files in Matlab/ Simulink software and basic programming skills.

CO2: Verify various network theorems using Matlab/ Simulink

CO3: Simulate and analyse two port networks using Matlab/ Simulink

CO4: Develop the various rectifier circuits using Matlab/Simulink

CO5: Analyze the Performance and speed control techniques DC shunt motors.

List of the Experiments

Note: All experiments are to be conducted

1. Introduction to MATLAB, MATLAB help system, Simulink Tools.
2. Verification of network theorems using MATLAB/Simulink.
    a. Verification of ohm's law.
    b. Verification of KVL & KCL.
    c. Verification of Thevenin's Theorem.
    d. Verification of Norton's Theorem.
    e. Verification of Maximum Power Transfer Theorem.
    f. Verification of Superposition Theorem.
    g. Verification of Reciprocity Theorem.
3. Verification of Two-port Network Parameters using MATLAB/Simulink.
4. Verification of Half-Wave Rectifier, observe the waveforms and calculate average value, RMS value, form factor and ripple factor using MATLAB/Simulink.
5. Verification of Full-wave Centre Tapped Rectifier, observe the waveforms and calculate average value, RMS value, form factor and ripple factor using MATLAB/Simulink.
6. Verification of Full-wave Bridge Rectifier, observe the waveforms and calculate average value, RMS value, form factor and ripple factor using MATLAB/Simulink.
7. Performance Analysis of DC Shunt motor using MATLAB/Simulink
8. Speed Control of DC Shunt motor using MATLAB/Simulink.

Case Studies: The students should select any one of the following case studies and submit the report at the end of the semester.

#The programs/experiments can be drafted to make the student acquainted with the latest concepts Related to Electrical Engineering from the following#.

1. Basic noise filtering in electrical signals - Implement a simple Low Pass and High Pass filters.
2. Modelling and performance analysis of transformer using simulation tools.
3. Harmonic Analysis for non-sinusoidal wave forms.
4. Transient and steady state response of first and second order electrical circuits.
5. AC Power analysis (real, reactive and apparent power) - Simulate an AC circuit and observe power calculations.
6. Power Factor Correction Simulation - Model an inductive load with a capacitor to improve power factor.
7. Develop MATLAB code to generate 2-D and 3-D plots and analysis.

Reference Books:

1. MATLAB and Simulation Books NI Engineering Signals and Systems, 2nd edition
2. Introduction to MATLAB for Engineers William J. Palm III.

Web References (e-Resources):

1. MATLAB Programming for Numerical Computation, NPTEL, SWAYAM Portal.

PROFESSIONAL ETHICS AND HUMAN VALUES

II Year B. Tech. II 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

ELECTRICAL MACHINES 2

II Year B. Tech. II Semester
[EEE]

Course Code: 24EE11RC09

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 construction and principle of operation of three phase induction machines.
CO2: Analyze the performance and outline the starting methods and speed control methods of three-phase induction motor.
CO3: Outline the principle of operation and analyze the performance of Alternators.
CO4: Analyze the operation of synchronous machines.
CO5: Outline the principle of operation of various single phase machines

UNIT-I **10 Lectures**

THREE PHASE INDUCTION MOTORS: Construction details of Squirrel cage and Slipring induction motors - Production of rotating magnetic field (RMF) - Principle of operation - Rotor frequency, EMF, current and power at standstill and during operation - Power flow diagram - Losses and efficiency - Rotor power input, rotor copper loss and mechanical power developed and their inter-relationship - equivalent circuit - phasor diagram

UNIT-II **10 Lectures**

CHARACTERISTICS OF INDUCTION MACHINES: Torque equation - expressions for maximum torque and starting torque - Torque-slip characteristic - crawling and cogging, operating characteristics of Induction motors - Brake test - No load and blocked rotor test - circle diagram for predetermination of performance - Starting of Induction motors using DOL starter, Rheostat/reactor starter, Auto-transformer starter, Star-Delta starter, and Rotor Resistance starter, - Torque and Power calculations - Applications - Induction generator - principle of operation.

SPEED CONTROL METHODS: Voltage control - Frequency control - Pole changing - Rotor resistance control - Cascading, and rotor EMF injection method

UNIT-III **10 Lectures**

POLYPHASE SYNCHRONOUS GENERATORS

Constructional Features of round rotor and salient pole machines - Armature windings - Integral slot and fractional slot windings - Distributed and concentrated windings - distribution, pitch and winding factors - E.M.F Equation - Armature reaction - leakage reactance - synchronous reactance and impedance - Phasor diagram - open circuit, short circuit and zero power factor characteristics.

Voltage regulation of Alternators using EMF, MMF and ZPF methods - Salient-pole synchronous machine - Two-reaction theory - Determination of direct axis reactance and quadrature axis reactance of salient-pole machines.

UNIT-IV **12 Lectures**

PARALLEL OPERATION OF ALTERNATORS: Synchronization of alternators - Parallel operation of two-alternators - Parallel operation of Synchronous Generator to infinite bus, sharing of real and reactive powers - Power-angle characteristics of synchronous machines - synchronizing power and torque -Power factor control of Alternators - Applications.

SYNCHRONOUS MOTORS: Principle of operation - starting methods - phasor diagram - effect of changing load and changing excitation on machine performance - V and Inverted 'V' curves - Hunting - Damper winding - Power developed by synchronous motor.

UNIT-V **08 Lectures**

SINGLE PHASE MACHINES: Single phase Induction motors: Constructional Features - Double-field revolving theory - Principle of operation of Split-phase, capacitor start, capacitor start and run, shaded pole machines.

Text Books:

1. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. M G Say, The performance and Design of Alternating Current Machines, 3rd edition, CBS Publishers & Distributors, New Delhi, 2002.
3. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

Web References (e-Resources):

1. https://archive.nptel.ac.in/courses/108/105/108105131/

ELECTRICAL MEASUREMENTS

II Year B. Tech. II Semester
[EEE]

Course Code: 24EE11RC10

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 various errors working principles of various electrical measuring instruments

CO2: Calculate the values of unknown resistance, inductance and capacitance using bridge

CO3: Demonstrate the working of Potentiometers and Instrument Transformers

CO4: Demonstrate the working of different Transducers

CO5: Analyze digital meters and CRO measurement principles.

UNIT-I: **10 LECTURES**

Measuring Instruments - Extension of range of MC and MI instruments (only) - Electrostatic voltmeters - Construction - Connection types - Torque equation - Errors and compensations - Dynamometer type wattmeter - Torque equation and errors and its compensation - LPF wattmeters - Energy Meters for Single Phase and Poly Phase - Errors and Compensation in energy meters - Power Factor Meters - Frequency Meters (electrical resonance type and mechanical resonance type) - Weston Type - Synchro Scope - Numerical Problems

UNIT-II: **10 LECTURES**

MEASUREMENT OF RESISTANCE, INDUCTANCE AND CAPACITANCE

DC Bridges: Classification of Resistances - Detectors - Measurement of Resistance - Wheatstone bridge - Kelvin's double bridge - Loss of charge method - Megger and Numerical Problems.

AC Bridges: Measurement of inductance and quality factor - Maxwell's bridge - Hay's bridge - Anderson's bridge - Measurement of capacitance and loss angle - De Sauty's bridge - Schering bridges (for high voltage also) - Measurement of frequency using Wien's bridge - Wagner's Earthing device - Numerical Problems

UNIT III: **10 LECTURES**

POTENTIOMETERS AND INSTRUMENT TRANSFORMERS

Potentiometers: Principle and operation of D.C. Crompton's potentiometer - Standardization - A.C. Polar and Co-Ordinate Type Potentiometers - Applications - measurement of Impedance - Calibration of Ammeters and Voltmeters - Wattmeter's and Numerical Problems.

Instrument Transformers: Current Transformer and Potential Transformer - construction - phasor diagram - errors - applications and Numerical Problems.

UNIT-IV: **10 LECTURES**

TRANSDUCERS: Definition, Classification, Resistive, Inductive and Capacitive Transducer, LVDT, Strain Gauge, Thermistors, Thermocouples, Piezoelectric and Photo Diode Transducers, Hall effect sensors, Numerical Problems.

UNIT-V: **10 LECTURES**

CRO & DIGITAL METERS

CRO: Introduction - Block diagram - Measurement of Voltage and Currents - Measurement of phase difference - Frequency using Lissajous patterns, Numerical Problems.

Digital meters: Digital Voltmeters - Successive approximation DVM - Ramp type DVM and Integrating type DVM - Digital frequency meter - Digital multimeter - Digital tachometer - Q meter.

Text Books:

1. A.K. Sawhney, A Course in Electrical and Electronics Measurements and Instruments DhanpatRai and Sons, Delhi, 2005. (CO1 to CO5)
2. D.V.S. Murthy, "Transducers and Instrumentation", PHI Learning, 2nd Edition, 2013 (24th Reprint) (CO4 & CO5)
3. U.A Bakshi, A.V Bakshi, K.A Bakshi, "Electrical Measurements", 1st Edition, 2012 Technical Publications.

Reference Books:

1. W.D. Coopers and Helfrick- "Modern Electronic instrumentation and Measurements Techniques", Pearson / Prentice Hall of India P. Ltd.2003
2. Electrical & Electronic Instrumentation by UmeshSinha, SatyaPrakashan, Newdelhi,1998.
3. G.N.Srinivas and S. Narasimha - "Electrical and Electronic Measurements and Instrumentation", B S Publications, 2018.
4. E.W. Golding and F.C.Widdis "Electrical Measurements and Measuring Instruments" Wheeler Publishing.5th Edition, 2012.

Web References:

1. https://archive.nptel.ac.in/courses/108/105/108105153/
2. https://onlinecourses.nptel.ac.in/noc19_ee44/preview

EMF THEORY

II Year B. Tech. II Semester

[EEE]

Course Code: 24EE11RC11

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 applications of coulomb's and Gauss's Law for electric fields

CO2: Analyse behaviour of conductors and dielectrics in electric fields, apply boundary conditions to calculate capacitance.

CO3: Outline the basic principles and laws of magnetostatics

CO4: Apply the principles of magnetostatics to determine self and mutual inductance.

CO5: Summarize the Maxwell's Equations for static and Time varying fields.

UNIT-I **10 Lectures**

Electrostatics: Introduction to Vector Analysis**:** Introduction to coordinate system - line, surface and volume integrals - Del operator, Gradient, Divergence, Curl, Laplacian - Divergence's and Stoke's theorem.

Coulomb's law - Electric field intensity (EFI) - EFI due to Continuous charge distributions (line and surface charge) - Electric flux density - Gauss's law (Maxwell's first equation) and its applications - Electric Potential, relationship between E and V (second Maxwell's equation for static electric fields) - Electric dipole - dipole moment - EFI due to electric dipole - Torque on an Electric dipole placed in an electric field - Potential gradient, Poisson's and Laplace's Equations

UNIT-II **10 Lectures**

Conductors, Dielectrics, and Capacitance: Introduction to conductors - Behaviour of conductor in Electric field - Dielectric materials - Polarization - Boundary conditions (between conductor to dielectric, dielectric to dielectric and conductor to free space), Capacitance - capacitance of parallel plate, coaxial cable and spherical capacitors, Current density - conduction and convection current densities - Ohm's law in point form - continuity - Energy stored and density in a static electric field.

UNIT-III **10 Lectures**

Static Magnetic Fields: Biot-Savart's Law and its applications viz. Straight current carrying conductor, circular, square and solenoid current carrying wire - Maxwell's second equation ($\nabla . \mathbf{B} = 0$) - Amperes Circuital Law and its applications viz. MFI due to a long current carrying filament, infinite sheet of current, solenoid and toroidal current carrying conductor - Maxwell's third equation

Force in Magnetic Fields: Introduction - Force and Torque on a moving charge - Lorentz force equation and its applications viz. force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, Magnetic dipole and dipole moment.

UNIT-IV **10 Lectures**

Self and Mutual Inductance

Self and Mutual Inductance - determination of self- inductance of solenoid, toroid and co-axial cable - Neumann's formula for mutual inductance, mutual inductance between two solenoids, Energy stored and energy density in a magnetic field.

UNIT-V **10 Lectures**

Time Varying Fields

Faraday's laws of electromagnetic induction in integral and point forms, Maxwell's fourth equation, statically and dynamically induced EMF - continuity equations for time varying fields - Modification of Maxwell's equations for time varying fields - Displacement current - Poynting theorem and Poynting vector.

Textbooks:

1. Elements of Electromagnetics by Matthew N.O. Sadiku, Oxford University Press, 7th Edition.
2. Engineering Electromagnetics by William H. Hayt Jr. and John A. Buck, Sixth Edition, McGraw Hill, New Delhi, 2001
3. Electromagnetics, Joseph A. Edminister, Schaum's Outline Series, McGraw-Hill International Editions

Reference Books:

1. Introduction to Electrodynamics by David J. Griffiths, 3rd Edition, Prentice Hall, New Jersey, 1999.
2. Elements of Electromagnetic Fields by S.P. Seth, Dhanpat Rai & Co. publications
3. Engineering Electromagnetics by J. P. Tewari, Khanna Publishers, 2nd edition.

Web References:

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

POWER SYSTEMS 1

II Year B. Tech. II Semester

[EEE]

L	T	P	C
3	0	0	3

Course Code: 24EE11RC12

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

CO1: Summarize different components and layouts of hydro and thermal power plants.

CO2: Outline the operation and basic layout of Nuclear, Diesel and Gas power plants.

CO3: Evaluate voltage drop calculations for DC/AC distribution systems.

CO4: Analyze various load curves and tariffs.

CO5: Outline the components in Air and Gas Insulated substations.

UNIT-I **10 Lectures**

HYDRO AND THERMAL POWER PLANTS

Introduction: Basic Structure of power system - Electrical Energy Generation - Types of Energy Sources.

Hydro Electric Power Plant: Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation.

Thermal Power Plant: Site Selection - Layout - Description of major components - Boiler and its types, Electrostatic precipitators - Cooling Water Systems.

UNIT-II **10 Lectures**

NUCLEAR, DIESEL AND GAS POWER PLANTS

Nuclear Power Plant: Site selection - Schematic Arrangement - Components of Nuclear Reactor - Classification and working of nuclear reactor - Different types of Power Reactors - PWR, BWR and FBR - Nuclear waste disposal.

Diesel Power Plant: Site Selection - Plant Layout - Components - Working Principle.

Gas Turbine Plants: Site Selection - Plant Layout Components of a Gas Turbine Plant, Open Cycle and Closed Cycle Plants.

Comparison of different types of power plants

UNIT-III **10 Lectures**

DISTRIBUTION SYSTEMS: Classification of distribution systems - design features of distribution systems - radial distribution, ring main distribution - voltage drop calculations: DC distributors for following cases - radial DC distributor fed at one end and at ends (equal / unequal voltages) - ring main distributor, stepped distributor and AC distribution - comparison of DC and AC distribution.

UNIT-IV **10 Lectures**

OPERATIONAL ASPECTS OF GENERATING STATIONS & ECONOMIC CONSIDERATIONS : Load curve, load duration and integrated load duration curves - Economic aspects: Connected load, Maximum demand, Demand factor, Load factor, Diversity factor, Capacity factor, Utilization factor, Capacity, utilization and plant use factors.

Capital and Running Costs of Generating Stations - Different Tariffs - Simple Rate Tariff, Flat Rate Tariff, Block-Rate Tariff, Two-part Tariff, Three-part Tariff and power factor Tariff, Comparison of Tariffs - Numerical Problems

UNIT-V **10 Lectures**

Classification of Air and Gas Insulated substations

Air Insulated Substations - indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment along with symbols - Bus bar arrangements in the sub-stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one, two and one and half circuit breakers, main and transfer bus bar system with relevant diagrams.

Gas Insulated Substations (GIS) - Layout - constructional aspects of GIS, installation and maintenance of GIS, comparison of air insulated substations and gas insulated substations - advantages.

Textbooks:

1. A Course in Electrical Power by J.B. Gupta by S.K. Kataria & Sons Publishers.
2. A Text Book on Power System Engineering by M.L Soni, P.V Gupta, U.S Bhatnagar & A. Chakrabarti, Dhanpati Rai & Co.
3. A Text Book on Power systems-1 by Dr. H. P. Inamdar, Electrotech Publication Engineering Series.

Reference Books:

1. Generation & Utilization by C. L. Wadhwa
2. Electrical Power by S. L. Uppal, Khanna Publishers

Web References:

1. https://archive.nptel.ac.in/courses/112/107/112107291/
2. https://onlinecourses.nptel.ac.in/noc24_me57/preview

ELECTRICAL MACHINES 1 LAB

II Year B. Tech. II Semester

[EEE]

Course Code: 24EE11RC13

L	T	P	C
0	0	3	1.5

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

CO1: Analyze the performance of a single-phase transformer through Open Circuit (OC), Short Circuit (SC), and Sumpner's tests.

CO2: Perform 3-phase to 2-phase transformation using the Scott connection and determine transformer losses.

CO3: Evaluate the performance characteristics of DC shunt and compound generators through load tests.

CO4: Implement and analyze speed control techniques for a DC motor.

CO5: Assess the performance characteristics of DC motors using direct and indirect tests.

List of the Experiments

Note: Any 10 of the experiments are to be conducted

1. Perform Open Circuit (O.C.) and Short Circuit (S.C.) tests on a single-phase transformer to determine equivalent circuit parameters.
2. Determine the efficiency and voltage regulation of single-phase transformers using Sumpner's test.
3. Implement the Scott connection using two transformers for three-phase to two-phase conversion.
4. Separate hysteresis and eddy current losses in a single-phase transformer
5. Plot the Open Circuit Characteristics (OCC) of a DC shunt generator and determine its critical field resistance and critical speed.
6. Conduct a load test on a DC shunt generator and evaluate its efficiency and voltage regulation.
7. Control the speed of a DC shunt motor using armature voltage control and field current control methods.
8. Predetermine the efficiency of a DC machine under various loads using Swinburne's test.
9. Perform a load test on a DC shunt motor to plot the performance characteristics.
10. Conduct a load test on a DC compound generator and analyze its performance under various load conditions.
11. Perform a retardation test on a DC shunt motor to calculate the machine's moment of inertia and friction losses.
12. Conduct Hopkinson's test on two identical DC shunt machines to determine their efficiency under load.

13. Perform a load test on a DC compound motor and evaluate its performance curves, including torque-speed characteristics.
14. Separate the hysteresis, eddy current, and mechanical losses in a separately excited DC motor to assess overall efficiency.

ELECTRICAL MEASUREMENTS LAB

II Year B. Tech. II Semester

[EEE]

Course Code: 24EE11RC14

L	T	P	C
0	0	3	1.5

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

CO1: Calibrate Wattmeter, Power Factor Meter and tong tester

CO2: Calibrate voltmeter, ammeter and Energy meter

CO3: Determine resistance, inductance and capacitance using DC &AC Bridges

CO4: Measure the earth resistance and dielectric strength of transformer oil

CO5: Measure the three phase power for unbalanced loads

List of the Experiments

Note: Any 10 of the experiments to be conducted

1. Calibration of DC Voltmeter and DC Ammeter using Crompton's DC potentiometer
2. Calibration of LPF Dynamometer type Wattmeter by direct loading method.
3. Calibration of UPF Dynamometer type Wattmeter by phantom loading method
4. Calibration and testing of single-phase energy meter.
5. Calibration of power factor meter by direct loading method.
6. Calibration of tong tester
7. Measurement of Dielectric strength of oil using H.T testing kit.
8. Measurement of power using three ammeter and three voltmeter method
9. Measurement of 3 - phase power by using single wattmeter and two CT's.
10. Measurement of resistance using Kelvin's double Bridge and determination of its tolerance.
11. Measurement of an unknown Inductance using Anderson Bridge
12. Measurement of an unknown capacitance using Schering Bridge
13. Measurement of earth resistance using Megger
14. Measurement of strain for a bridge strain gauge

E L E C T R I C A L C A D

II Year B. Tech. II Semester
[Skill Course: EEE]

Course Code: 24EE11SC02

L	T	P	C
1	0	2	2

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

CO1: Demonstrate the features of ECAD and basic commands.

CO2: Acquire the knowledge of creating projects in ECAD

CO3: Acquire the knowledge of drawing reports and bill of materials in electrical circuits.

CO4: Develop the schematic wiring diagrams of electrical machines including protection using ECAD

CO5: Familiarize with standard 2D, isometric views, 3D drawings & animations

List of the Experiments

Note: Any 10 of the experiments to be conducted.

1. Introduction and overview of ECAD
2. Starting with Electrical CAD and basic drawing commands
3. Creation of simple project and inserting and interconnecting components
4. Schematic reports
5. Bill of material reports
6. Star-Delta Starter Control Circuit of three phase Induction Motor
7. Forward-Reverse Control Circuit of three phase Induction Motor
8. Electrical motor connections
9. 2D drawings in AutoCAD
10. Isometric Views in AutoCAD
11. 3D drawings in AutoCAD
12. 2D &3D animation in AutoCAD

Domain Specific any cases

At the end of the course, students should complete both case studies and submit a report for each as part of their assessment.

Case Study 1: Simple Electrical Wiring for a Room (Electrical CAD)

Objective: Students will design a basic electrical wiring diagram for a small room and generate a BOM for the required components.

Scenario: An electrician needs a wiring diagram for a single-room home office setup, including:

- Two light fixtures
- Two power sockets
- One switchboard

Tasks:

- Draw the electrical circuit using standard electrical symbols in ECAD.
- Interconnect the components with appropriate wiring.
- Generate a BOM, listing wires, switches, bulbs, and sockets.

Outcome:

A clear electrical wiring diagram with a detailed bill of materials for implementation.

Case Study 2: 2D Floor Plan of a Small House (AutoCAD 2D)

Objective: Students will create a basic 2D floor plan of a small house with essential rooms, doors, windows, and furniture layout using AutoCAD.

Scenario:

A homeowner wants a simple 2D layout of their new house before construction. The house should have:

- A living room, kitchen, bedroom, and bathroom
- Windows and doors with proper dimensions
- Electrical outlet placements

Tasks:

- Draw the floor plan with accurate dimensions.
- Label the rooms and add symbols for doors, windows, and electrical outlets.
- Prepare a BOM listing the required materials (e.g., number of doors, windows, electrical points).

Outcome:

A detailed 2D house plan with an organized bill of materials.

Case Study 3: Design and Development of Control Panel Wiring

Reference Books:

1. Gaurav Verma & Matt Weber, “AutoCAD Electrical 2016 Black book”, CADCAMCAE works, USA, 2015.

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.

CONTROL SYSTEMS

III Year B. Tech. I semester

(EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11RC15

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

CO1: Develop mathematical models for physical systems and determine overall transfer function using block diagram algebra and signal flow graphs.

CO2: Analyse the time response of first and second order systems and improvement of performance by PI, PD and PID controllers.

CO3: Investigate the stability of closed loop systems using Routh‟s stability criterion and the analysis by root locus method.

CO4: Analyse the stability of LTI systems using frequency response methods.

CO5: Apply state variable theory to determine the dynamic behaviour of linear control systems

UNIT-I **10 Lectures**

Mathematical Modelling of Control Systems: Classification of control systems - Open Loop and closed loop control systems and their differences - Feedback Characteristics - Differential equations of electrical networks - Modelling of Mechanical Systems - Equations of Mechanical Systems - Analogous Systems - Transfer Function of DC Servo motor - Block Diagrams of Control Systems - Signal Flow Graphs - Numerical Problems

UNIT-II **10 Lectures**

Time Response Analysis: Standard test signals - Time response of first and second order systems - Time domain specifications - Steady state errors and error constants - Effects of integral and derivative control actions on system performance - PD,PI and PID Controllers-
Numerical Problems

UNIT-III **10 Lectures**

Stability: Concept of Stability and Necessary Conditions for Stability - Routh-Hurwitz Criterion -limitations of Routh‟s stability.

Root-locus Technique: Concept and Construction of Root Loci and its analysis - Numerical Problems

UNIT-IV **10 Lectures**

Frequency Domain Analysis of Control Systems: Introduction to Frequency domain specifications - Bode diagrams - Phase margin and Gain margin - Stability Analysis from Bode Plots - Polar and Nyquist plots - Numerical Problems

Compensators: Introduction - Realization of lag, lead and lag-lead

UNIT-V **10 Lectures**

State Space Analysis of Linear Time Invariant Systems: Concepts of state, state variables and state model, state space representation of transfer function - Diagonalization - Solving the time invariant state equations - State Transition Matrix and it‟s Properties - Concepts of Controllability and Observability - Numerical Problems

Text Books:

1. Automatic control systems by Benjamin C.Kuo, Prentice Hall of India.
2. Control Systems Engineering, I.J.Nagarath and M.Gopal, Newage International Publications.

Reference Books:

1. Control Systems principles and design, M.Gopal, Tata McGraw Hill education Pvt Ltd.
2. Control Systems Engineering by Norman S. Nise, Wiley Publications.
3. Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India.

Web References:

1. https://archive.nptel.ac.in/courses/107/106/107106081/
2. https://archive.nptel.ac.in/courses/108/106/108106098/

POWER ELECTRONICS

III Year B. Tech. I semester

(Branch: EEE)

Course Code: 24EE11RC16

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 characteristics of power semiconductor devices and design of firing circuits for SCR.

CO2: Analyze the performance of single phase controlled converters.

CO3: Analyze the performance of three phase AC-DC and AC-AC converters.

CO4: Summarize the operation DC-DC converters.

CO5: List the advantages of the DC-AC converters and summarize its operation.

UNIT-I **10 Lectures**

Power Semi-Conductor Devices:

Silicon controlled rectifier (SCR) - Two transistor analogy - Static and Dynamic characteristics - Turn-on and Turn-off Methods - Triggering Methods (R, RC and UJT) - Snubber circuit design. Static and Dynamic Characteristics of Power MOSFET and IGBT- Gate Driver Circuits for Power MOSFET and IGBT - Introduction to WBG devices (SiC and GaN) - Numerical problems.

UNIT-II **10 Lectures**

Single-phase AC-DC Converters

Single-phase half-wave controlled rectifiers - R and RL loads with and without freewheeling diode - Single-phase fully controlled mid-point and bridge converter with R and RL loads - Continuous and Discontinuous conduction - Effect of source inductance in Single-phase fully controlled Bridge rectifier - Single-phase Semi - Converter with R and RL loads - Continuous and Discontinuous conduction - Numerical Problems.

UNIT-III **10 Lectures**

Three-phase AC-DC Converters

Three-phase half-wave Rectifier with R and RL load - Three-phase fully controlled rectifier with R and RL load - Three-phase semi converter with R and RL load - Expression for Output Voltage.

AC - AC Converters

Single-phase AC-AC power control by phase control with R and RL loads - Expression for RMS output voltage - Single-phase step down and step up Cyclo-converter - Numerical Problems.

UNIT-IV **10 Lectures**

DC-DC Converters

Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equations using volt-sec balance in CCM & DCM - Expressions for output voltage ripple and inductor current ripple - Switching control techniques - PWM control - Numerical Problems.

UNIT-V **10 Lectures**

DC-AC Converters

Introduction - Single-phase half-bridge and full-bridge inverters with R and RL loads - Phase Displacement Control - PWM with bipolar voltage switching, PWM with unipolar voltage switching -Three-phase square wave inverters - 120^0 conduction and 180^0 conduction modes of operation -Sinusoidal Pulse Width Modulation - Current Source Inverter (CSI) - Comparison between VSI and CSI - Numerical Problems.

Text Books:

1. Power Electronics: Converters, Applications and Design by Ned Mohan, Tore Undeland, William P Robbins, John Wiley & Sons.
2. Power Electronics: Circuits, Devices and Applications - by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
3. Power Electronics: Essentials & Applications by L.Umanand, Wiley, Pvt. Limited, India, 2009.

Reference Books:

1. Elements of Power Electronics-Philip T.Krein. Oxford University Press; Second edition
2. Power Electronics - by P.S.Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers - by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.

Web References:

1. https://archive.nptel.ac.in/courses/108/102/108102145/

POWER SYSTEMS 2

III Year B. Tech. I semester

(Branch: EEE)

Course Code: 24EE11RC17

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 resistance, inductance, and capacitance of transmission lines, including conductor types, effects, and configurations.

CO2: Describe transmission line models and their effects on voltage regulation, efficiency, and the Ferranti effect.

CO3: Describe power system transients, surge propagation, and the impact of corona on transmission lines.

CO4: Perform sag and tension calculations for transmission lines and *assess* the effects of wind and ice on conductors and analyze insulator types and apply methods to improve efficiency

CO5: Summarize the construction, insulation, and electrical properties of different types of cables.

UNIT-I **10 Lectures**

Transmission Line Constants:

Conductor materials - Types of conductors - Calculation of resistance for solid conductors - Skin and Proximity effects - Calculation of inductance for Single-phase and Three-phase- Single and double circuit lines - Concept of GMR and GMD-Symmetrical and asymmetrical conductor configuration with and without transposition -Bundled conductors - Calculation of capacitance for 2 wire and 3 wire systems - Effect of ground on capacitance - Capacitance calculations for symmetrical and asymmetrical single and Three-phase-Single and double circuit lines without and with Bundled conductors - Numerical problems.

UNIT-II **10 Lectures**

Transmission Line Modeling :

Generalized Network Constants - Modeling of Short Transmission line - Modeling of Medium transmission line: Nominal-T and Nominal-π methods and Long Transmission Lines - Rigorous Line Modeling - Regulation and efficiency for all types of lines - equivalent T and π of long transmission lines - Ferranti Effect - Surge impedance and SIL - Numerical problems.

UNIT-III **10 Lectures**

Power System Transients

Types of System Transients - Propagation of Surges - Attenuation - Distortion- Reflection and Refraction Coefficients. Termination of lines with different types of conditions - Open Circuited Line-Short Circuited Line - T Junction - Lumped Reactive Junctions.

Corona: Phenomenon of Corona - Critical Voltages - Power Loss due to Corona - Factors Affecting Corona Loss - Radio Interference - Numerical problems

UNIT-IV **10 Lectures**

Mechanical Design of Transmission Lines

Sag and Tension Calculations with equal and unequal heights of towers - effect of Wind and Ice on weight of conductor - Line Supports - Numerical problems

Over Head Line Insulators

Types of Insulators - String efficiency and Methods for improvement -Voltage distribution - Calculation of string efficiency - Capacitance grading and Static Shielding - Numerical problems

UNIT-V **10 Lectures**

Under-Ground Cables

Overhead Lines Vs Underground Cables - Types of Cables, Insulation resistance in Cable, Armouring & Covering of Cable, Dielectric stress in Cables, ratio of Maximum stress to minimum stress - Sheathing in Cable, Use of Inter Sheaths, Capacitance Grading, Capacitance in 3-Core Cables - Laying of cables - Numerical problems

Text Books:

1. Electrical Power Systems by C. L. Wadhwa.
2. A Text Book on Power Systems Engineering by Sony, Gupta, Bhatnagar and Chakrabarti, Dhanapatrai& Co.
3. A Course in Power Systems by J. B. Gupta.

Reference Books:

1. Electrical Power by S. L. Uppal.
2. Electrical Power Transmission and Distribution by S. Siva Nagaraju and S. Satyanarayana.

Web References:

1. http://elearn.psgcas.ac.in/nptel/courses/video/108102047
2. https://archive.nptel.ac.in/courses/108/105/108105104/

CONTROL SYSTEMS LAB

III Year B. Tech. I semester

(Branch: EEE)

L	T	P	C
0	0	3	1.5

Course Code: 24EE11RC18

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

CO1: Analyze the performance and working Magnetic amplifier, D.C and A.C. servo motors and synchros

CO2: Design P,PI,PD and PID controllers and Evaluate temperature control of an oven using PID controller

CO3: Analyze the time and frequency response of the control systems.

CO4: Analyze the stability of control systems using MATLAB

CO5: Test the controllability and observability

List of the Experiments

Note: Any 10 of the experiments are to be conducted

1. Characteristics of DC Servomotor.
2. Characteristics of AC Servomotor.
3. Characteristics of synchro pair.
4. Characteristics of magnetic amplifier.
5. Temperature control system using PID controller.
6. Effect of P, PI, PID controller on second order system.
7. Time response of second order system.
8. Frequency response of compensating networks.
9. Stability analysis of linear time invariant systems using MATLAB.
10. Controllability and Observability test using MATLAB.
11. Transfer function of DC motor.
12. Stability Analysis using Routh-Hurwitz Criterion in MATLAB

ELECTRICAL MACHINE 2 LAB

III Year B. Tech. I semester

(Branch: EEE)

Course Code: 24EE11RC19

L	T	P	C
0	0	3	1.5

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

CO1: Assess the performance of single phase and three phase induction motors.

CO2: Predetermine the regulation of three-phase alternator by various methods.

CO3: Find the Xd/Xq ratio of alternator and asses the performance of three-phase synchronous motor.

CO4: Analyze the performance of single-phase induction motor.

CO5: Control the speed of three phase induction motor.

List of the Experiments

Note: Any 10 of the experiments are to be conducted

1. Performance characteristics of a three- phase Induction Motor by conducting Brake test
2. Determination of equivalent circuit parameters, efficiency and regulation of a three phase Induction motor by conducting No-load & Blocked rotor tests.
3. Determination of Regulation of a three-phase alternator by using synchronous impedance & m.m.f. methods.
4. Determination of Regulation of a three-phase alternator by using Potier triangle method
5. Determination of V and Inverted V curves of a three-phase synchronous motor.
6. Determination of Xd and Xq of a salient pole synchronous machine.
7. Speed control of three phase induction motor by V/f method.
8. Determination of efficiency of three-phase alternator by loading with three phase induction motor.
9. Determination of equivalent circuit parameters of single-phase induction motor.
10. Power factor improvement of single-phase induction motor by using capacitors.
11. Determination of efficiency of a single-phase Induction Motor by conducting Brake test.
12. Starting of single-phase Induction motor by using capacitor start and capacitor start run methods.
13. Parallel operation of three-phase alternator under no-load and load conditions.

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)

MICROPROCESSORS AND MICROCONTROLLERS

III Year B. Tech. II semester

[EEE]

L	T	P	C
3	0	0	3

Course Code: 24EC11RC19

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

ELECTRIC DRIVES

III Year B. Tech. II semester

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11RC20

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

CO1: Summarize the concept of load torque, dynamics of electric drive, four quadrant operation and braking methods.

CO2: Analyze the performance of single phase controlled converter fed dc drives.

CO3: Analyze speed torque characteristics of dc-dc converter fed dc drives under motoring & braking conditions.

CO4: Analyze the performance of power converter fed induction motor from stator and rotor sides

CO5: Summarize the operation of power converter fed synchronous motor drives.

UNIT-I **10 Lectures**

Fundamentals of Electric Drives

Electric drive and its components- Fundamental torque equation - Load torque components - Nature and classification of load torques - Steady state stability - Load equalization- Four quadrant operation of drive (hoist control) - Braking methods: Dynamic - Plugging - Regenerative methods.

UNIT-II **10 Lectures**

Controlled Converter Fed DC Motor Drives

3-phase half and fully-controlled converter fed separately excited DC motor drive - Output Voltage and current waveforms - Speed-torque expressions - Speed-torque characteristics - Introduction to Dual Converter and Dual Converter fed DC motor drives - Numerical problems.

UNIT-III **10 Lectures**

DC-DC Converters Fed DC Motor Drives

Introduction to Choppers - Types - Single quadrant, two quadrant and four quadrant DC-DC converter fed separately excited DC motors - Continuous current mode of operation - Output voltage and current waveforms - Speed- torque expressions and characteristics - Closed loop operation (qualitative treatment only).

UNIT-IV **10 Lectures**

Stator and Rotor side control of 3-phase Induction Motor Drive

Stator voltage control -Speed torque characteristics -Variable Voltage Variable Frequency control of induction motor by PWM voltage source inverter -Closed loop V/f control of induction motor drives (qualitative treatment only). Static rotor resistance control - Slip power recovery schemes - Static Scherbius drive - Static Kramer drive - Performance and speed torque characteristics.

UNIT-V **10 Lectures**

Control of Synchronous Motor Drives

Separate control of synchronous motor - self-control of synchronous motor employing load commutated thyristor inverter - closed loop control of synchronous motor drive (qualitative treatment only)- Permanent Magnet synchronous motor (Basic operation only).

Text Books:

1. Electric Motor Drives: Modeling, Analysis, and Control by R Krishnan, Pearson Publications
2. Fundamentals of Electric Drives - by G K Dubey - Narosa Publications - 2nd edition - 2002.
3. Power Semiconductor Drives - by S.B.Dewan - G.R.Slemon - A.Straughen - Wiley India - 1984.
4. Modern Power Electronics and AC Drives by B K Bose, Prentice Hall

Reference Books:

1. Electric Motors and Drives Fundamentals - Types and Applications - by Austin Hughes and Bill Drury - Newnes.4th edition - 2013.
2. Thyristor Control of Electric drives - Vedam Subramanyam Tata McGraw Hill Publications - 1987.
3. Power Electronic Circuits - Devices and applications by M.H.Rashid - PHI - 3rd edition - 2009.

Web References:

1. https://archive.nptel.ac.in/courses/108/104/108104140/
2. https://nptel.ac.in/courses/108104011

POWER SYSTEM ANALYSIS AND STABILITY

III Year B. Tech. II semester

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11RC21

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

CO1: Develop the per unit system of power systems and bus admittance matrix

CO2: Formulate and solve the power flow problems of power systems

CO3: Apply the concepts of addition or removal of element in the power system for determining the impedance matrix and short circuit calculations for symmetrical faults

CO4: Determine the fault voltages and currents for various unsymmetrical faults.

CO5: Analyze the stability of power system under various disturbances.

UNIT-I **10 Lectures**

Per Unit Representation & Topology

Per Unit Quantities-Single line diagram - Impedance diagram of a power system - Graph theory definition - Formation of element node incidence, bus incidence, branch path, basic cut set and basic loop incidence matrices - Primitive network representation - Formation of Y- bus matrix by singular transformation and direct inspection methods - Numerical Problems

UNIT-II **10 Lectures**

Power Flow Studies

Necessity of power flow studies - Derivation of static power flow equations - Power flow solution using Gauss-Seidel Method - Newton Raphson Method (Rectangular and polar coordinates form) - Decoupled and Fast Decoupled methods - Numerical Problems

UNIT-III **10 Lectures**

Z-Bus Algorithm & Symmetrical Fault Analysis

Formation of Z_{Bus}: Partial network- Algorithm for the formation of Z_{Bus} Matrix for addition element for the following cases: Addition of element from a new bus to reference- Addition of element from a new bus to an old bus- Addition of element between an old bus to reference and Addition of element between two old buses - Modification of Z_{Bus} (without mutual impedance) - Numerical Problems

Symmetrical Fault Analysis: Reactance‟s of Synchronous Machine - Three Phase Short Circuit Currents - Short circuit MVA calculations for Power Systems - Numerical Problems.

UNIT-IV **10 Lectures**

Symmetrical Components

Definition of symmetrical components - symmetrical components of unbalanced three phase systems - Power in symmetrical components - Sequence impedances and Sequence networks: Synchronous generator - Transmission line and transformers - Phase-shift of symmetrical components in Y-Δ- Power in terms of symmetrical components - Numerical Problems.

Unsymmetrical Fault Analysis

Various types of faults: LG- LL- LLG and LLL on unloaded alternator- unsymmetrical faults on power system.

UNIT-V **10 Lectures**

Power System Stability Analysis

Elementary concepts of Steady state- Dynamic and Transient Stabilities- Description of Steady State Stability Power Limit-Transfer Reactance Synchronizing Power Coefficient - Power Angle Curve and Determination of Steady State Stability -Derivation of Swing Equation-Determination of Transient Stability by Equal Area Criterion-Application of Equal Area Criterion-Methods to improve steady state and transient stability.

Text Books:

1. Electrical Power Systems by C L Wadhwa, New Academic Science Limited
2. Modern Power system Analysis - by I. J. Nagrath& D. P. Kothari: Tata McGraw-Hill Publishing Company, 2nd edition.

Reference Books:

1. Power System Analysis by HadiSaadat - Tata McGraw-Hill 3rd edition - 2010.
2. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.

Web References:

1. https://archive.nptel.ac.in/courses/117/105/117105140/
2. https://archive.nptel.ac.in/courses/108/105/108105067/
3. https://archive.nptel.ac.in/courses/108/104/108104051/

MICROPROCESSORS AND MICROCONTROLLERS LAB

III Year B. Tech. II semester

[EEE]

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

POWER ELECTRONICS LAB

III Year B. Tech. II semester

(Branch: EEE)

L	T	P	C
0	0	3	1.5

Course Code: 24EE11RC22

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

CO1: Analyze the characteristics of Power semiconductor devices and SCR firing circuits

CO2: Analyze the operation of phase-controlled converters

CO3: Analyze the operation of single phase AC voltage controller and Cyclo-converter

CO4: Analyze the operation of single phase inverter and DC-DC Converters.

CO5: Simulate the PWM techniques and DC-DC Converters using MATLAB.

List of experiments:

Note: Any 10 experiments are to be conducted

1. Characteristics of SCR, MOSFET and IGBT.
2. Analysis of various firing circuits.
3. Single-phase half-controlled and bridge rectifiers with R and RL loads.
4. Single-phase fully-controlled bridge rectifiers with R and RL loads.
5. Three-phase half-controlled and bridge rectifiers with R and RL loads.
6. Three-phase fully-controlled bridge rectifiers with R and RL loads.
7. Single-phase Cyclo-converter with R and RL loads.
8. Single-phase AC voltage regulator with R and RL loads.
9. Single -phase square wave bridge inverter with R and RL loads.
10. Single-phase PWM inverter with R and RL loads.
11. Analyze the operation of Buck and Boost converters.
12. Single-phase Dual-converter with resistive load.
13. Simulation of DC-DC converters using MATLAB.
14. Simulation of PWM techniques using MATLAB.
15. Simulation of four quadrant chopper using MATLAB.

POWER SYSTEMS SIMULATION LAB

III Year B. Tech. II semester

(Branch: EEE)

L	T	P	C
0	0	3	1.5

Course Code: 24EE11RC23

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

CO1: Estimate the sequence impedances of 3-phase Transformer and Alternators

CO2: Evaluate the performance of transmission lines

CO3: Analyse and simulate power flow methods in power systems

CO4: Analyse and simulate the performance of the power system for load frequency control and Economic load dispatch

CO5: Analyse and simulate stability studies of power systems

List of experiments:

Note: Any 10 experiments are to be conducted

1. Determination of sequence impedances of 3-phase Transformer
2. Estimation of sequence impedances of 3-phase Alternator by Fault Analysis
3. Determination of ABCD parameters on transmission line model
4. Performance of long transmission line with and without shunt compensation
5. Determination of Ybus using direct inspection method
6. Load flow solution of a power system network using Gauss-Seidel method
7. Load flow solution of a power system network using Newton Raphson method.
8. Economic load dispatch in power system
9. Load frequency control of a single area Power System without & with PI controller
10. Transient Stability analysis of single machine connected to an infinite bus (SMIB) using equal area criterion.
11. Electromagnetic transients in power system: Transmission line energization.
12. Formation of Zbus by building algorithm.
13. Estimation of sequence impedances of 3-phase Alternator by Direct method
14. Plot the VI characteristics of a series and parallel connected PV module and determination of Maximum Power Point

FUNDAMENTALS OF PLC PROGRAMMING

III Year B. Tech. II semester

(Branch: EEE)

L	T	P	C
1	0	2	2

Course Code: 24EE11SC03

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

CO1: Identify the components and Program execution of the SIMATIC S7-1200 PLC

CO2: Develop logic using Gates for Electrical Systems in PLC

CO3: Implement Timers, Counters and Math Operations in PLC

CO4: Develop logic for Traffic Light Control and Water filling/discharge in a Tank in PLC

CO5: Interface an HMI with the PLC control system

List of the Experiments

Note: Any10 of the experiments to be conducted

1. Overview of the SIMATIC S7-1200 system family. Hardware and software commissioning of the SIMATIC S7-1200 with the TIA Portal
2. Setup and assembly of the SIMATIC S7-1200 automation system
3. The components of the TIA Portal: SIMATIC STEP 7 Basic and WinCC Basic
4. Program execution in automation systems. Addressing and wiring the signal modules
5. Programming Logic Gates Function in PLC
6. Latching and Unlatching Motors
7. Implementation of Timers
8. Implementation of Counters
9. Implementation of Math Operations
10. PLC Program for Traffic Light Control System
11. PLC Program for Water filling and Discharging Process
12. Introduction to the Touch panel (HMI) and Interface an HMI with PLC.

Case Studies:

At the end of this course, students must submit report, based on one of the following themes:

1. Design and implement a system that allows for forward and reverse control of a motor using a PLC. The motor's direction will be controlled through simple push- button inputs, with appropriate safety and operational considerations.

2. Design and develop the logic using PLC for starting the three Phase induction Motors via Star-Delta Starter. Ensures proper timing for the transition between the star and delta configurations.
3. PLC control system in a high-rise office building to control elevator movement, load balancing between elevators, and emergency stop functions.
4. A chemical plant where PLCs control the mixing of raw materials, monitor temperature and pressure in reactors, and handle the transfer of chemicals through pipelines, ensuring safety and consistency in the product.
5. A large office complex where PLCs monitor the energy consumption of HVAC (Heating, Ventilation, and Air Conditioning) systems, lighting, and elevators to optimize energy use, reduce costs, and improve environmental sustainability.
6. A nuclear power plant where PLCs control coolant pumps, reactor temperature, and safety shutdown systems to maintain safe and efficient operation.

Reference Books:

1. Programming Guideline for S7-1200/1500
2. John W. Webb & Ronald A.Reiss, "Programmable Logic Controllers-Principles and Applications", Fifth Edition, PHI, 2009.
3. Jr. Hackworth & F.D Hackworth Jr., "Programmable Logic Controllers-Programming Method and Applications", Pearson, 2003.

Web References:

1. http://www.siemens.com/tiaportal.
2. https://support.industry.siemens.com/cs/ww/en/view/81318674

DATA STRUCTURES USING PYTHON

III Year B. Tech. II semester

(Branch: EEE)

L	T	P	C
1	0	2	2

Course Code: 24CS11SC02

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

CO1: Understand the fundamentals of Python data structures such as lists, tuples, sets, and dictionaries and classes and objects

CO2: Evaluate and compare the performance of searching and sorting algorithms

CO3: Demonstrate basic operations for Stacks and Queues using Python lists, and apply these data structures in solving problems.

CO4: Apply the operations of singly linked lists and doubly linked lists to solve problems and analyze the efficiency of these operations.

CO5: Implement and analyze BST, min/max heaps, and graph traversals (DFS, BFS) using adjacency lists

1) Lists and Tuples

a) Write a program to get list of odd numbers from a given list of numbers

b) Write a program to create tuples (name,age,address,college)for atleast two members and display the concatenation of tuples and print the first tuple n number of times.

2) Sets and Dictionaries

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

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

b) Write a program to check if a given key exists in a dictionary or not.

3) Classes and objects

a) Write a python Program to call data member and function using classes and objects.

b) Write a program to read 3 subject marks and display pass or failed using class and object.

4) Searching

a) Write a Python program to implement Linear Search.

b) Write a Python program to implement Binary Search using recursion.

5) Sorting

a) Write a Python program to implement Bubble sort, Insertion sort and Quick sort.

b) Compare sorting times using time module

6) Stacks

a) Implement a stack using a python list with push,pop, and display operations.

b) Convert an infix expression to postfix using a stack.

7) Queues

a) Implement a queue using a list with enqueue and dequeue operations.

b) Implement a circular queue and its operations.

8) Linked Lists

a) Create a class for singly linked list and perform insertion and deletion operations.

b) Create a class for doubly linked list and perform insertion and deletion operations.

9) Trees

a) Create a Binary Search tree from a list of numbers and perform tree traversals.

b) Implement Search, insert and delete operations in BST.

10) Heaps

a) Implement a min/max heap using list.

b) Write a program to find the k^{th} smallest and largest element using heap.

11) Graphs

a) Represent a graph using an adjacency list.

b) Implement DFS and BFS traversal of a graph

Reference Books:

1. Python Programming: Using Problem Solving Approach by Reema Theraja , Oxford publications
2. Fundamentals of Data Structures using Python, P Lalitha Surya Kumari, P. S. Avadhani, Lambert Academic Publishing.

Web References:

1. https://onlinecourses.nptel.ac.in/noc19_cs40/preview
2. https://onlinecourses.nptel.ac.in/noc19_cs41/preview

DESIGN THINKING, INNOVATION & ENTREPRENEURSHIP

III Year B. Tech. II Semester

(EEE)

Course Code: 24EE11MC01

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

IOT AND ITS APPLICATIONS

IV Year B. Tech. I semester

(Branch: EEE)

L	T	P	C
1	0	2	2

Course Code: 24EE11SC04

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

CO1: Identify various IoT components, sensors, and communication interfaces used in Arduino/Raspberry Pi applications.

CO2: Demonstrate the functionality of sensors, actuators, and wireless communication protocols.

CO3: Implement IoT-based systems for data acquisition, processing, and real-time control.

CO4: Analyse different data transmission methods, cloud integration techniques, and automation systems.

CO5: **Design** and develop basic IoT-based monitoring and control applications using Arduino/Raspberry Pi

List of the Experiments

Note: Any 10 of the experiments to be conducted.

1. Introduction to Arduino/Raspberry Pi
2. LED/Buzzer Interfacing.
3. Push Button & Sensor Interfacing
4. Temperature Sensor Interfacing
5. OLED Display Interfacing
6. Bluetooth Communication (Sensor Data)
7. Bluetooth-Based LED control
8. Cloud Data Logging with ThingSpeak
9. 7-Segment Display Interfacing
10. Analog Input & Digital Output
11. Night Light Control & Monitoring System
12. Fire Alarm System

Case Studies:

At the end of this course, students must develop and demonstrate a working IoT-based project based on one of the following themes:

1. Remote Data Monitoring.
2. Controlling or actuating devices remotely.
3. Sending out alerts by objects without human intervention.
4. Machine to Machine communication.
5. Web-Based IoT System.
6. Developing an elementary home automation model.

Reference Books:

1. Internet of Things: Surya Durbha, Jyoti Joglekar

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_cs53/

MACHINE LEARNING USING PYHON

IV Year B. Tech. I semester

(Branch: EEE)

Course Code: 24AI11SC03

L	T	P	C
1	0	2	2

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

CO1: **Apply** exploratory data analysis and categorical encoding techniques to understand the data and make it ready for model building. (L3).

CO2: **Build** ML models Using ID3, KNN, linear regression and logistic regression. (L3)

CO3: **Develop** Programs for Bias, Variance, Cross Validation and for Implementing Support Vector Machine (SVM) Algorithm, Principal Component Analysis (PCA) (L3)

CO4: **Build** ML models based on ensemble techniques (L3)

CO5: Unsupervised learning models using K-Means and Expectation-Maximization (EM) algorithms .(L3)

Module-1:

Illustrate Exploratory Data Analysis for Classification using Pandas or Matplotlib: Getting a quick statistical summary of the dataset, Checking Missing Values, Removing Duplicates, Showing Correlations, and Looking for Outliers using BoxPlots.

Module-2:

Write a program to implement Categorical Encoding: One-hot/Label/Ordinal Encodings.

Module-3:

Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Module-4:

Use sklearn's k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. You need to print the attributes values for wrong predictions.

Module-5:

Solve real-world problems using Linear Regression.

Module-6:

Solve real-world problems using Logistic Regression.

Module-7:

Develop a program for Bias, Variance, and Cross Validation.

Module-8:

Write a program to Implement Support Vector Machines and Principle Component Analysis.

Module-9:

Run decision tree classification and random forest algorithms on a dataset and confirm that ensembling indeed improves performance significantly reducing the variance component (using bias-variance decomposition). Also, print feature importances as found by the random forest algorithm.

Module-10:

Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.

Case Study: Select any practical 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. Customer Segmentation for a Retail Business
   Concepts: Clustering (k-Means, EM), PCA
   Description: Analyze customer purchase history and segment customers for personalized marketing strategies.

2. Credit Card Fraud Detection
   Concepts: Logistic Regression, Random Forest, Decision Trees, Gradient Boosting
   Description: Use transaction data to predict fraudulent transactions, improving fraud detection mechanisms.

3. Employee Attrition Prediction
   Concepts: Logistic Regression, Decision Trees, Categorical Encoding
   Description: Identify key factors influencing employee retention in a company.

4. Predicting House Prices
   Concepts: Linear Regression, PCA, Gradient Boosting
   Description: Build a model to predict house prices based on historical housing data.

5. Fake News Detection

   Concepts: NLP, Logistic Regression, Decision Trees, SVM

   Description: Classify news articles as real or fake using text-based features.

6. Movie Recommendation System

   Concepts: k-NN, PCA

   Description: Build a recommendation system based on user preferences and ratings.

7. Stock Market Price Prediction

   Concepts: Linear Regression, Gradient Boosting

   Description: Predict stock prices based on historical trends and market indicators.

8. Healthcare Readmission Prediction

   Concepts: Logistic Regression, Decision Trees

   Description: Predict which patients are at high risk of hospital readmission.

9. Air Quality Prediction

   Concepts: Linear Regression, PCA, Decision Trees

   Description: Predict air pollution levels based on meteorological and traffic data.

10. Predicting Loan Default Risk

    Concepts: Logistic Regression, Random Forest

    Description: Assess whether a loan applicant is likely to default.

11. E-commerce Product Review Sentiment Analysis

    Concepts: NLP, SVM, k-NN

    Description: Classify product reviews into positive, neutral, or negative sentiments.

12. Energy Consumption Forecasting

    Concepts: Linear Regression, Gradient Boosting

    Description: Predict energy consumption trends for efficient energy planning.

13. Traffic Accident Severity Prediction

    Concepts: Decision Trees, k-NN, PCA

    Description: Predict accident severity based on road conditions, weather, and driver behavior.

14. Disease Diagnosis from Symptoms

    Concepts: Decision Trees, Random Forest, SVM Description:

    Predict diseases based on patient symptoms.

15. Customer Churn Prediction for Telecom

Concepts: Logistic Regression, Decision Trees, Categorical Encoding

Description: Predict which customers are likely to switch telecom providers.

Reference Books:

1. Aurélien Géron (2022), "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow," 3rd Edition, O'Reilly Publications.

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc25_cs46/preview
2. https://www.coursera.org/specializations/machine-learning-introduction

ARTIFICIAL INTELLIGENCE APPLICATIONS IN POWER SYSTEMS

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

Course Code: 24EE11PE01

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 AI, current trends, biological and artificial neural network models.

CO2: Describe the ANN architectures and Learning laws.

CO3: Summarize the DNN and GAN models.

CO4: Apply artificial intelligent and fuzzy logic techniques in power systems.

CO5: Describe Fuzzy Logic, Fuzzification and Defuzzification methods.

UNIT-I **10 Lectures**

Artificial Intelligence: Introduction, AI, ML and DNN Definitions, Growth of AI, AI and Industry, AI and the world, Current Trends in AI.

Artificial Neural Network: Introduction-Definition- Biological Neural Network-Modeling of a Neuron -Activation functions-Initialization of weights-Typical Architectures-Learning and Training laws.

UNIT-II **10 Lectures**

ANN Paradigms: Perceptron-Architectures-Linear Separability-XOR Problem-Multi-layer perceptron using Back propagation Algorithm (BPA)-Self- Organizing Map (SOM)-Learning Vector Quantization (LVQ)-Radial Basis Function Network-Hopfield Network-Bidirectional Associate Memory (BAM).

UNIT-III **10 Lectures**

Deep Learning- Deep Architectures - Convolutional Neural Networks - Convolutional Layer - Pooling Layer - Normalization Layer- Fully Connected Layer - Deep belief Networks.

GAN: Generative Models-Architecture and working principle of GAN-Training.

UNIT-IV **10 Lectures**

Applications of ANN- Economic load dispatch - Load frequency control - Reactive power control-Power System Protection

UNIT-V **10 Lectures**

Fuzzy Logic:

Introduction, Foundation of Fuzzy Systems, Representing Fuzzy Elements, Basic Terms and Operations, Properties of Fuzzy Sets, Fuzzification, Arithmetic Operations of Fuzzy Numbers, The alpha cut method, The extension method, Linguistic Descriptions and their Analytical Forms, Fuzzy Linguistic Descriptions, Fuzzy Relation Inferences, Fuzzy Implication and Algorithms, Defuzzification Methods-Centre of Area and Centre of Sums methods - Fuzzy control applications for Solar Power Forecasting.

Text Books:

1. Rajasekharan and Pai, Neural Networks, Fuzzy logic, Genetic Algorithm - Synthesis and Applications, PHI second edition, 2017
2. S. N. Sivanandam, S. Sumathi, S. N. Deepa, “Soft computing techniques”, Wiley Publications third edition 2018.
3. Fuzzy Logic with Engineering Applications, 3rd ed., Thimothy J Ross, Wiley Student Edition, 2016.
4. Fuzzy Set Theory Fuzzy Logic and Their Applications, A. K. Bhargava, S. Chand, 2013

Reference Books:

1. Jacek M Zurada, Introduction to Artificial Neural Systems Jaico Publishing House, First edition, 1994.
2. Charu C. Aggarwal, Neural Networks and Deep Learning: Springer International Publishing AG. 2018 1/e
3. F. Karray and C. De Silva, “Soft Computing and Intelligent Systems Design, Theory, Tools and Applications”, Prentice Hall, first edition 2009.

Web References:

1. https://nptel.ac.in/courses/106105173

DIGITAL CONTROL SYSTEMS

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE02

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

CO1: Summarize the concepts of analog and digital control systems

CO2: Analyze the digital systems using Z-Transforms

CO3: Examine the system stability using Routh‟s and Jury‟s tests.

CO4: Test for controllability and observability in discrete-time systems.

CO5: Design digital controller for discrete systems.

UNIT-I **10 Lectures**

Introduction to Digital Control Systems:

Introduction to analog and digital control systems - Advantages of digital systems - Examples - Signals and processing - Sample and hold devices - Sampling theorem and data reconstruction - Frequency domain characteristics of zero order hold.

UNIT-II **10 Lectures**

Modelling of Digital Control Systems:

Z-Transforms - Theorems - Inverse Z-transforms - Formulation of difference equations and solving - Block diagram representation - Pulse transfer functions and finding open loop and closed loop responses - Time Response of a Discrete-Time System, Frequency Response of Discrete-Time Systems.

UNIT-III **10 Lectures**

Stability of Digital Control Systems:

Mapping between the s-Plane and the z-Plane - Primary strips and Complementary strips - Stability criterion - Modified Routh‟s stability criterion and Jury‟s stability test.

UNIT-IV **10 Lectures**

State space analysis and the concepts of Controllability and observability

State space representation of discrete time systems - State transition matrix and methods of evaluation - Discretization of continuous - Time state equations - Concepts of controllability and observability - Tests (without proof).

UNIT-V **10 Lectures**

State Feedback Control:

Design of state feedback controller through pole placement - Necessary and sufficient conditions - Ackerman‟s formula.

Text Books:

1. Digital control systems by K.Ogata.
2. Digital Control and State Variable Methods by M.Gopal, TMH

Reference Books:

1. Digital control systems by B.C.Kuo, Oxford University Press.
2. Digital Control Engineering: Analysis and Design, By M. Sami Fadali, Antonio Visioli, Academic Press; 1edition (February 16, 2009).

Web References:

1. https://nptel.ac.in/courses/108103008

ELECTRICAL DISTRIBUTION SYSTEMS

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE03

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

CO1: Summarize various load models and economic aspects of distribution systems.

CO2: Summarize the factors influencing primary feeder ratings and voltage levels.

CO3: Analyze the modelling of distribution system components.

CO4: Describe distribution system automation and types of distributed generation.

CO5: Analyze the system for power factor compensation and voltage control.

UNIT-I **10 Lectures**

Distribution System Basics

Brief description about electrical power transmission and distribution systems, Factors effecting the system planning, Distribution system planning methods, Planning models, Factors for future planning, Distribution system loading characteristics -diversity factor, coincidence factor, load diversity, contribution factor, loss factor; relation between load and loss factors.

UNIT-II **10 Lectures**

Distribution Systems

Types of distribution systems, Substation bus schemes and comparison, Factors effecting the substation location, Rating of a distribution substation for square and hexagonal shaped distribution substation service area, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level and loading, Tie-lines, Radial feeder with uniformly and non-uniformly distributed loading

UNIT-III **10 Lectures**

Distribution System Components

Approximate line segment model, Various types of loads, Definitions of various terms related to system loading, Detailed description of distribution transformer loading, feeder loading, Modelling of star and delta connected loads, two-phase and single-phase loads, shunt capacitors, Voltage regulators, Line-drop compensator

UNIT-IV **10 Lectures**

Modern Distribution Systems

Distribution system automation, Architecture and implementation strategies for distribution automation, Distribution management system functions, Real-time control system, Outage management, Decision support applications, Concepts of distributed generation, Various types of distributed generators.

UNIT-V **10 Lectures**

Compensation for Power Factor Improvement

Capacitive compensation for power factor control - Different types of power capacitors - shunt and series capacitors - Effect of shunt capacitors (Fixed and switched) - Power factor correction - Capacitor allocation - Economic justification - Procedure to determine the best capacitor location.

Voltage Control

Equipment for voltage control - Effect of series capacitors - Effect of AVR - Line drop compensation.

Text Books:

1. Electric Power Distribution System Engineering, TuranGonen, McGraw-Hill Inc., New Delhi, 1986.

Reference Books:

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.
2. Electric Power Distribution - by A.S. Pabla - Tata McGraw-hill Publishing Company - 4 th edition - 1997.
3. Electrical Power Distribution Systems by V.Kamaraju - Right Publishers.

Web References:

1. https://archive.nptel.ac.in/courses/108/107/108107112/
2. https://archive.nptel.ac.in/courses/117/103/117103149/

ELECTRICAL ENERGY AUDIT AND MANAGEMENT

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE04

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

CO1: Discuss the basic principles of Energy Audit and importance of energy conservation.

CO2: Summarize the concepts of energy management.

CO3: Analyze the methods of improving energy efficiency in different electrical systems

CO4: Describe power factor improvement methods, lighting system practices, and energy instruments used in energy auditing.

CO5: Calculate life cycle costing analysis and return on investment on energy efficient technologies.

UNIT-I **10 Lectures**

Basic Principles of Energy Audit

Energy audit-definitions-concept-types of audit-energy index-cost index-pie charts-Sankey diagrams-load profiles- Energy conservation schemes- Energy audit of industries- energy saving potential-energy audit of process industry-thermal power station-building energy audit.

UNIT-II **10 Lectures**

Energy Management

Principles of energy management-organizing energy management program-initiating- planning-controlling-promoting-monitoring-reporting-Energy manger-Qualities and functions-language.

UNIT-III **10 Lectures**

Energy Efficient Motors

Standard motors vs Energy efficient motors - factors affecting efficiency-loss distribution-constructional details-characteristics-variable speed-variable duty cycle systems.

RMS-voltage variation-voltage unbalance-over motoring-motor energy audit.

UNIT-IV **10 Lectures**

Power Factor Improvement, Lighting and Energy Instruments

Power factor - methods of improvement- location of capacitors- effect of power factor with non-linear loads, harmonics - power factor motor controllers.

Good lighting system design and practice, lighting control Schemes - lighting energy audit - Energy Instruments - wattmeter-data loggers-thermocouples-pyrometers-lux meters-tong testers.

UNIT-V **10 Lectures**

Economic Aspects and Analysis

Economics Analysis-Depreciation Methods-time value of money-rate of return-present worth method-replacement analysis-life cycle costing analysis- calculation of simple payback method-net present worth method - Applications of life cycle costing analysis - Return on investment (RoI).

Text Books:

1. Energy Management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012.
2. Energy Efficient Electric Motors by John. C. Andres, Marcel Dekker Inc. Ltd - 2nd Edition, 1995.
3. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publishing Company Ltd, New Delhi.

Reference Books:

1. Energy management by Paulo‟ Callaghan, Mc - Graw Hill Book company - 1st edition, 1998.
2. Energy management hand book by W.C. Turner, John wiley and son, 2001.
3. Energy management and good lighting practice: fuel efficiency booklet12 - EEO.

Web References:

1. https://onlinecourses.swayam2.ac.in/nou25_es05
2. https://beeindia.gov.in/sites/default/files/1Ch3.pdf

FLEXIBLE AC TRANSMISSION SYSTEMS

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE05

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

CO1: Summarize the concepts of various FACTS devices

CO2: Describe the operation of voltage and current source converters.

CO3: Apply the shunt compensation to enhance the power quality and stability.

CO4: Analyze the effects of series compensators to improve stability of a system.

CO5: Describe the operation of UPFC and IPFC.

UNIT-I **10 Lectures**

Introduction to FACTS

Power flow in an AC System - Loading capability limits - Dynamic stability considerations - Importance of controllable parameters - Basic types of FACTS controllers - Benefits from FACTS controllers - Requirements and characteristics of high power devices - Voltage and current rating - Losses and speed of switching - Parameter trade-off devices.

UNIT-II **10 Lectures**

FACTS Converters

Types of Converters, Concept and operation of Voltage sourced converters, Current Sourced converters, Operation of Single-Phase and Three-Phase Bridge Converters, Description of Three-Level VSC and PWM Converters, Transformer Connections for 12-pulse operation.

UNIT-III **10 Lectures**

Shunt Compensators

Objective of Shunt Compensation, Mid-point voltage regulation for line segmentation, End of line voltage support to prevent voltage instability, Improvement of transient stability, Power oscillation damping.

Methods of Controllable Shunt VAR Generation

Variable Impedance Type VAR Generator: Thyristor Switched/Controlled Reactor (TSR/TCR), Fixed Capacitor Thyristor Controlled Reactor (FC-TCR), Thyristor Switched Capacitor (TSC), Thyristor Switched Capacitor and Thyristor Controlled Reactor (TSC-TCR),

Switching Converter type VAR generator(STATCOM), comparison of SVC and STATCOM

UNIT-IV **10 Lectures**

Series Compensators

Objective of Series Compensation, Improvement of voltage stability, Transient stability, Power oscillation damping, Methods of Controllable Series VAR Generation, GTO Thyristor controlled Series Capacitor (GSC), Thyristor Switched Series Capacitor (TSSC) and Thyristor Controlled Series Capacitor (TCSC), Switching Converter type Series Compensation(SSSC).

UNIT-V **10 Lectures**

UPFC and IPFC

Unified Power Flow Controller (UPFC) - Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control;

Principle of operation and Characteristics of Interline Power Flow Controller (IPFC), UPFC and IPFC control structures (only block diagram description).

Text Books:

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. R Mohan Mathur and Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2002

Reference Books:

1. K R Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publishers, New Delhi, 2007.
2. AnriqueAcha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles- Camacho, FACTS: Modelling and Simulation in Power Networks, John Wiley & Sons, West Sussex, 2004.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_ee58

HVDC TRANSMISSION

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE06

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

CO1: Summarize the technical, economic, reliability, and environmental aspects of HVDC transmission and its applications.

CO2: Summarize HVDC converter circuits including their components, pulse numbers, and operating principles.

CO3: Analyze the characteristics of HVDC converters and evaluate different pulse converter configurations for transmission applications.

CO4: Apply various control strategies for HVDC transmission including firing angle, current, and power flow control.

CO5: Analyze converter valve malfunctions and protection mechanisms in HVDC systems.

UNIT-I **10 Lectures**

General aspects of DC transmission and comparison of it with AC transmission: Introduction, General aspects of transmission, Transmission links, types- Monopolar, Homopolar, Bipolar and Back-to-Back, Constitution of dc and ac links. Technical aspects, Economic aspects, Reliability aspects and Environmental aspects of HVDC Transmission (HVDCT), Advantages and disadvantages of HVDCT, Applications of DC Transmission,

HVDC light.

UNIT-II **10 Lectures**

Converters:

Definition, Thury system, Valves, Valve characteristics, Components of circuits, Properties of converter circuits, Pulse number, Single phase and three phase converters, Assumptions in converter circuit, 6-pulse Greatz circuit, Bridge converter with grid control without overlap, Bridge converter with grid control with overlap less than 60^0

UNIT-III **10 Lectures**

HVDC Links and Converters:

Characteristics of converter circuits - Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link, Brief description of 12-pulse and 24-pulse converters transformer configurations, Choice of converter circuit for

HVDC transmission, Introduction to Modular Multilevel Converters.

UNIT-IV **10 Lectures**

HVDC Converter control:

Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing- angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

UNIT-V **10 Lectures**

Mis-operation and Protection of DC links:

Malfunction of converter valves, Arc-back, Arc-through, Misfire, Quenching, Commutation failure, Valve blocking and bypass, short circuits within the converter station. DC reactors, valve dampers, line dampers, circuit breakers.

Text Books:

1. E.W. Kimbark, Direct current transmission, Vol. I, Wiley, New York, 1971.
2. P Kundur, Power System Stability and Control, McGraw Hill Inc., New York, 1994.
3. HVDC Transmission by S Kamakshaiah and V Kamaraju, McGraw Hill Publications

Reference Books:

1. K. R. Padiyar, HVDC Power Transmission Systems: Theory and System Interactions, New Age International Publishers, New Delhi, 2009.
2. Erich Uhlmann, Power Transmission by Direct Current, Springer-Verlag, Berlin/Heidelberg, 1975.

Web References:

1. https://nptel.ac.in/courses/108104013

HYBRID ELECTRIC VEHICLES

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE07

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

CO1: Summarize the concept of Electric Vehicles (EV) and Hybrid Electric Vehicles (HEV).

CO2: Analyze the various drive train configurations of hybrid electric vehicles.

CO3: Choose an effective motor for EV and HEV application and summarize drive train concept of plug in electric vehicles.

CO4: Analyze the power converters used in hybrid electric vehicles.

CO5: Summarize concept of energy storage systems using battery and other storage systems.

UNIT-I **10 Lectures**

Introduction

Fundamentals of vehicle - components of conventional vehicle and propulsion load - Drive cycles and drive terrain - Concept of electric vehicle and hybrid electric vehicle - History of hybrid vehicle - advantages and applications of Electric and Hybrid Electric Vehicles- comparison of ICE, HEV and EV.

UNIT-II **10 Lectures**

Hybridization of Automobile

Architectures of HEVs - series and parallel HEVs - complex HEVs - Plug-in hybrid vehicle (PHEV) - Constituents of PHEV - comparison of HEV and PHEV - Extended range hybrid electric vehicles (EREVs) - blended PHEVs.

UNIT-III **10 Lectures**

Electric Motors for HEV and EVs

Characteristics of traction drive - requirement of electric motors for HEV/EVs - Induction Motor drives - their control and applications in HEV/EVs - Permanent Magnet Synchronous motor: configuration - control and applications in HEV/EVs.

Brushless DC Motors: Advantages - control of application in HEV/EVs - Switched reluctance motors: Merits - limitations - converter configuration - control of SRM for HEV/EVs - Comparison between all drives.

UNIT-IV **10 Lectures**

Power Electronics in HEVs

Boost and Buck-Boost converters - Multi Quadrant DC-DC converters - DC-AC Inverter for HEV and EV applications - Three Phase DC-AC inverters - Voltage control of DC-AC inverters using PWM - EV and PHEV battery chargers.

UNIT-V **10 Lectures**

Energy Sources for HEVs

Energy Storage - Battery based energy storage and simplified models of battery - fuel cells - their characteristics and simplified models - super capacitor based energy storage - its analysis and simplified models - flywheels and their modeling for energy storage in HEV/EV - Hybridization of various energy storage devices.

Text Books:

1. Ali Emadi - Advanced Electric Drive Vehicles - CRC Press - 2014.
2. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2003.

Reference Books:

1. MehrdadEhsani - YimiGao - Sebastian E. Gay - Ali Emadi - Modern Electric - Hybrid Electric and Fuel Cell Vehicles: Fundamentals - Theory and Design - CRC Press - 2004.
2. James Larminie - John Lowry - Electric Vehicle Technology Explained - Wiley - 2003.
3. H. Partab: Modern Electric Traction - Dhanpat Rai& Co - 2007.

Web References:

1. https://archive.nptel.ac.in/courses/108/103/108103009/
2. https://onlinecourses.swayam2.ac.in/nou24_ec10/

MACHINE LEARNING APPLICATIONS IN ELECTRICAL ENGINEERING

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE08

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

CO1: Summarize the types of machine learning and differentiate between supervised, unsupervised, and reinforcement learning

CO2: Apply data cleaning techniques, perform feature scaling and selection.

CO3: Describe various machine learning algorithms for classification.

CO4: Summarize the various machine learning Regression methods.

CO5: Implement machine learning techniques for Electrical Engineering applications.

UNIT-I **10 Lectures**

Introduction to Machine Learning:

Introduction to Machine Learning-Role of ML in Electrical Engineering Applications- Different Types of Machine Learning Methods, Supervised, Semi Supervised, Unsupervised and Reinforcement Learning.

UNIT-II **10 Lectures**

Data Pre-processing and Feature Engineering:

Data cleaning and handling missing Values-Removing rows/columns, Imputation, Outlier detection, Feature scaling -standardization & min max scaling, Feature Normalization, Feature extraction-Principal component extraction- Domain specific extraction, Feature Selection- Filter methods-wrapper methods-embedded methods. Feature selection techniques to identify the most relevant inputs or states for controllers in process plants.

UNIT-III **10 Lectures**

Classification Algorithms: Difference Between Classification and Regression-Classification Algorithms-KNN Algorithm-Challenges and Limitations-Optimal Location for EV Charge stations using KNN.

Advanced Classification Algorithm:

Support Vector Machines: linear and nonlinear SVM classification-Power Quality Monitoring using SVM.

UNIT-IV **10 Lectures**

Regression Algorithms: Linear Regression- Decision Tree Regression, Ensemble Learning and Random Forest Regression-Energy Consumption in buildings using Decision Tree.

Unsupervised Learning: k-means clustering and its limitations.

UNIT-V **10 Lectures**

ML Applications in Electrical Engineering:

Load Forecasting - Renewable energy forecasting- Solar power MPPT- False data injection attack detection.

Text Books:

1. Machine Learning and Artificial Intelligence by Joshi and Ameet V (2022) Springer International Publishing.
2. Aurélien Géron (2022), "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow," 3rd Edition, O"Reilly Publications.
3. Anuradha Srinivasaraghavan , Vincy Joseph , Machine Learning, Wiley 2019.

Reference Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill International Edition, 2013
2. Giuseppe Bonaccorso, Machine Learning Algorithms, Packt Publishing; 2018 2/e

Web References:

1. https://onlinecourses.nptel.ac.in/noc25_cs46
2. https://nptel.ac.in/courses/106106198

POWER SYSTEM OPERATION AND CONTROL

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE09

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

CO1: Compute optimal load scheduling of Generator with and without considering transmission losses

CO2: Explain the need for Hydro-thermal coordination. Formulate hydrothermal scheduling and unit commitment problem.

CO3: Analyse the effects of Load Frequency Control for single area and two area systems with and without control

CO4: Analyze the static and dynamic response of the AVR loop

CO5: Apply computer-based tools for monitoring and controlling power systems

UNIT-I **10 Lectures**

Optimal System Operation

Characteristics of various steam units, combined cycle plants, cogeneration plants, Hydro- electric units, Steam units, General transmission line loss formula, Economic dispatch problem with and without considering losses and solution using Lagrange multiplier method.

UNIT-II **10 Lectures**

Hydro-Thermal Coordination

Hydro-electric plant models, Scheduling energy, Short-term hydrothermal scheduling.

Unit Commitment

Constraints in unit commitment, Generation of state, optimizing the states using Priority-list method, Unit commitment problem solution using Priority-list method and Dynamic Programming.

UNIT-III **10 Lectures**

Automatic Generation Control-1

Necessity of keeping frequency constant, Modelling of steam turbine, speed governing, generator, Automatic Load-frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop.

Automatic Generation Control-2

Automatic Load Frequency Control of two area system uncontrolled case and controlled case, Tie-line bias control of two area and multi-area system, Load Frequency Control and Economic dispatch control.

UNIT-IV **10 Lectures**

Voltage Control

Automatic voltage regulator (AVR), Exciter types, Exciter modelling, Generator modelling, Static and Dynamic response of AVR loop.

UNIT-V **10 Lectures**

Computer Control of Power Systems

Need of computer control of power systems - concept of energy control centers and functions- PMU - System monitoring - Data acquisition and controls - System hardware configurations - SCADA and Energy Management System functions - State estimation problem - measurements and errors - weighted least square estimation - various operating states - state transition diagram.

Text Books:

1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd edition, 1996.
2. Modern Power System Analysis - by I.J.Nagrath &D.P.Kothari Tata McGraw Hill Publishing Company Ltd - 2nd edition.
3. Electric Energy systems Theory - by O.I.Elgerd - Tata McGraw-hill Publishing Company Ltd. Second edition.

Reference Books:

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., Thompson, 3rdEdition.
2. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
3. Power System Analysis by HadiSaadat - TMH Edition.
4. Power System stability & control, Prabha Kundur,TMH

Web References:

1. https://archive.nptel.ac.in/courses/108/104/108104052/
2. https://onlinecourses.nptel.ac.in/noc23_ee128/

POWER SYSTEM PROTECTION

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE10

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

CO1: Outline the need for protection systems and type of faults.

CO2: Summarize the operation of electromagnetic relays.

CO3: Summarize the operation of static relays.

CO4: Analyse the performance of circuit breakers

CO5: Describe the protection of major power system components.

UNIT-I **10 Lectures**

Introduction to Protection Scheme

Need for Protective systems - Nature and causes of Faults - Types of faults - Effect of faults - fault statistics - Evolution of protective relays - Zones of protection - Primary and Back -up Protection - Essential qualities of Protection - Classification of Protective schemes - Automatic reclosing - CT and PT for Protection.

UNIT-II **10 Lectures**

Relays

Basic relay terminology - Balanced beam type attracted armature relay - Induction disc and Induction cup relays - Torque equations - Classification of relays - Concept of reset, pick up, inverse time and definite time characteristics - Directional over current relay and its operating characteristics - Universal torque equation - Distance relays: Impedance, Reactance and Mho relays - Differential Relays: Current and percentage differential relays.

UNIT-III **10 Lectures**

Static Relays

Introduction- Advantages and limitations of static relays - Applications - Amplitude and Phase comparators, Duality between AC and PC, Static amplitude comparator, integrating and instantaneous comparators, static phase comparators, coincidence type of phase comparator, - Static over current, directional, distance and differential relays - Electronic relay - Microprocessor Based Relays: Advantages, over current relays, directional relays, distance relays.

UNIT-IV **10 Lectures**

Switchgear

Introduction - Arc Phenomenon - Methods of arc extinction - Factors affecting active recovery voltage - Derivation of RRRV & Restriking voltages - Types of circuit breakers & their applications - Rating selection and testing of circuit breakers/operating mechanisms - Description and operation of Air Blast- Vacuum and SF6 circuit breakers.

UNIT-V **10 Lectures**

Generator Protection - Types & detection of faults and their effects - Biased Differential scheme - Earth fault Protection

Transformer Protection - Types & detection of faults and their effects - Percentage differential protection - Design of CT‟s ratio- Buchholz relay protection-Numerical examples. **Bus bar protection** - Differential Overcurrent Protection - Frame leakage protection.

Transmission line protection - Pilot relaying schemes - Power line carrier protection.

Feeder Protection - Types - Parallel Feeder - Ring Feeder.

Text Books:

1. Badriram & Vishwakarma, “Power System Protection”, Tata McGraw-Hill Education, 2011.
2. Paithankar Y. G., S. R. Bhide., “Fundamentals of power system protection”, PHI Learning Pvt. Ltd., 2004.

Reference Books:

1. Ravindra Nath.B, and Chandar.M, “Power systems protection and switchgear”, New age international (P) Ltd. 2005.
2. Sunil S Rao, “Switchgear and protection”. Khanna Publishers, 1999.
3. Paithankar.Y.G,” Transmission Network Protection: Theory and Practice”, Marcel Deicker, Inc.1998.

Web References:

1. https://archive.nptel.ac.in/courses/108/107/108107167/
2. https://onlinecourses.nptel.ac.in/noc21_ee110/preview

RENEWABLE ENERGY SOURCES

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE11

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

CO1: Summarize the concepts of solar power generation.

CO2: Assess the performance and limitations of wind energy systems

CO3: Outline the geothermal and ocean energy sources

CO4: Summarize the biomass, fuel cells and hydrogen energy technologies.

CO5: Analyze the impact of renewable energy integration in power systems.

UNIT-I **10 Lectures**

Introduction to Energy Sources: Energy sources and their availability - non-conventional sources - renewable energy sources - advantages and prospects of renewable energy sources.

Solar Energy: Extra-terrestrial solar radiation - terrestrial solar radiation - Solar energy collectors - flat plate collectors and concentrating collectors - Applications of solar energy - solar pond - solar water heater - solar distillation - solar cooking

Photovoltaics: Solar cell - equivalent circuit - characteristics of PV cell - PV array design - PV System components - Sizing and economics - Peak power operation - Fill Factor- MPPT (P&O only)

UNIT-II **10 Lectures**

Wind Energy: Wind power sources - wind characteristics - site selection - Criterion, momentum theory, WECS and its types - Components of wind energy systems - performance and limitations - classification of wind energy Turbines - Aerodynamic forces acting on blades - applications and environmental impacts.

UNIT-III **10 Lectures**

Geothermal Energy: Origin and types: Hydrothermal - Types - Geo-pressurized & Petro thermal, advantages and disadvantages of geothermal energy.

Energy from the oceans: Ocean temperature differences - principles of OTEC plant operations. Open cycle and closed cycle systems- ocean waves - wave energy conversion systems.

Energy from Tides - basic principle of tidal power, components of tidal power plants- single basin and double basin systems.

UNIT-IV **10 Lectures**

Energy from Biomass: Biomass conversion technologies, photosynthesis - biogas generation-factors affecting biogas generation - Bio fuels: Classification - direct combustion for heat and electricity generator - anaerobic digestion for biogas - biogas digester - KVIC power generation.

Chemical Energy: Fuel cells - Principle of operation of fuel cell - Types of fuel cells - applications of fuel cells - Hydrogen energy - Green hydrogen production (PV) - Storage and applications.

UNIT-V **10 Lectures**

Renewable Energy Integration in Power Systems

Standalone and grid integrated systems - Distributed Generation - Renewable energy penetration - Point of common coupling (PCC) - Connection voltage - Voltage Effects - Steady state voltage rise - Islanding.

Text Books:

1. G.D. Rai, Non-Conventional energy sources, 6th Edition, Khanna Publishers, 2011.
2. Renewable Energy in Power Systems by Leon Freris and David Infield, John Wiley & Sons, Ltd.

Reference Books:

1. John Twidell & Toney Weir - Renewable Energy Sources, E & F.N. Spon
2. G.S. Sawhney, Non-Conventional Energy Sources, 1st Edition, Prentice India Pvt. Ltd, 2012.
3. G.N. Tiwari and M.K. Ghosal, Renewable Energy Resources: Basic Principles and Applications, 1st Edition, Alpha Science International Ltd, 2004.
4. Chetan Singh Solanki, Fundamentals, Technologies & Applications, Solar Photovoltaic, PHIPublishers, 2019, 3rd Edition.

Web References:

1. https://nptel.ac.in/courses/108/105/108105058/

SMART GRIDS

(PROFESSIONAL ELECTIVE)

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE12

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

CO1: Summarize the features and architecture of Smart Grid

CO2: Assess the role of automation in transmission and distribution.

CO3: Analyze the operation of DG and storage technologies.

CO4: Summarize the communication technologies and cyber-security in Smart Grid.

CO5: Outline the planning, operation, control and analysis of Smart Electric Grid.

UNIT-I **10 Lectures**

Introduction to Smart Grid: Introduction, Definition of smart grid, Concept of smart grid structure, Conventional grid Vs. Smart grid, Opportunities & Barriers of Smart Grid, Enablers of smart grid, Smart-grid activities in India, Key Challenges for Smart Grid.

UNIT-II **10 Lectures**

Smart Grid Architecture: Components and Architecture of Smart Grid Design, Review of the proposed architectures for Smart Grid, Advanced metering infrastructure, The fundamental components of Smart Grid designs -Transmission Automation -Distribution Automation - Renewable Integration.

UNIT-III **10 Lectures**

Distribution Generation Technologies: Introduction to Renewable Energy Technologies, Micro grids, Storage Technologies - Electric Vehicles and PHEVs, Environmental impact and Climate Change, Economic Issues.

UNIT-IV **10 Lectures**

Communication Technologies and Smart Grid: Introduction to Communication Technology - Two-way digital communications paradigm, Synchro - Phasor Measurement Units (PMUs), Wide Area Measurement Systems (WAMS), Introduction to Internet of things (IOT) - Applications of IOT in Smart Grid, Cyber Security for Smart Grid.

UNIT-V **10 Lectures**

Smart Grid Planning: Planning aspects of smart grid, Operation and control of AC, DC & hybrid smart grid, Demand side management - Demand response, Energy management, Planning of smart grid systems.

Text Books:

1. J. Ekanayake, N. Jenkins, K. Liyanage, J.Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley, 1st Edition, 2012.
2. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 1st edition, 2012.
3. Ali Keyhani, "Design of smart power grid renewable energy systems", Wiley IEEE, 3 rd Edition, 2019.

Reference Books:

1. J. Ekanayake, N. Jenkins, K. Liyanage, J.Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley, 1st Edition, 2012.
2. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 1st edition, 2012.
3. Ali Keyhani, "Design of smart power grid renewable energy systems", Wiley IEEE, 3 rd Edition, 2019.

Web References:

1. https://archive.nptel.ac.in/courses/108/107/108107113/

SPECIAL ELECTRICAL MACHINES

PROFESSIONAL ELECTIVE

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE13

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

CO1: Summarize the different types of permanent magnet materials used in motors and their effect on motor performance.

CO2: Analyze different types of stepper motors and compare open-loop and closed-loop control systems.

CO3: Summarize the concepts of switched Reluctance Motors.

CO4: Describe the operation and characteristics of BLDC motors and compare the performance of square wave and sine wave control methods.

CO5: Describe the construction, operation, and types of Linear Induction Motors.

UNIT-I **10 Lectures**

Permanent Magnet Materials and PMDC motors:

Introduction - classification of permanent magnet materials used in electrical machines - minor hysteresis loop and recoil line - Stator frames of conventional dc machines - Development of electronically commutated dc motor from conventional dc motor - Permanent magnet materials and characteristics - BH loop and demagnetization characteristics-high temperature effects-reversible losses - Irreversible losses - Mechanical properties - handling and magnetization - Application of permanent magnets in motors - power density – operating temperature range - severity of operation duty- Hysteresis - Eddy current Motors.

UNIT-II **10 Lectures**

Stepper Motors:

Principle of operation of Stepper Motor - Constructional details - Classification of stepper motors - Different configuration for switching the phase windings - Control circuits for stepper motors - Open loop and closed loop control of two phase hybrid stepping motor.

UNIT-III **10 Lectures**

Switched Reluctance Motors:

Construction and Principle of operation of Switched Reluctance Motor - Comparison of conventional and switched reluctance motors - Design of stator and rotor pole arcs. Torque producing principle and torque expression - Different converter configurations for SRM - Drive and power circuits for SRM - Position sensing of rotor - Applications of SRM

UNIT-IV **10 Lectures**

Permanent Magnet Motors:

BLDC motor: Principle of operation of BLDC motor - Types of constructions - Surface mounted and interior type permanent magnet DC Motors - Torque and EMF equations for Square wave & Sine wave for PMBLDC Motor - Torque - Speed characteristics of Square wave & Sine wave for PMBLDC Motor - Applications.

PMSM: Principle of operation of PMSM - Torque and EMF equations - Torque Speed characteristics - Applications.

UNIT-V **10 Lectures**

Linear Induction Motors (LIM):

Construction - principle of operation - Double sided LIM from rotating type Induction Motor - Schematic of LIM drive for traction - Development of one sided LIM with back iron - equivalent circuit of LIM - Applications

Text Books:

1. Brushless Permanent magnet and reluctance motor drives, Clarenden press, T.J.E. Miller, 1989, Oxford.
2. Special electrical Machines, K.Venkata Ratnam, University press, 2009, New Delhi.

Reference Books:

1. Yomg Hua Song, „Flexible AC Transmission Systems‟ (FACTS) IEE Press,1999
2. E. Acha, V. G. Agelidis, O. Anaya-Lara, T. J. E. Miller, „Power Electronic Control in Electrical Systems‟ Newnes Power Engineering Series, Oxford, 2002.

Web References:

1. https://nptel.ac.in/courses/108102156

UTILIZATION OF ELECTRICAL ENERGY

PROFESSIONAL ELECTIVE

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EE11PE14

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

CO1: Design Illumination systems for various applications

CO2: Summarize various heating and welding methods

CO3: Analyse the electrical circuits used in refrigerator, water cooler and air-conditioner

CO4: Illustrate various electric traction systems

CO5: Summarize energy storage schemes for various applications

UNIT-I **10 Lectures**

Illumination fundamentals: Introduction terms used in illumination - laws of illumination - polar curves - photometry - integrating sphere - sources of light.

Various Illumination Methods: Mercury and Sodium vapour lamps - filament lamps and fluorescent tubes - Basic principles of light control - Types and design of lighting schemes - factory, street and flood lighting - principle and operation of LED Lighting.

UNIT-II **10 Lectures**

Electric Heating: Advantages - Design of Heating Element - Properties of heating elements - Types of heating methods - Resistance heating - direct and indirect resistance heating - Induction heating - principle of core type and coreless induction furnace - Dielectric Heating.

Electric Welding: Advantages - methods of Electric welding - Resistance and arc welding - Electric welding equipment - Comparison between AC and DC Welding

UNIT-III **10 Lectures**

HVAC Systems: Modes of heating - Advantages of HVAC Systems - Air Conditioning and Water Coolers - Principle of air conditioning - vapour pressure, refrigeration cycle - eco- friendly refrigerants - Description of Electrical circuit used in refrigerator, water cooler and air conditioner.

UNIT-IV **10 Lectures**

Electric Traction: System of electric traction and track electrification - Review of existing electric traction systems in India - Special features of traction motor - Mechanics of train movement - Speed-time curves for different services - trapezoidal and quadrilateral speed time curves - Calculations of tractive effort - coefficient of adhesion - power output, specific energy consumption for given run, effect of varying acceleration and braking retardation - Numerical problems

UNIT-V **10 Lectures**

Introduction to Energy Storage Systems: Need for Energy Storage - Types of Energy Storage - Thermal - Electrical - Mechanical - Magnetic and Chemical Storage Systems - Comparison of Energy Storage Technologies - and Applications.

Text Books:

1. E. Openshaw Taylor: Utilization of Electric Energy, Orient Longman, Reprint 2010. (Unit I, II, III)
2. J.B. Gupta, Rajeev Manglik, RohitManglik, "Utilization of Electric Energy and Traction", Kataria & Sons Publishers, Delhi, 2014 Edition, (reprint) (Units 1-5).
3. "Thermal energy storage systems and applications"-by Ibrahim Dincer and Mark A.Rosen. John Wiley and Sons 2002.

Reference Books:

1. C.L. Wadhwa, "Generation, Distribution and Utilization of electrical Energy", New Age International (P) Limited Publishers, 3rd Edition, 2010.
2. N.V. Suryanarayana, "Utilization of Electrical Power including Electric drives and Electric traction", New Age International (P) Limited Publishers, 1st Edition,1994.
3. H. Partab: Art & Science of Utilisation of Electric Energy, DhanpatRai & Sons, Reprint 2011

Web References:

1. https://archive.nptel.ac.in/courses/108/105/108105060/

BASICS OF SIGNALS AND SYATEMS

PROFESSIONAL ELECTIVE

(Branch: EEE)

L	T	P	C
3	0	0	3

Course Code: 24EC11PE14

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 in signal processing for system analysis and signal comparison.

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, effect of Under sampling, aliasing, unilateral and bilateral Z-Transforms, Properties of Z-Transform, Z- Transform of basic signals, Inverse Z-Transform

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, Second edition , Prentice Hall India Learning Private Limited, 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

BASICS OF ELECTRICAL WIRING

(OPEN ELECTIVE)

L	T	P	C
3	0	0	3

Course Code: 24EE11EL01

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

CO1: Identify various electrical symbols and simple electrical circuits.

CO2: Summarize the various materials required for wiring.

CO3: Outline the various electrical accessories for electrical wiring installations

CO4: Describe various aspects of all electrical protection devices

CO5: Design of electrical installation for different types of buildings and small industries.

UNIT-I **10 Lectures**

Electrical Symbols and Simple Electrical Circuits

Need of electrical symbols, list of symbols, Electrical Diagrams, Methods of representation for wiring diagrams, introduction to simple light and fan circuits, system of connection of appliances and accessories, Numerical Problems on light and fan circuits.

UNIT-II **10 Lectures**

Materials: Properties of good conductor, classification of conductors, difference between wire and cable, current rating and fusing current of cable, necessity of stranding cables, types of cables, selection of cable for wiring installation, sizes and types of wires, wire splicing and terminations

UNIT-III **10 Lectures**

Electrical Accessories: Switchers, ceiling roses, socket outlets, plugs, terminal blocks, appliance connector, main switch, splitter units, distribution fuse boards, Neutral links, insulators and its qualities, MCB and its specifications.

UNIT-IV **10 Lectures**

Protective Devices: Features of good protective device, fuse elements, Earth leakage circuit breaker, points to remember while providing earthing, precautions against shocks, Over load trip.

UNIT-V **10 Lectures**

Electric Wiring: Selection of wiring, Wiring Systems - Service mains, meter board and distribution board, Types of wirings and their Installations, House wiring (one lamp-one switch, Stair case, Corridor wiring, Power wiring), Basic LT panel wiring diagram.

Text Books:

1. Electrical Design and Estimation Costing - K. B. Raina and S.K.Bhattacharya - New Age International Publishers.
2. Electrical wiring estimating and costing - S.L.Uppal and G.C.Garg - Khanna publishers, sixth edition, 1987.

Reference Books:

1. A course in electrical installation estimating and costing - J.B.Gupta -Kataria SK & Sons.
2. J B Gupta, A course in Electrical Installation Estimating and Costing, S K Kataria & Sons, New Delhi, 9th Edition, 2012.
3. Frederic P Hartwell and Herbert P. Richter, Practical Electrical Wiring: Residential, farm, Commercial and Industrial, Park Publishing Inc., Wisconsin, 22nd edition, 2014.
4. Ray C Mullin and Phil Simmons, Electrical Wiring: Residential, Delmar Cengage Learning, New York, 17th edition, 2012
5. Design of Electrical Installations, Dr. V.K. Jain, Dr. Amitabh Bajaj, University Science Press.

FUNDAMENTALS OF POWER ELECTRONICS

(OPEN ELECTIVE)

L	T	P	C
3	0	0	3

Course Code: 224EE11EL02

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

CO1: Summarize the characteristics of power semiconductor devices and SCR firing circuits.

CO2: Analyze the performance of phase-controlled rectifiers.

CO3: Analyze the performance of AC-AC converters

CO4: Summarize the operation DC-DC converters

CO5: Analyse the operation of PWM inverters for voltage control

UNIT-I **10 Lectures**

Modern Power Semiconductor Devices: Basic Structure and Characteristics of Diode - Transistor - SCR - MOSFET -IGBT - GTO - DIAC - TRIAC.

Thyristors: Two transistor analogy - Static and Dynamic characteristics - Turn on and Turn off Methods - Triggering Methods (R, RC and UJT)

UNIT-II **10 Lectures**

Phase Controlled Rectifiers (AC to DC converters): Single Phase-Half wave Rectifier with R & RL Circuits - Single Phase Full wave & Bridge Controlled Rectifiers -Three-Phase Controlled Rectifier.

UNIT-III **10 Lectures**

AC - AC Converters: Classification of AC Regulators - unidirectional and bidirectional AC voltage Regulator with R and RL loads - Expression for rms output voltage

UNIT-IV **10 Lectures**

Choppers (DC to DC converters): Principle of Operation - Step-up (boost) - Step-down (buck), Step-up & Step-down (buck-boost) Choppers - Numerical Problems

UNIT-V **10 Lectures**

Inverters (DC-AC Converters): Classification - Half and Full Bridge Inverters - PWM Techniques

Applications: UPS - On-line & Off-line Charging - Circuit Diagram

Text Books:

1. Power Electronics: Converters, Applications and Design by Ned Mohan, Tore Undeland, William P Robbins, John Wiley & Sons.
2. Power Electronics: Circuits, Devices and Applications - by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
3. Power Electronics: Essentials & Applications by L. Umanand, Wiley, Pvt. Limited, India, 2009.

Reference Books:

1. Elements of Power Electronics-Philip T. Krein. Oxford University Press; Second edition
2. Power Electronics - by P.S. Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers - by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.

Web References:

1. https://archive.nptel.ac.in/courses/108/101/108101126/

FUNDAMENTALS OF UTILIZATION OF ELECTRICAL ENERGY

(OPEN ELECTIVE)

L	T	P	C
3	0	0	3

Course Code: 24EE11EL03

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

CO1: Design Illumination systems for various applications

CO2: Distinguish between various types of heating methods

CO3: Distinguish between various types of Welding methods

CO4: Summarize different types of electrical traction systems, describe, and calculate tractive power and specific energy consumption

CO5: Validate the necessity and usage of different energy storage schemes for different applications

UNIT-I **10 Lectures**

Illumination fundamentals: Illumination fundamentals Introduction - terms used in illumination -Laws of illumination -Lux meter - Sources of light.

Various Illumination Methods: Tungsten filament lamps and fluorescent lamps - Comparison -Basic principles of light control - Types and design of lighting and flood lighting - LED lighting - Energy conservation.

UNIT-II **10 Lectures**

Electric Heating: Advantages and methods of electric heating - Resistance heating - induction heating - dielectric heating.

UNIT-III **10 Lectures**

Electric Welding: Advantages and methods of Electric welding - Resistance and arc welding - Electric welding equipment - Comparison between AC and DC Welding

UNIT-IV **10 Lectures**

Electric Traction: System of electric traction and track electrification- Review of existing electric traction systems in India- Special features of traction motor- Mechanics of train movement-Speed-time curves for different services - Trapezoidal and quadrilateral speed time curves - Coefficient of adhesion - Calculations of tractive effort- Numerical Problems

UNIT-V **10 Lectures**

Introduction to Energy Storage Systems: Need for energy storage - Types of energy storage-Thermal - electrical - magnetic and chemical storage systems - Comparison of energy storage technologies-Applications.

Text Books:

1. E. Openshaw Taylor: Utilization of Electric Energy, Orient Longman, Reprint 2010. (Unit I, II, III)
2. J.B. Gupta, Rajeev Manglik, RohitManglik, "Utilization of Electric Energy and Traction", Kataria & Sons Publishers, Delhi, 2014 Edition, (reprint) (Units 1- 4).
3. "Thermal energy storage systems and applications"-by Ibrahim Dincer and Mark A.Rosen. John Wiley and Sons 2002.

Reference Books:

1. C.L. Wadhwa, "Generation, Distribution and Utilization of electrical Energy", New Age International (P) Limited Publishers, 3rd Edition, 2010.
2. N.V. Suryanarayana, "Utilization of Electrical Power including Electric drives and Electric traction", New Age International (P) Limited Publishers, 1st Edition,1994.
3. H. Partab: Art & Science of Utilisation of Electric Energy, DhanpatRai & Sons, Reprint 2011.

Web References:

1. https://archive.nptel.ac.in/courses/108/105/108105060/

LINEAR CONTROL SYSTEMS

(OPEN ELECTIVE)

Course Code: 24EE11EL04

L	T	P	C
3	0	0	3

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

CO1: Develop mathematical models for physical systems and determine overall transfer function using block diagram algebra and signal flow graphs.

CO2: Analyse the time response of first and second order systems and improvement of performance by PI, PD and PID controllers.

CO3: Investigate the stability of closed loop systems using Routh‟s stability criterion and the analysis by root locus method.

CO4: Analyse the stability of LTI systems using frequency response methods.

CO5: Apply state variable theory to determine the dynamic behaviour of linear control systems

UNIT-I **10 Lectures**

Mathematical Modelling of Control Systems: Classification of control systems - Open Loop and closed loop control systems and their differences - Feedback Characteristics - Differential equations of electrical networks - Modelling of Mechanical Systems - Equations of Mechanical Systems - Analogous Systems - Transfer Function of DC Servo motor - Block Diagrams of Control Systems - Signal Flow Graphs - Numerical Problems.

UNIT-II **10 Lectures**

Time Response Analysis: Standard test signals - Time response of first and second order systems - Time domain specifications - Steady state errors and error constants - Effects of integral and derivative control actions on system performance - PD,PI and PID Controllers- Numerical Problems.

UNIT-III **10 Lectures**

Stability: Concept of Stability and Necessary Conditions for Stability - Routh-Hurwitz Criterion -limitations of Routh‟s stability.

Root-locus Technique: Concept and Construction of Root Loci and its analysis - Numerical Problems

UNIT-IV **10 Lectures**

Frequency Domain Analysis of Control Systems: Introduction to Frequency domain specifications - Bode diagrams - Phase margin and Gain margin - Stability Analysis from Bode Plots - Polar and Nyquist plots - Numerical Problems

Compensators: Introduction - Realization of lag, lead and lag-lead

UNIT-V **10 Lectures**

State Space Analysis of Linear Time Invariant Systems: Concepts of state, state variables and state model, state space representation of transfer function - Diagonalization - Solving the time invariant state equations - State Transition Matrix and it‟s Properties - Concepts of Controllability and Observability - Numerical Problems

Text Books:

1. Automatic control systems by Benjamin C.Kuo, Prentice Hall of India.
2. Control Systems Engineering, I.J.Nagarath and M.Gopal, Newage International Publications.

Reference Books:

1. Control Systems principles and design, M.Gopal, Tata McGraw Hill education Pvt Ltd.
2. Control Systems Engineering by Norman S. Nise, Wiley Publications.
3. Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India.

Web References:

1. https://archive.nptel.ac.in/courses/107/106/107106081/
2. https://archive.nptel.ac.in/courses/108/106/108106098/

SUSTAINABLE ENERGY SOURCES

(OPEN ELECTIVE)

L	T	P	C
3	0	0	3

Course Code: 24EE11EL05

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

CO1: Identify various energy sources and discus the applications of solar energy.

CO2: Demonstrate the concepts of photovoltaic systems.

CO3: Outline the wind and geothermal energy sources

CO4: Illustrate ocean and wave energy conversion systems.

CO5: Summarize the biomass, fuel cells and hydrogen energy technologies.

UNIT-I **10 Lectures**

Introduction to Energy Sources: Energy sources and their availability - non-conventional sources - advantages of renewable energy sources - prospects of renewable energy sources **Solar Energy:** Extra-terrestrial solar radiation - terrestrial solar radiation - instruments for measuring solar radiation- Solar energy collectors - flat plate collectors and concentrating collectors - Applications of solar energy - solar pond - solar water heater - solar cooking.

UNIT-II **10 Lectures**

Photovoltaics: Solar cell - equivalent circuit - characteristics of PV cell - PV array design - PV System components - Sizing and economics - Peak power operation - Fill Factor- MPPT (P&O only)

UNIT-III **10 Lectures**

Wind Energy: Wind power sources - wind characteristics - site selection - Criterion, momentum theory, WECS and its types - Components of wind energy systems - performance and limitations - classification of wind energy Turbines - Aerodynamic forces acting on blades - applications and environmental impacts.

Geothermal Energy: Origin and types: Hydrothermal, Geo-pressurized & Petro thermal, advantages and disadvantages of geothermal energy.

UNIT-IV **10 Lectures**

Ocean Energy: Ocean temperature differences - principles of OTEC plant operations. Open cycle and closed cycle system -Basic principle of tidal power, components of tidal power plants, ocean waves - wave energy conversion systems.

UNIT-V **10 Lectures**

Energy from Biomass: Biomass conversion technologies, photosynthesis - biogas generation-factors affecting biogas generation - Bio fuels: Classification - direct combustion for heat and electricity generator - anaerobic digestion for biogas - biogas digester - KVIC power generation.

Chemical Energy: Fuel cells - Principle of operation of fuel cell - Types of fuel cells - applications of fuel cells - Hydrogen energy - Green hydrogen production (PV) - Storage and applications.

Text Books:

1. G.D. Rai, Non-Conventional energy sources, 6th Edition, Khanna Publishers, 2011.
2. RenewableEnergyin Power Systems by Leon Freris and David Infield, John Wiley & Sons, Ltd

Reference Books:

1. John Twidell& Toney Weir - Renewable Energy Sources, E & F.N. Spon
2. G.S. Sawhney, Non-Conventional Energy Sources, 1st Edition, Prentice India Pvt. Ltd, 2012.
3. G.N. Tiwari and M.K. Ghosal, Renewable Energy Resources: Basic Principles and Applications, 1st Edition, Alpha Science International Ltd, 2004.
4. Chetan Singh Solanki, Fundamentals, Technologies & Applications, Solar Photovoltaic, PHIPublishers, 2019, 3rd Edition.

Web References:

Link: https://nptel.ac.in/courses/108/105/108105058/

BASICS OF SMART GRIDS

(MINOR ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11MN01

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

CO1: Summarize the features and architecture of Smart Grid

CO2: Assess the role of automation in transmission and distribution.

CO3: Analyze the operation of DG and storage technologies.

CO4: Summarize the communication technologies and cyber-security in Smart Grid.

CO5: Understand the planning, operation, control and analysis of Smart Electric Grid.

UNIT-I **10 Lectures**

Introduction to Smart Grid: Introduction, Definition of smart grid, Concept of smart grid structure, Conventional grid Vs. Smart grid, Opportunities & Barriers of Smart Grid, Enablers of smart grid, Smart-grid activities in India, Key Challenges for Smart Grid.

UNIT-II **10 Lectures**

Smart Grid Architecture: Components and Architecture of Smart Grid Design, Review of the proposed architectures for Smart Grid, Advanced metering infrastructure, The fundamental components of Smart Grid designs -Transmission Automation -Distribution Automation -Renewable Integration.

UNIT-III **10 Lectures**

Distribution Generation Technologies: Introduction to Renewable Energy Technologies, Micro grids, Storage Technologies - Electric Vehicles and PHEVs, Environmental impact and Climate Change, Economic Issues.

UNIT-IV **10 Lectures**

Communication Technologies and Smart Grid: Introduction to Communication Technology - Two-way digital communications paradigm, Synchro - Phasor Measurement Units (PMUs), Wide Area Measurement Systems (WAMS), Introduction to Internet of things (IOT) - Applications of IOT in Smart Grid, Cyber Security for Smart Grid.

UNIT-V **10 Lectures**

Smart Grid Planning: Planning aspects of smart grid, Operation and control of AC, DC & hybrid smart grid, Demand side management - Demand response, Energy management, Planning of smart grid systems.

Text Books:

1. J. Ekanayake, N. Jenkins, K. Liyanage, J.Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley, 1st Edition, 2012.
2. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 1st edition, 2012.
3. Ali Keyhani, "Design of smart power grid renewable energy systems", Wiley IEEE, 3 rd Edition, 2019.

Reference Books:

1. J. Ekanayake, N. Jenkins, K. Liyanage, J.Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley, 1st Edition, 2012.
2. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 1st edition, 2012.
3. Ali Keyhani, "Design of smart power grid renewable energy systems", Wiley IEEE, 3 rd Edition, 2019.

Web References:

1. https://archive.nptel.ac.in/courses/108/107/108107113/

CONCEPTS OF POWER SYSTEM ENGINEERING

(MINOR ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code:24EE11MN02

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

CO1: Summarize the concepts of power generation from various resources.

CO2: Describe the performance of short transmission lines and concepts of distribution systems

CO3: Outline the concepts of protection system devices

CO4: Summarize the economic aspects of power systems and various tariff methods

CO5: Summarize the power factor correction methods

UNIT-I **10 Lectures**

Power Generation Concepts & Types:

Generation and sources of Energy - working principle and Schematic diagram approach of Thermal Power Plant - Hydro Power Plant - Nuclear Power Plant - Gas Power Plants - Comparison between Power Plants.

UNIT-II **10 Lectures**

Transmission and Distribution Concepts:

Types of Conductors Materials - Constants of Transmission Line - Classification and performance of Overhead Transmission Lines.

Distribution Systems - Sub Station - Connection Schemes of Distribution Systems - Introduction to underground Cables - Differences between Overhead & Underground systems.

UNIT-III **10 Lectures**

Protection and Grounding:

Basic concepts of fuse - Circuit Breakers - SF6 Circuit Breakers - Vacuum Circuit Breakers -- Relays - Isolators, Lightning Arrester, Surge arresters - Grounding and its advantages - Difference between Earth, Neutral and Grounding.

UNIT-IV **10 Lectures**

Economic Aspects:

Definitions of Load - Load & Load Duration Curves - Load Factor - Demand Factor - Utilization Factor - Types of Tariff - Cost of Electrical Energy - Expression for Cost of Electrical Energy - Numerical Problems

UNIT-V **10 Lectures**

Power Factor Improvement:

Power Factor - Effects and Causes of low Power Factor - Shunt & Series Capacitor Compensation - Numerical Problems

Text Books:

1. Principles of Power System by V.K.Mehata - Rohit Mehata - S.Chand Publishers.
2. Electrical Power Systems by C.L.Wadwa - New Age International Publishers

Reference Books:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar A.Chakrabarthy, DhanpatRai Co Pvt. Ltd.2016
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_ee17/
2. https://nptel.ac.in/courses/108105104

ELECTRICAL VEHICLE TECHNOLOGY

(MINOR ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11MN03

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

CO1: Summarize the concept of Electric Vehicles (EV) and Hybrid Electric Vehicles (HEV).

CO2: Analyze the various drive train configurations of hybrid electric vehicles.

CO3: Outline the communication protocols in EVs/HEVs

CO4: Summarize the importance and operation of sensors used in EVs

CO5: Outline concept of energy storage systems using battery and other storage systems.

UNIT-I **10 Lectures**

Introduction

Fundamentals of vehicle - components of conventional vehicle and propulsion load - Drive cycles and drive terrain - Concept of electric vehicle and hybrid electric vehicle - History of hybrid vehicle - advantages and applications of Electric and Hybrid Electric Vehicles.

UNIT-II **10 Lectures**

Hybridization of Automobile

Architectures of HEVs - series and parallel HEVs - complex HEVs. Plug-in hybrid vehicle (PHEV) - Constituents of PHEV - comparison of HEV and PHEV - Extended range hybrid electric vehicles (EREVs) - blended PHEVs - Fuel Cell vehicles and its constituents.

UNIT-III **10 Lectures**

Communication Protocols:

Overview of Data Communication and Networking in Vehicles, Need for In-Vehicle Networking, Different Networks and Protocols in EV: Ethernet, TCP, UDP, IP, ARP, RARP, LIN, CAN, CANFD, TTCAN, Network Management, Message Transfer, Challenges in Controller Interfacing.

UNIT-IV **10 Lectures**

Sensors -Thermal Runaway Detection sensors - Temperature, Pressure, Gas Concentration; Liquid Cooling - Temperature, Pressure, Level; Inverter Sensors-Temperature, Current sensors, Transmission, Position, Speed, Park Lock Position, Drive Mode Position

UNIT-V **10 Lectures**

Energy Sources for HEVs

Energy Storage - Battery based energy storage and simplified models of battery - fuel cells - their characteristics and simplified models - super capacitor based energy storage - its analysis and simplified models - flywheels and their modeling for energy storage in EV/HEV - Hybridization of various energy storage devices.

Text Books:

1. Ali Emadi - Advanced Electric Drive Vehicles - CRC Press - 2014.
2. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2003.

Reference Books:

1. MehrdadEhsani - YimiGao - Sebastian E. Gay - Ali Emadi - Modern Electric - Hybrid Electric and Fuel Cell Vehicles: Fundamentals - Theory and Design - CRC Press - 2004.
2. James Larminie - John Lowry - Electric Vehicle Technology Explained - Wiley - 2003.
3. H. Partab: Modern Electric Traction - Dhanpat Rai& Co - 2007.
4. ElGhanam, E., Hassan, M., Osman, A. and Ahmed, I., 2021. Review of Communication Technologies for Electric Vehicle Charging Management and Coordination. World Electric Vehicle Journal, 12(3), p.92.

Web References:

1. https://archive.nptel.ac.in/courses/108/103/108103009/
2. https://onlinecourses.swayam2.ac.in/nou24_ec10/

ENERGY CONSERVATION, AUDIT AND MANAGEMENT

(MINOR ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11MN04

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

CO1: Discuss the basic principles of Energy Audit and importance of energy conservation.

CO2: Summarize the concepts of energy management.

CO3: Analyze the methods of improving energy efficiency in different electrical systems

CO4: Describe power factor improvement methods, lighting system practices, and energy instruments used in energy auditing.

CO5: Calculate life cycle costing analysis and return on investment on energy efficient technologies.

UNIT-I **10 Lectures**

Basic Principles of Energy Audit

Energy audit-definitions-concept-types of audit-energy index-cost index-pie charts-Sankey diagrams-load profiles- Energy conservation schemes- Energy audit of industries- energy saving potential-energy audit of process industry-thermal power station-building energy audit.

UNIT-II **10 Lectures**

Energy Management

Principles of energy management-organizing energy management program-initiating-planning-controlling-promoting-monitoring-reporting-Energy manger-Qualities and functions-language.

UNIT-III **10 Lectures**

Energy Efficient Motors

Standard motors vs Energy efficient motors - factors affecting efficiency-loss distribution-constructional details-characteristics-variable speed-variable duty cycle systems. RMS-voltage variation-voltage unbalance-over motoring-motor energy audit.

UNIT-IV **10 Lectures**

Power Factor Improvement, Lighting and Energy Instruments

Power factor - methods of improvement- location of capacitors- effect of power factor with non-linear loads, harmonics - power factor motor controllers.

Good lighting system design and practice, lighting control Schemes - lighting energy audit - Energy Instruments - wattmeter-data loggers-thermocouples-pyrometers-lux meters-tong testers.

UNIT-V **10 Lectures**

Economic Aspects and Analysis

Economics Analysis-Depreciation Methods-time value of money-rate of return-present worth method-replacement analysis-life cycle costing analysis- calculation of simple payback method-net present worth method - Applications of life cycle costing analysis - Return on investment (RoI).

Text Books:

1. Energy Management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012.
2. Energy Efficient Electric Motors by John. C. Andres, Marcel Dekker Inc. Ltd - 2nd Edition, 1995.
3. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publishing Company Ltd, New Delhi.

Reference Books:

1. Energy management by Paulo' Callaghan, Mc - Graw Hill Book company - 1st edition, 1998.
2. Energy management hand book by W.C. Turner, John wiley and son, 2001.
3. Energy management and good lighting practice: fuel efficiency booklet12 - EEO.

Web References:

1. https://onlinecourses.swayam2.ac.in/nou25_es05

POWER ELECTRONICS

(MINOR ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11MN05

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

CO1: Summarize the characteristics of power semiconductor devices and design of firing circuits for SCR.

CO2: Analyze the performance of single phase controlled converters.

CO3: Analyze the performance of three phase AC-DC and AC-AC converters.

CO4: Summarize the operation DC-DC converters.

CO5: List the advantages of the DC-AC converters and summarize its operation.

UNIT-I **10 Lectures**

Power Semi-Conductor Devices:

Silicon controlled rectifier (SCR) - Two transistor analogy - Static and Dynamic characteristics - Turn-on and Turn-off Methods - Triggering Methods (R, RC and UJT) - Snubber circuit design. Static and Dynamic Characteristics of Power MOSFET and IGBT- Gate Driver Circuits for Power MOSFET and IGBT - Introduction to WBG devices (SiC and GaN) - Numerical problems.

UNIT-II **10 Lectures**

Single-phase AC-DC Converters:

Single-phase half-wave controlled rectifiers - R and RL loads with and without freewheeling diode - Single-phase fully controlled mid-point and bridge converter with R and RL loads - Continuous and Discontinuous conduction - Effect of source inductance in Single-phase fully controlled Bridge rectifier - Single-phase Semi - Converter with R and RL loads - Continuous and Discontinuous conduction - Numerical Problems.

UNIT-III **10 Lectures**

Three-phase AC-DC Converters

Three-phase half-wave Rectifier with R and RL load - Three-phase fully controlled rectifier with R and RL load - Three-phase semi converter with R and RL load - Expression for Output Voltage.

AC - AC Converters

Single-phase AC-AC power control by phase control with R and RL loads - Expression for RMS output voltage - Single-phase step down and step up Cyclo-converter - Numerical Problems.

UNIT-IV **10 Lectures**

DC-DC Converters

Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equations using volt-sec balance in CCM & DCM - Expressions for output voltage ripple and inductor current ripple - Switching control techniques - PWM control - Numerical Problems.

UNIT-V **10 Lectures**

DC-AC Converters

Introduction - Single-phase half-bridge and full-bridge inverters with R and RL loads - Phase Displacement Control - PWM with bipolar voltage switching, PWM with unipolar voltage switching -Three-phase square wave inverters - 120^0 conduction and 180^0 conduction modes of operation - Sinusoidal Pulse Width Modulation - Current Source Inverter (CSI) - Comparison between VSI and CSI - Numerical Problems.

Text Books:

1. Power Electronics: Converters, Applications and Design by Ned Mohan, Tore Undeland, William P Robbins, John Wiley & Sons.
2. Power Electronics: Circuits, Devices and Applications - by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
3. Power Electronics: Essentials & Applications by L.Umanand, Wiley, Pvt. Limited, India, 2009.

Reference Books:

1. Elements of Power Electronics-Philip T.Krein. Oxford University Press; Second edition
2. Power Electronics - by P.S.Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers - by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.

Web References:

1. https://archive.nptel.ac.in/courses/108/102/108102145/

POWER ELECTRONICS LAB

(MINOR ENGINEERING COURSE)

L	T	P	C
0	0	3	1.5

Course Code: 24EE11MN06

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

CO1: Analyze the characteristics of Power semiconductor devices and SCR firing circuits

CO2: Analyze the operation of phase-controlled converters

CO3: Analyze the operation of single phase AC voltage controller and Cyclo-converter

CO4: Analyze the operation of single phase inverter and DC-DC Converters.

CO5: Simulate the PWM techniques and DC-DC Converters using MATLAB.

List of experiments:

Note: Any 10 experiments are to be conducted

1. Characteristics of SCR, MOSFET and IGBT.
2. Analysis of various firing circuits.
3. Single-phase half-controlled and bridge rectifiers with R and RL loads.
4. Single-phase fully-controlled bridge rectifiers with R and RL loads.
5. Three-phase half-controlled and bridge rectifiers with R and RL loads.
6. Three-phase fully-controlled bridge rectifiers with R and RL loads.
7. Single-phase Cyclo-converter with R and RL loads.
8. Single-phase AC voltage regulator with R and RL loads.
9. Single -phase square wave bridge inverter with R and RL loads.
10. Single-phase PWM inverter with R and RL loads.
11. Analyze the operation of Buck and Boost converters.
12. Single-phase Dual-converter with resistive load.
13. Simulation of DC-DC converters using MATLAB.
14. Simulation of PWM techniques using MATLAB.
15. Simulation of four quadrant chopper using MATLAB.

POWER SYSTEMS SIMULATION LAB

(MINOR ENGINEERING COURSE)

L	T	P	C
0	0	3	1.5

Course Code: 24EE11MN07

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

CO1: Estimate the sequence impedances of 3-phase Transformer and Alternators

CO2: Evaluate the performance of transmission lines

CO3: Analyse and simulate power flow methods in power systems

CO4: Analyse and simulate the performance of the power system for load frequency control and Economic load dispatch

CO5: Analyse and simulate stability studies of power systems

List of experiments:

Note: Any 10 experiments are to be conducted

1. Determination of ABCD parameters on transmission line model
2. Performance of long transmission line without shunt compensation
3. Performance of long transmission line with and without shunt compensation
4. Analyze the Ferranti effect on long transmission line
5. Economic load dispatch in power system without losses
6. Plot the VI characteristics of a series and parallel connected PV module and determination of Maximum Power Point
7. Improvement of Power factor with compensation
8. Measurement of earth resistance using Megger
9. Determination of Dielectric Strength of transformer oil
10. Performance of the transmission line for various loading conditions

DIGITAL PROTECTION OF POWER SYSTEMS

(HONOR ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN11

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

CO1: Assess the benefits of digital relays relative to conventional relay systems.

CO2: Apply the suitable signal processing techniques for protection

CO3: Apply modern digital protection techniques **and i**dentify and correct CT and PT errors

CO4: Analyze the adaptive criterion for relay decision making

CO5: Analyze emerging protective relaying technologies and their applications in modern power systems.

UNIT-I **10 Lectures**

Overview: Static relays Transmission line protection, Transformer protection, Need for digital protection

Introduction to Digital Sub-stations Digital Relays: Basic elements of a digital relay and their functions, signal conditioning subsystem, conversion subsystem, digital relay subsystem

UNIT-II **10 Lectures**

Signal processing techniques: Sinusoidal based algorithms, Fourier analysis-based algorithms, Least squares based algorithm, Discrete Fourier Transforms, Wavelet Transforms, Kalman Filtering

UNIT-III **10 Lectures**

Protection Schemes: Travelling Wave Protection scheme, Digital Protection of Transformers, Infinite Impulse Response Filters, Finite Impulse Response filters.

Correction of errors introduced by Instrument Transformers: PTs and CTs, detection of unsaturated fragment of wave shape, CT saturation correction procedure.

UNIT-IV **10 Lectures**

Decision making in Protective Relays: Deterministic decision making, Statistical Hypothesis testing, Decision making with multiple criterions, Adaptive decision schemes, Adaptive Differential protective scheme.

UNIT-V **10 Lectures**

Applications: Fuzzy Logic and ANN for power system protection, Fault location algorithm, Wide Area Monitoring and Protection.

Text Books:

1. A.G. Phadke, James S.Thorp, Computer Relaying for Power Systems, John-Wiley and sons, 2009, 2nd Edition.
2. 2. Waldemar Rebizant, Janusz Szafran, Andrzej Wiszniewski, Digital Signal Processing in Power System Protection and Control, Springer Publication, 2011, 1st Edition.
3. Johns, Digital Protection for Power Systems, IET Power Series, 2012.

Reference Books:

1. Singh, Digital Power System Protection, Prentice-Hall of India Pvt. Limited, 2007, 1st Edition.
2. 2. Orhan Gazi, Understanding Digital Signal Processing, Springer, 2017, 2nd Edition.
3. 3. Y.G. Paithankar, Fundamentals of Power System Protection, PHI, 2010, 2nd Edition.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_ee73
2. https://archive.nptel.ac.in/courses/117/107/117107148
3. https://onlinecourses.nptel.ac.in/noc22_ee46

ELECTRICAL VEHICLE MOTOR DRIVES

(HONORS ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN01

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

CO1: Outline the basic operating principle and design criterion of drives for DC motor run EV

CO2: Analyze the characteristics and control of induction motors

CO3: Describe the operating principle, characteristics of permanent magnet motor drives

CO4: Summarize the working and control of reluctance motor drives

CO5: Outline the basic sensors used in EV for motors

UNIT-I **10 Lectures**

DC Motor Drives: Operating Principle, Working, Characteristics, Motor Control schemes: open loop and closed loop control, Design Criteria of DC Motor Drives for EVs.

UNIT-II **10 Lectures**

Induction Motor Drives - Operating Principle, Working, Characteristics, Motor Control schemes: open loop and closed loop control, Design Criteria of Induction Motor Drives for EVs.

UNIT-III **10 Lectures**

Permanent Magnet Motor Drives-Operating Principle, Working, Characteristics, Motor Control schemes: open loop and closed loop control, Design Criteria of Permanent Magnet Motor Drives for EVs.

UNIT-IV **10 Lectures**

Reluctance Motor Drives- Operating Principle, Working, Characteristics, Motor Control schemes: open loop and closed loop control, Design Criteria of Reluctance Motor Drives for EVs.

UNIT-V **10 Lectures**

Motor Sensors in EV: E-Motor - Temperature, Position - Motor Stator Temperature, Motor Position Sensor - Eddy Current Sensor, Resolver.

Text Books:

1. Electric Vehicle Machines and Drives: Design, Analysis and Application, By K. T. Chau, Wiley-IEEE Press. ISBN:9781118752524
2. Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel

Cell Vehicles, By John G. Hayes and G. Abas Goodarzi, Wiley Publication. ISBN:9781119063643

Reference Books:

1. Electric Vehicle Technology Explained, By James Larminie, John Wiley & Sons Ltd. ISBN: 978-1119942733
2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, By Mehrdad Ehsani, Yimin Gao, Stefano Longo, and Kambiz M. Ebrahimi, CRC Press.ISBN: 9780429504884
3. Modern Power Electronics and AC Drives, By Bimal K. Bose, Pearson Education. ISBN: 978-0130167439
4. Fundamentals of Electrical Drives, By Gopal K. Dubey, Narosa Publishing House ISBN: 978-8173194283

ENERGY MANAGEMENT STRATEGIES AND COMMUNICATION PROTOCOLS FOR EV/HEV

(HONORS ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN02

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

CO1: Describe the basic electrical structure of HEV

CO2: Summarize the energy management strategies for HEVs with ICE and battery

CO3: Describe the energy management strategies for HEVs with other hybrid energy sources

CO4: Outline the communication protocols in EVs/HEVs

CO5: Understand the communication from/to vehicle

UNIT-I **10 Lectures**

Hybrid Electric Vehicle (HEV): Introduction to HEVs - Classification of HEVs - Power trains of different HEVs

UNIT-II **10 Lectures**

Energy Management Strategies for HEVs with ICE and battery: Importance - Classification - Principle of EMS - Optimization problem formulation - Control Strategies.

UNIT-III **10 Lectures**

Energy Management Strategies for HEVs with other hybrid energy storage systems: Importance - Control strategies - Problem formulation.

UNIT-IV **10 Lectures**

Communication Protocols: Overview of Data Communication and Networking in Vehicles, Need for In-Vehicle Networking, Different Networks and Protocols in EV: Ethernet, TCP, UDP, IP, ARP, RARP, LIN, CAN, CANFD, TTCAN, Network Management, Message Transfer, Challenges in Controller Interfacing.

UNIT-V **10 Lectures**

Communication and Networking for EV/HEV: Fundamental Communication Principles – Protocols – Standards used within EV systems - V2G, V2V and G2V protocols.

Text Books:

1. Hybrid Electric Vehicles Energy Management Strategies, By Simona Onori, Lorenzo Serrao and Giorgio Rizzoni, Springer. ISBN: 978-1-4471-6781-5
2. Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, By John G. Hayes and G. Abas Goodarzi, Wiley Publication. ISBN:9781119063643

Reference Books:

1. M. Ehsani, Y. Gao, and A. Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, 2nd ed. Boca Raton, FL, USA: CRC Press, 2010. ISBN: 9780429504884
2. Xue, Q., Zhang, X., Teng, T., Zhang, J., Feng, Z. and Lv, Q., 2020. A comprehensive review on classification, energy management strategy, and control algorithm for hybrid electric vehicles. Energies, 13(20), p.5355.
3. Shen, J. and Khaligh, A., 2015. A supervisory energy management control strategy in a battery/ultracapacitor hybrid energy storage system. IEEE Transactions on transportation electrification, 1(3), pp.223-231.
4. Zheng, C., Li, W. and Liang, Q., 2018. An energy management strategy of hybrid energy storage systems for electric vehicle applications. IEEE Transactions on Sustainable Energy, 9(4), pp.1880-1888.
5. Zhou, S., Chen, Z., Huang, D. and Lin, T., 2020. Model prediction and rule based energy management strategy for a plug-in hybrid electric vehicle with hybrid energy storage system. IEEE Transactions on Power Electronics, 36(5), pp.5926-5940.
6. ElGhanam, E., Hassan, M., Osman, A. and Ahmed, I., 2021. Review of Communication Technologies for Electric Vehicle Charging Management and Coordination. World Electric Vehicle Journal, 12(3), p.92.
7. Seref, S., 2011. Electric vehicles-the benefits and barriers, Intech publishers ISBN: 978-953-307-287-6

ENERGY STORAGE SYSTEMS

(HONORS ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN03

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

CO1: Summarize the basic concepts, application and challenges of various energy storage systems in power systems.

CO2: Analyse the performance of different battery storage systems.

CO3: Understand the importance of battery management systems to improve the performance of a battery.

CO4: Interpret the applications of super capacitors for appropriate storage systems.

CO5: Outline different types of fuel cells.

UNIT-I **10 Lectures**

Basic concept, history of energy storage technologies, demand functions of energy storage technology in power system, application and challenges of energy storage technology in power system.

UNIT-II **10 Lectures**

Lead Acid, Nickel-Cadmium, Zinc Manganese dioxide, and Lithium Battery, specifications of a battery cell, electrical equivalent circuit of the battery, different charging methods of a battery.

UNIT-III **10 Lectures**

Battery management systems: typical structures, main functions; state of charge (SOC) estimation method: definition, the methods of SOC estimation; state of health (SOH) estimation technology: definition, methods for SOH estimation; balance management technology; protection technology: overvoltage protection, under voltage protection, overcurrent protection, short circuit protection, over temperature protection, Thermal runaway.

UNIT-IV **10 Lectures**

Overview of ultra-capacitor technologies, electric double-layer capacitors, electric circuit model of an ultra-capacitor, charging and discharging of ultra-capacitor, disadvantages and advantages of super capacitors compared to battery systems, applications.

UNIT-V **10 Lectures**

Basics of fuel cell**,** types of fuel cells - hydrogen oxygen cells, hydrogen air cell, alkaline fuel cell, and phosphoric fuel cell, key parameters of a fuel cell, advantages and applications.

Text Books:

1. Gregory L. Plett, 'Battery Management Systems-Battery Modeling', artech house, London,2015, ISBN-13: 9781630810238.
2. Andrew L., Dicks, David A. J., Rand, 'Fuel Cell Systems Explained', J. Wiley, 2017, ISBN-13: 9781118613528.

Reference Books:

1. Tetsuya Osaka, MadhavDatta, 'Energy Storage Systems in Electronics', Gordon and Breach Science Publishers, 2000, ISBN-13: 9789056991760.
2. R. M., Dell, D.A.J., Rand, 'Understanding Batteries', RSC Publications, 2001, ISBN-13: 9780854046058.
3. Petar J., Grbovic, 'Ultra-Capacitors in Power Conversion Systems Applications, Analysis and Design from Theory to Practice', Wiley, 2014, ISBN-13: 9781118356265

EV CHARGING TECHNOLOGIES

(HONORS ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN04

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

CO1: Describe the various principles of power trains of EVs and the wiring layout of EV

CO2: Illustrate the power converters used in EV

CO3: Identify the chargers and their standards for charging station of EV

CO4: Differentiate different types of charging methods

CO5: Identify the sensors used in EV

UNIT-I **10 Lectures**

Electric Power Train: Introduction, Principles of EV Power Trains and Their Performance, System Modelling Fundamentals - Driving Cycles, Range Modelling; Wiring Layout of Electric Vehicle, Types of EVs.

UNIT-II **10 Lectures**

Thermal Management: Power Electronics, Battery and Motor - Types of cooling Techniques - De-rating Strategy for Vehicle.

UNIT-III **10 Lectures**

Chargers and Charging Station in India: Charging Technologies - Types of Chargers - On-Board and Off-Board Charging, Types of Guns - CCS, CHAdeMO, Type-2A, Bharat DC-001, Internal Structure, Specification, Power Requirements for Charging Station, Power Architecture of AC and DC Charging Stations- Basics of information Exchange between EV and station - Wireless Charging

UNIT-IV **10 Lectures**

Plugin EV and Electrical Infrastructure: Power Electronics for PEV Charging, Grid-Tied Home and Public Systems, V2G, V2V and G2V Technologies, Impact of Charging and V2G Power Flow on the Grid.

UNIT-V **10 Lectures**

Sensors -Thermal Runaway Detection sensors - Temperature, Pressure, Gas Concentration; Liquid Cooling - Temperature, Pressure, Level; Inverter Sensors-Temperature, Current sensors, Transmission, Position, Speed, Park Lock Position, Drive Mode Position

Text Books:

1. Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications, Haitham Abu-Rub, Mariusz Malinowski and Kamal Al-Haddad, Wiley, IEEE Press. ISBN: 9781118634035
2. Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, By John G. Hayes and G. Abas Goodarzi, Wiley Publication. ISBN:9781119063643

Reference Books:

1. Handbook of Electric Vehicle Charging Infrastructure Implementation, by Government of India
2. Electric Vehicle Technology Explained, By James Larminie, John Wiley & Sons Ltd. ISBN: 978-1119942733
3. Automotive Electrical and Electronic Systems, Tom Denton, Routledge, Taylor and Francis Group, 5th Edition, 2017. ISBN: 9781315856629
4. Power Electronics, Rashid.M.H, Prentice Hall of India, New Delhi, 2008. ISBN: 978-0133125900

SWITCHED MODE POWER CONVERSION

(HONORS ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN05

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

CO1: Summarize Switch Mode Power Conversion and classify the DC to DC Converters.

CO2: Differentiate the various Power semiconductor switches.

CO3: Illustrate Isolated Power Conversion

CO4: Analyze the performance of the Magnetic Components

CO5: Describe the switching regulator control, soft-switched dc-dc power converters

UNIT-I **10 Lectures**

Introduction to Switch Mode Power Converters:

About Switch Mode Power Conversion - SMPS requirements. Cuk converters - and their principles of operation - continuous and discontinuous modes of operation.

UNIT-II **10 Lectures**

Thyristor Commutation Techniques:

Review of Recent developments in power devices for switch mode power supplies. Selection of devices - Commutation: Load Commutation - Resonant Pulse Commutation - Complementary Commutation, Impulse Commutation, External Pulse Commutation.

UNIT-III **10 Lectures**

Transformer-Isolated Converters:

Single-switch and multi-switch transformer-isolated DC-DC converters. Flyback and forward converters - transformer isolated half-bridge - full-bridge converters. Push-pull converters. Voltage fed and current-fed converters.

UNIT-IV **10 Lectures**

Magnetic Component Design:

Magnetic core materials and performance - basic inductor and transformer design - practical magnetic design - design aspects to be considered for designing transformers for specific applications - flyback, push-pull converters - Concept of ferrite bit and filter capacitance in gate driver circuit for EMI and EMC reduction.

UNIT-V **10 Lectures**

Switching Regulator Control & Soft-Switched DC-DC Power Converters:

Small-signal models for switching regulators. Performance analysis and design of closed-loop system under different control methods - and operating modes. Measurement of small signal transfer functions. Soft Switched DC-DC Power Converters -Motivation. Hard-switching vs soft-switching.

Text Books:

1. N Mohan, T M Undeland and W P Robbins, "Power Electronics: Converters, Applications and Design", Wiley , 3rd Edition, 2007
2. Abraham Pressman, Keith Billings, Taylor Morey, "Switching Power Supply Design", McGraw-Hill.3rd Edition, 2009

Reference Books:

1. K. Kit Sum, Switch Mode Power Conversion: Basic Theory and Design 1st Edition, Kindle Edition,2017

Web References:

1. https://archive.nptel.ac.in/courses/108/108/108108036/

EVOLUTIONARY ALGORITHMS APPLICATIONS IN POWER ENGINEERING

(HONORS ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN06

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

CO1: Apply metaheuristic optimization techniques to solve constrained and unconstrained problems

CO2: Implement Genetic Algorithm and Particle Swarm Optimization techniques to address real-world optimization challenges

CO3: Apply Artificial Bee Colony (ABC) and Differential Evolution (DE) algorithms to solve Power System optimization problems

CO4: Apply Bat and Shuffled Frog Leaping Algorithms to solve optimization problems

CO5: Implement Multi-Objective Optimization techniques to solve complex problems

UNIT-I **10 Lectures**

Fundamentals of Soft Computing Techniques:

Definition-Classification of optimization problems - Unconstrained and Constrained optimization Optimality conditions- Introduction to intelligent systems - Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of metaheuristic techniques - Single solution based and population based algorithms - Exploitation and exploration in population based algorithms - Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Single objective and multi-objective problems

UNIT-II **10 Lectures**

Genetic Algorithms and Particle Swarm Optimization:

Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators -Bird flocking and Fish Schooling - anatomy of a particle- equations based on velocity and positions -PSO topologies - control parameters - GA and PSO algorithms for solving ELD problem - Control of Power Converters

UNIT-III **10 Lectures**

Artificial Bee Colony Algorithm and Differential Evolution:

Artificial bee colony (ABC) algorithms binary ABC algorithms - ACO and ABC algorithms for solving Economic Dispatch of thermal units. The Motivation for Differential Evolution (DE) -

Introduction to Parameter Optimization - Single-Point, Derivative Based Optimization - Local Versus Global Optimization - Differential Mutation - Recombination, Selection - Benchmarking Differential Evolution - DE Versus Other Optimizers - DE on Parallel Processors

UNIT-IV **10 Lectures**

Shuffled Frog-Leaping Algorithm and Bat Optimization Algorithm:

Bat Algorithm- Echolocation of bats- Behaviour of microbats- Acoustics of Echolocation- Movement of Virtual Bats- Loudness and Pulse Emission- Shuffled frog algorithm-virtual population of frogs- comparison of memes and genes -memeplex formation- memeple updation- BA and SFLA algorithms for solving ELD.

UNIT-V **10 Lectures**

Multi Objective Optimization:

Multi - Objective optimization Introduction - Concept of Pareto optimality - Non-dominant sorting technique - Pareto fronts-best compromise solution- min-max method-NSGA-II algorithm and applications - optimal sizing of DG.

Text Books:

1. Xin-She Yang, Recent Advances in Swarm Intelligence and Evolutionary Computation - Springer International Publishing - Switzerland, 2015 - 1e
2. Kalyanmoy Deb- Multi-Objective Optimization using Evolutionary Algorithms John Wiley & Sons, 2001, 1e.
3. Altaf Q. H. Badar, Evolutionary Optimization Algorithms - CRC Press, 2022

Reference Books:

1. James Kennedy and Russel E Eberheart, Swarm Intelligence , The Morgan Kaufmann Series in Evolutionary Computation, 2001
2. N P Padhy - Artificial Intelligence and Intelligent Systems, Oxford University Press - 2005

Web References:

1. https://archive.nptel.ac.in/courses/112/103/112103301/

POWER CONVERTERS FOR MICROGRID

(HONORS ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN07

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

CO1: Summarize the basic concepts and types of Microgrid.

CO2: Analyze various control methods of Microgrid

CO3: Outline the various power converters for Microgrid.

CO4: Illustrate the control of AC Microgrid.

CO5: Describe the need and control process of DC-DC converter for DC Microgrid.

UNIT-I **10 Lectures**

Microgrid:

Power system resilience - Concept of Microgrids - Types of Microgrids - Autonomous and non-autonomous grids - Sizing - Modelling and analysis - Microgrids with multiple DGs - Standards and regulation issues associated with AC & DC Microgrids - Comparison between AC and DC Microgrids.

UNIT-II **10 Lectures**

Microgrid Control:

Centralized control - Hierarchical principle: Primary - secondary and tertiary control- Distributed control - Protection issues and Communication based techniques.

UNIT-III **10 Lectures**

Modeling of Power Electronic Converters in Microgrid applications:

Modeling of voltage source PWM rectifier - modeling of voltage source inverter in current controlled mode and voltage-controlled mode - modelling of boost DC-DC converter and its control - modeling of isolated bidirectional DC-DC converter and its control - Microgrid Dynamics - Modeling of AC & DC microgrid and its dynamic studies.

UNIT-IV **10 Lectures**

Control of grid connected inverter in AC Microgrid: Basics of Voltage-frequency control and P-Q control in AC microgrid - control of grid-forming inverter - control of grid-feeding inverter - control of grid-supporting power inverter - synchronization of inverters in ac microgrids.

UNIT-V **10 Lectures**

Control of DC-DC converter in DC Microgrid: Voltage control and power control in DC Microgrid - Control of parallel DC-DC converters in a DC Microgrid - Advantages and Applications of DC Microgrid.

Text Books:

1. Fusheng Li, Ruisheng Li, Fengquan Zhou, "Microgrid Technology and Engineering Application", Elsevier, 2015.
2. S. Chowdhury, P. Crossley,"Microgrids and Active Distribution Networks", Institution of Engineering and Technology, 2009.
3. Nikos Hatziargyriou, "Microgrids Architectures and Control", John Wiley Sons, 2014.
   Hassan Bevrani, Bruno Francois, Toshifumi Ise, "Microgrid Dynamics and Control", John Wiley Sons, 2017

Reference Books:

1. Gevork B. Gharehpetian, S. Mohammad Mousavi Agah, Butterworth Heinemann, "Distributed Generation Systems: Design, Operation and Grid Integration", 2017.
2. Suleiman M. Sharkh, Mohammad A. Abusara , Georgios I.Orfanoudakis, Babar Hussain, "Power Electronic Converters for Microgrids", Wiley- IEEE Press, 2014

Web References:

1. https://nptel.ac.in/courses/108107143

POWER QUALITY

(HONORS ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN08

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

CO1: Summarize the power quality issues and their impact on electrical systems

CO2: Discuss the sources and protection methods for transient over voltages

CO3: Describe the principles of voltage regulation and the use of capacitors for voltage regulation

CO4: Summarize the concepts of harmonic distortion with filtering techniques.

CO5: Describe the resurgence of distributed generation and related power quality monitoring.

UNIT-I **10 Lectures**

Introduction - Terms & Definitions:

Overview of power quality - Concern about the power quality - General classes of power quality and voltage quality problems - Transients - Long-duration voltage variations - Short-duration voltage variations - Voltage unbalance - Waveform distortion - Voltage fluctuation - Power frequency variations - Voltage Sags - Voltage Swell.

UNIT-II **10 Lectures**

Transient Over Voltages:

Sources of Transient Over voltages - Principles of Over voltage protection- Devices for Over voltage protection - Utility Capacitor Switching Transients - Utility System Lightning Protection - Ferro resonance - Switching Transient Problems with Loads – Flicker.

UNIT-III **10 Lectures**

Long - Duration Voltage Variations:

Principles of regulating the voltage - Device for voltage regulation - Utility voltage regulator application - Capacitor for voltage regulation - End-user capacitor application - Regulating utility voltage with distributed resources

UNIT-IV **10 Lectures**

Harmonic distortion and solutions:

Voltage distortion vs. Current distortion -Harmonic indices: THD - TDD and True Power Factor- Sources of harmonics - Effect of harmonic distortion - Impact on capacitors - transformers, motors and meters - Concept of Point of common coupling - Passive and active filtering - Numerical problems.

UNIT-V **10 Lectures**

Distributed Generation and Monitoring:

Resurgence of distributed generation - DG technologies - Interface to the utility system - Power quality issues and operating conflicts - DG on low voltage distribution networks.

Monitoring:

Power quality monitoring and considerations - Historical perspective of PQ measuring instruments - PQ measurement equipment - Assessment of PQ measuring data.

Text Books:

1. Electrical Power Systems Quality - Dugan R C - McGranaghan M F - Santoso S - and Beaty H W - Second Edition - McGraw-Hill - 2012 - 3 rd edition.
2. Electric power quality problems -M.H.J.Bollen IEEE series-Wiley india publications - 2011.
3. Power Quality Primer - Kennedy B W - First Edition - McGraw-Hill - 2000.

Reference Books:

1. Understanding Power Quality Problems: Voltage Sags and Interruptions - Bollen M HJ - First Edition - IEEE Press; 2000.
2. Power System Harmonics - Arrillaga J and Watson N R - Second Edition - John Wiley & Sons - 2003.
3. Electric Power Quality control Techniques - W. E. Kazibwe and M. H. Sendaula - Van Nostrad Reinhold - New York.
4. Power Quality C.Shankaran - CRC Press - 2001

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1. https://archive.nptel.ac.in/courses/108/102/108102179/
2. https://onlinecourses.nptel.ac.in/noc20_ee10/

POWER SYSTEM RELIABILITY

(HONORS ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN09

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

CO1: Apply probability distributions and reliability concepts to assess system performance and failure rates.

CO2: Evaluate power system reliability using probabilistic methods to analyze capacity outages and load loss indices

CO3: Assess and model power system reliability by applying probabilistic methods to operating reserves, bulk power systems, and interconnected networks

CO4: Evaluate reliability indices for radial and parallel distribution systems using customer and energy-oriented approaches.

CO5: Analyze the effects of short circuits and circuit breaker operations while considering failure modes and preventive maintenance strategies.

UNIT-I **10 Lectures**

Basic Probability Theory:

Elements of probability - probability distributions - Random variables - Density and Distribution functions- Binomial distribution- Expected value and standard deviation - Binomial distribution - Poisson distribution, normal distribution - exponential distribution - Weibull distribution. Definition of Reliability: Definition of terms used in reliability - Component reliability - Hazard rate - derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve - Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time between Failures.

UNIT-II **10 Lectures**

Generating System Reliability Analysis:

Generation system model - capacity outage probability tables - Recursive relation for capacitive model building - sequential addition method - unit removal - Evaluation of loss of load and energy indices - Examples. Frequency and Duration methods - Evaluation of equivalent transitional rates of identical and non-identical units - Evaluation of cumulative probability and cumulative frequency of non-identical generating units - 2-level daily load representation - merging generation and load models - Examples.

UNIT-III **10 Lectures**

Operating Reserve Evaluation:

Basic concepts - risk indices - PJM methods - security function approach - rapid start and hot reserve units - Modeling using STPM approach.

Bulk Power System Reliability Evaluation:

Basic configuration - conditional probability approach - system and load point reliability indices - weather effects on transmission lines - Weighted average rate and Markov model - Common mode failures.

Interconnected System Reliability Analysis:

Probability array method - Two inter connected systems with independent loads - effects of limited and unlimited tie capacity - imperfect tie - Two connected Systems with correlated loads - Expression for cumulative probability and cumulative frequency.

UNIT-IV **10 Lectures**

Distribution System Reliability Analysis:

Basic Techniques - Radial networks -Evaluation of Basic reliability indices - performance indices - load point and system reliability indices - customer oriented - loss and energy-oriented indices - Examples. Basic concepts of parallel distribution system reliability

UNIT-V **10 Lectures**

Substations and Switching Stations:

Effects of short-circuits - breaker operation - Open and Short-circuit failures - Active and Passive failures - switching after faults - circuit breaker model - preventive maintenance - exponential maintenance times.

Text Books:

1. Reliability Evaluation of Power systems by R. Billinton, R. N. Allan, BS Publications, 2007.
2. Reliability Modeling in Electric Power Systems by J. Endrenyi, John Wiley and Sons, 1978

Reference Books:

1. Reliability Engineering: Theory and Practice by Alessandro Birolini, Springer Publications.
2. An Introduction to Reliability and Maintainability Engineering by Charles Ebeling, TMH Publications.
3. Reliability Engineering by E. Balaguruswamy, TMH Publications.
4. Reliability Engineering by Elsayed A. Elsayed, Prentice Hall Publications.

Web References:

1. https://archive.nptel.ac.in/courses/127/105/127105234/

RESTRUCTURED POWER SYSTEMS

(HONORS ENGINEERING COURSE)

L	T	P	C
3	0	0	3

Course Code: 24EE11HN10

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

CO1: Understand the need for restructured power system and economics

CO2: Evaluate the roles of ISO, Smart Grid trading mechanisms, and Open Access systems for effective power sector management

CO3: Summarize transmission congestion and estimate loss allocation in Power System

CO4: Analyze the economic operation of power system in restructured environment

CO5: Analyze energy and reserve markets, smart grid optimization and assess the impact of energy transition on power system restructuring.

UNIT-I **10 Lectures**

Restructuring of power industry and Fundamentals of Economics:

Introduction, Reasons for restructuring / deregulation of power industry, Fundamentals of Deregulation - Motivation of restructuring the power industries - restructuring process - unbundling & privatization - restructuring models - Components of restructured systems - fundamentals of Economics.

UNIT-II **10 Lectures**

Power Market Reforms:

Reforms in Indian power sector - Independent System Operator (ISO): Functions and responsibilities - Smart Grid trading arrangements (Pool, bilateral & multilateral) - Open Access Transmission Systems - and Open Access Same Time Information system (OASIS).

UNIT-III **10 Lectures**

Transmission Pricing & Congestion Management:

Cost components - Postage Stamp Method - Megawatt Mile Method - Contract Path Method. Classification of congestion management methods - Calculation of ATC-TTC-CBM - Non-market methods - Market based methods - Nodal pricing, Inter-zonal Intra - zonal congestion management - Price area congestion management - Locational Marginal Prices.

UNIT-IV **10 Lectures**

Economic Operation in restructured Environment:

Economic dispatch problem and methods of solutions - Optimal Power flow (OPF) - General OPF formulation - Security constrained OPF - Solution techniques - OPF application in Electricity Market.

UNIT-V **10 Lectures**

Risk Management in Restructured Environment:

Energy and Reserve Markets - Market Power - Forward and Future market - Smart grid Optimization with risk constraints - General risk measures, Portfolio selection problem - Financial Transmission Rights.

Impact of Energy Transition on Power System restructuring - Key drivers in energy transition - role of power market in energy transition - re-organizing power systems for the transition.

Text Books:

1. L. L. Lai, Power System Restructuring and Deregulation, John Wiley & Sons Ltd., 2012, 1st Edition.
2. K. Bhattacharya, J. E. Daadler, and Math H.J Bollen, Operation of restructured power systems, Kluwer Academic Pub., 2012, 1st Edition (Reprint).
3. D. Kirschen and G. Strbac, Fundamentals of Power System economics, John Wiley & Sons Ltd,2019, 2nd Edition

Reference Books:

1. S. Hunt, Making competition work in electricity, John Wiley & Sons, Inc., 2002, 1st Edition.
2. Ashikur Bhuiya: Power System Deregulation: Loss Sharing in Bilateral Contracts and Generator Profit Maximization, VDM Verlag Publisher, 2008

Web References:

1. https://archive.nptel.ac.in/courses/108/104/108104052/
2. https://archive.nptel.ac.in/courses/108/101/108101005/