Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure

Second Year B. Tech. (Electrical Engineering)

with effect from Academic Year 2023-24

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph. No.: 02563 259 802, web: www.rcpit.ac.in

Vision of the Institute

To become a leading Institute in Technical education fostering innovation, research, ethical values, and sustainable development for the betterment of society.

Mission of the Institute

To impart high quality Technical Education through:

- **M1:** Innovative and Interactive learning process and high quality, globally recognized instructional programs.
- **M2:** Fostering a collaborative scientific temper among students with ethical responsibility towards the society.
- **M3:** Preparing students from diverse backgrounds to have aptitude for employment, entrepreneurship and research with a spirit of professionalism.
- **M4:** To contribute to the nation's sustainable development.

Vision of the Electrical Engineering Department

To produce competent Electrical Engineers committed to innovation, sustainability and service to society.

Mission of the Electrical Engineering Department

- **M1:** Deliver innovative, interactive learning fostering excellence in Electrical Engineering and emerging technologies.
- **M2:** Cultivate scientific inquiry, ethical responsibility, and interdisciplinary collaboration to address energy, automation, and societal challenges.
- **M3:** Empower diverse students with skills for employment, entrepreneurship, and research, nurturing professionalism and lifelong learning.

Program Educational Objectives

The educational objectives of the Undergraduate Programmes of Electrical Engineering are:

- **PEO1:** Graduates will apply electrical engineering knowledge and innovation to solve complex industrial and societal problems.
- **PEO2:** Graduates will demonstrate ethical leadership and collaborate across disciplines to promote sustainable and inclusive development.
- **PEO3:** Graduates will pursue careers in employment, entrepreneurship, or research, embracing professionalism and lifelong learning.

Second Year B. Tech. Electrical Engineering Semester-III (with effect from 2023-24)

S. N.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credits	
							Continuous Assessment (CA)				ESE			
				L	T	P	TA	Term Test-I (TT-I)	Term Test-II (TT-II)	Best of TT-I and TT-II				
							[A]			[B]	[C]	[A+B+C]		
1	PC	22BSEE3010T	Engineering Mathematics-III	3	1		20	15	15	15	65	100	4	4
2	PC	22PCEE3020T	Electrical Circuit Theory	3			20	15	15	15	65	100	3	4
	PC	22PCEE3020L	Electrical Circuit Theory Laboratory			2	25				25	50	1	
3	PC	22PCEE3030T	Analog Electronics	3			20	15	15	15	65	100	3	4
	PC	22PCEE3030L	Analog Electronics Laboratory			2	25				25	50	1	
4	PC	22PCEE3040T	Electrical Measurements and Instrumentation	3			20	15	15	15	65	100	3	4
	PC	22PCEE3040L	Electrical Measurements and Instrumentation Laboratory			2	25				25	50	1	
5	PC	22PCEE3050T	Electrical Energy Generation System	3			20	15	15	15	65	100	3	3
6	PC	22PCEE3060L	Electrical and Electronics Workshop			2	25				25	50	1	1
7	HM	22HMEE3070T	Universal Human Values	2			20	15	15	15	65	100	2	2
8	PJ	22PJEE3080L	Semester Project-I			2	25				25	50	1	1
			Total	**17**	**1**	**10**	**245**			**90**	**515**	**850**		**23**

PC:Programme Core, HM: Humanities and Management, ES : Engineering Science, PJ: Project

Prepared by	Checked by	BOS Chairman	Dean Academic / Dy. Director	C.O.E.	Director
Mr. Y. K. Kirange	Mr. Nadeem Akhtar	Dr. S. A. Patil	Prof. Dr. P. J. Deore	Prof. S. P. Shukla	Prof. Dr. J. B. Patil

R. C. Patel Institute of Technology, Shirpur
SES
Autonomous

Second Year B. Tech. Electrical Engineering Semester-IV (with effect from 2023-24)

S. N.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme						Credits	
							Continuous Assessment (CA)				ESE	Total		
				L	T	P	TA	Term Test-I (TT-I)	Term Test-II (TT-II)	Best of TT-I and TT-II				
							[A]			[B]	[C]	[A+B+C]		
1	BS	22BSEE4010T	Engineering Mathematics-IV	3	1		20	15	15	15	65	100	4	4
2	PC	22PCEE4020T	Electrical Machine-I	3			20	15	15	15	65	100	3	4
	PC	22PCEE4020L	Electrical Machine-I Laboratory			2	25				25	50	1	
3	PC	22PCEE4030T	Digital Electronics	3			20	15	15	15	65	100	3	4
	PC	22PCEE4030L	Digital Electronics Laboratory			2	25				25	50	1	
4	PC	22PCEE4040T	Power System Transmission and Distribution	3			20	15	15	15	60	100	3	4
	PC	22PCEE4040L	Power System Transmission and Distribution Laboratory			2	25				25	50	1	
5	PC	22PCEE4050T	Microcontroller and Its Applications	3			20	15	15	15	60	100	2	4
	PC	22PCEE4050L	Microcontroller and Its Applications Laboratory			2	25				25	50	1	
6	MC	22MCEE4060T	Constitution of India	1									Audit	Audit
7	PJ	22PJEE4070L	Semester Project-II			2	25				25	50	1	1
8	HM	22HMEE4080L	Employability Skill Development Program-I			2	25				25	50	1	1
			Total	**16**	**1**	**12**	**250**			**75**	**475**	**800**		**22**

PC:Programme Core, HS: Humanities and Management, ES : Engineering Science, PJ: Project

Prepared by	Checked by	BOS Chairman	Dean Academic / Dy. Director	C.O.E.	Director
Mr. Y. K. Kirange	Mr. Nadeem Akhtar	Dr. S. A. Patil	Prof. Dr. P. J. Deore	Prof. S. P. Shukla	Prof. Dr. J. B. Patil

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Engineering Mathematics - III (BSEE3010T)		

Course Objectives

1. To build the strong foundation in Mathematics of learner needed for the field of Electrical Engineering.
2. To provide learner with mathematics fundamentals necessary to formulate, solve and analyses complex engineering problems.
3. To prepare student to apply reasoning informed by the contextual knowledge to engineering practice.
4. To prepare learner to work as part of teams on multi-disciplinary projects.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply the knowledge of Laplace transform and its properties to evaluate specific kind of integrals.	L3	Apply
CO2	Apply knowledge of Inverse Laplace transform to solve ordinary simultaneous differential equations.	L3	Apply
CO3	Follow Fourier series expansion of functions which satisfy Dirichlet conditions and Fourier transform.	L3	Apply
CO4	Demonstrate an ability to use vector algebra and vector calculus.	L5	Evaluate

Engineering Mathematics - III (BSEE3010T)
Course Contents

Unit-I 08 Hrs.

Laplace Transform: Laplace Transform (LT) of Standard Functions: Definition of Laplace transform, Condition of Existence of Laplace transform, Laplace transform of e^{at} , *sinat* , *cosat* , *sinhat*, *coshat* , t^n. Heaviside unit step function, Dirac-delta function, Laplace transform of Periodic function Properties of Laplace Transform: Linearity, first shifting theorem, second shifting theorem, multiplication by t^n,Division by t, Laplace Transform of derivatives and integrals, change of scale, convolution theorem, Evaluation of integrals using Laplace transform.

Unit-II 08 Hrs.

Inverse Laplace Transform and its Applications: Partial fraction method, Method of convolution, Laplace inverse by derivative. Applications of Laplace Transform: Solution of ordinary differential equations, Solving RLC circuit differential equation of first order and second order with boundary condition using Laplace transform (framing of differential equation is not included).

Unit-III 06 Hrs.

Fourier Series: Introduction: Orthogonal and orthonormal set of functions, Introduction of Dirichlet's conditions, Euler's formulae. Fourier Series of Functions: Exponential, trigonometric functions of any period =2L, even and odd functions, half range sine and cosine series. Complex form of Fourier series.

Unit-IV 06 Hrs.

Vector Algebra, Vector Differentiation and Vector Integral: Vector differentiation, Gradient of scalar point function, Divergence and Curl of vector point function Properties: Solenoidal and irrotational vector fields, conservative vector field. Vector Integral: Green's theorem in a plane, Gauss' divergence theorem and Stokes' theorem.

Mapping: Conformal mapping, Bilinear transformations, cross ratio, fixed points.

Unit-V 05 Hrs.

Complex Variable: Analytic Function: Necessary and sufficient conditions (No Proof), Cauchy Riemann equation Cartesian form (No Proof) Cauchy Riemann Equation in polar form (with Proof), Milne Thomson Method and its application, Harmonic function, orthogonal trajectories. Mapping: Conformal mapping, Bilinear transformations, cross ratio, fixed points.

Text Books

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publication.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata Mc-Graw Hill Publication
3. H.K. Das, "Advanced Engineering Mathematics", S . Chand, 2008. 1st edition (January 1, 2012).

Reference Books

1. Erwin Kreysizg, "Advanced Engineering Mathematics", John Wiley & Sons, Inc.
2. Wylie and Barret, "Advanced Engineering Mathematics", Tata Mc-Graw Hill 6th Edition.
3. Dennis G. Zill & Warren S. Wright. "Advanced Engineering Mathematics", Jones and Bartlett Publishers, 1st Edition, 2009.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Electrical Circuit Theory (22PCEE3020T)		
Electrical Circuit Theory Laboratory (22PCEE3020L)		

Prerequisite: Basic Electrical Engineering, Linear Algebra.

Course Objectives

1. To understand circuit analysis using network theorems.
2. To understand the network topology and duality of the network.
3. To understand the transient and steady state response of the circuits.
4. To understand the network parameter for circuit analysis and frequency selective networks.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Recall fundamental concepts of electrical circuits and apply network theorems for circuit analysis.	L3	Apply
CO2	Apply network topology concepts for the formulation and solution of electrical circuits.	L3	Apply
CO3	Analyze transient responses of RC, RL, and RLC circuits.	L4	Analyze
CO4	Evaluate electrical network parameters for various applications.	L5	Evaluate
CO5	Design and assess frequency-selective circuits.	L6	Create

Electrical Circuit Theory (22PCEE3020T)
Course Contents

Unit-I 08 Hrs.

Circuit Analysis using Theorems: Mesh and Supermesh analysis, Node and Supernode analysis

Circuit Theorems for Independent and Dependent sources: Superposition, Thevenin's, Norton's Reciprocity, Maximum Power Transfer Theorem and Millman Theorem.

Unit-II 08 Hrs.

Network Topology : Graph of network, oriented graph, definition of basic terminologies of graph theory, tree, cotree, link, twigs, incidence and reduced incidence matrix, loop and tieset matrix, cutset and fundamental cutset matrix, Network Equilibrium equations in matrix form: Mesh or Loop or KVL Equilibrium, Node or KCL Equilibrium equations, Dual circuit and Duality.

Unit-III 09 Hrs.

Transient Analysis : Solution of differential equation, General and particular solutions, series and parallel R-L, R-C circuits, Mathematical analysis of circuit transients, Charging and discharging condition, time constant of the circuit, Analysis with initial and without initial condition in network, steady state and transient state response for DC voltage, Over damped and Underdamped series RLC circuit.

Laplace Transform (LT) of standard test signals, LT of R, L and C. Inverse LT using Partial fraction expansion method. Analysis of RL, RC and RLC circuits using LT, Initial condition.

Unit-IV 09 Hrs.

Two Port Network: Two Port Network: Introduction to Two port networks analysis, Reciprocity and Symmetry conditions, Open circuit Impedance parameters, Short circuit Admittance parameters, Transmission parameters, Inter conversion of parameters, Interconnection of Two port parameters: series and parallel connection.

Unit-V 08 Hrs.

Frequency Selective Networks: Introduction to Filters, Pass band, Attenuation band, Low Pass Filter, High Pass Filter, Band Pass Filter, Band Reject Filter, cutoff frequency.

Resonance Circuit: R-L-C series circuits, Series resonance Variation of Z with frequency, maximum value of VC and VL, Bandwidth, Q factor.

Electrical Circuit Theory Laboratory (22PCEE3020L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. Verification of Superposition Theorem.
2. Verifications of Thevenin's Theorem.
3. Verifications of Norton's Theorem using simulation tools.
4. Verification of Maximum Power Transfer Theorem.
5. Verification of Reciprocity Theorem.
6. Determination of transient response of current in RL & RC circuits with step voltage input using simulation tools.
7. Measurement of Z parameter of two port network.
8. Measurement of Y parameter of two port network.
9. Measurement of parameters using Interconnection of two port network.
10. Determination of frequency response of current in series RLC circuit with sinusoidal ac input.
11. Determine characteristics of Low pass and high pass filter.
12. Design and verification cut off frequency of Band Pass Filter.
13. Determination of transient response of current in underdamped, overdamped and critically damped RLC circuit with standard input signals.
14. Determination of voltage and current using network equilibrium using node base equation.
15. Determination of voltage and current using network equilibrium using loop base equation.
16. Determination of transient response of current in RLC circuit with step voltage input for under damped, critically damped and over damped cases using simulation tools.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books

1. Ravish R. Singh, "Circuit Theory and Network: Analysis and Synthesis", Mc Graw Hill Education (India) Pvt Ltd, 2nd Edition, 2019.
2. S. K. Pandey, "Network Analysis and Synthesis", S. Chand and Company Ltd, 1st Edition, 2011.
3. A. Charaborthy, "Circuit Theory (Analysis and Synthesis)", Dhanpat Rai and Company, 1st Edition, 2008.
4. R. K. Mehta and A. K. Mal, "Problems and Solutions of Electrical Circuit Analysis", CBS Publishers, 1st Edition, 2015.

Reference Books

1. A. Anand Kumar, "Network Analysis and Synthesis", PHI Learning, 1st Edition, 2019.
2. S. P. Ghosh, A. K. Chakraborty, "Network Analysis and Synthesis", Tata McGraw Hill Education Pvt Ltd, New Delhi, 2010.
3. M.E. Valkenburg, "Network Analysis", Pearson Education, 3rd Edition, 2019.
4. Franklin Fa-Kun. Kuo, "Network Analysis and Synthesis", John Wiley & Sons, 2nd Edition, 2009.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Analog Electronics (22PCEE3030T)		
Analog Electronics Laboratory (22PCEE3030L)		

Prerequisite: Basics of mathematics and semiconductor physics.

Course Objectives

1. To understand operation of semiconductor devices viz. diodes, MOSFET, BJT and operational amplifier.
2. To analyze various diode circuits like rectifier, clipper and clamper.
3. To apply concepts for the design of regulators, amplifiers and oscillators.
4. To introduce basic concepts of Linear and Non-Linear Op-Amp.
5. To verify the theoretical concepts through laboratory and simulation experiments.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain current–voltage characteristics of semiconductor devices	L2	Understand
CO2	Design analog electronic circuits such as rectifiers, amplifiers, oscillators, and regulators using discrete components	L6	Create
CO3	Apply concepts to design biasing circuits for transistors	L3	Apply
CO4	Evaluate the performance of positive and negative feedback in oscillators and amplifiers	L5	Evaluate
CO5	Design operational amplifier-based circuits	L6	Create

Analog Electronics (22PCEE3030T)
Course Contents

Unit-I 08 Hrs.

Diodes and Its Applications: P-N junction diode, V-I characteristics of a diode, half-wave, full wave rectifiers and bridge rectifiers, Filter circuit, clamper, clipper, voltage doublers, opto-couplers, Zener diode as a voltage regulator. Numerical on rectifier circuit, clipper and clamper

.

Unit-II 08 Hrs.

Bipolar Junction Transistors and Coupling : Construction and operation of transistor, BJT configuration, I-V characteristics of a BJT, DC load line analysis: fixed bias, emitter bias and voltage divider bias configuration stability and DC biasing circuits-fixed-bias, Emitter-bias and voltage divider bias configuration DC analysis of BJT only, BJT as a switch, BJT as an amplifier, Cascade amplifiers: Types of coupling.

Unit-III 09 Hrs.

Metal-Oxide-Semiconductor Field Effect Transistor : MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, Trans conductance, high frequency equivalent circuit.

Unit-IV 09 Hrs.

Feedback Amplifier, Oscillators and Multivibrator: Feedback concept. Barkhausen criterion, classification voltage/ current series/shunt feedback amplifier.

Oscillator: operation and analysis of R C phase shift, Wein bridge, Heartly, Colpitts and crystal oscillators **[using BJT only]**.

Multivibrator: IC 555 Timer, Astable, Bistable and monostable

Unit-V 08 Hrs.

Op-Amp and Its Linear and Non-Linear Applications : Ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product). Linear Applications: Idealized analysis of op-amp circuits, virtual ground concept, inverting and non-inverting amplifier, differential amplifier, adder, subtractor, v to I converter, Integrator, Differentiator, instrumentation amplifier, Non-Linear Applications: Comparator, Zero Crossing Detector, Schmitt trigger with hysteresis, Square-wave generator, triangular-wave generators.

Analog Electronics Laboratory (22PCEE3030L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. To plot V-I characteristics of P-N junction diode.
2. To Design and Test Half wave rectifier circuit with and without LC filter and determines the ripple factor and efficiency.
3. Find performance parameter of the full wave- center tap and bridge type rectifier circuits with and without LC filter.
4. To plot forward and reverse characteristics of PN junction diode.
5. To design, assemble and test the wave shaping circuit using diode - clipping and clamping circuits.
6. To Plot I/P and O/P characteristics of BJT (CE Configuration).
7. To Plot DC Load Line for BJT (Voltage Divider biasing circuit).
8. To Plot the Drain characteristics of the N-channel Enhancement type MOSFET.
9. To design and implement different types of oscillators-Build and test Phase Shift Oscillator Circuit.
10. To Design inverting and non-inverting configurations of Op-Amp.
11. To Design and implementation of integrator, differentiator using Op-Amp.
12. To Design of the astable multivibrator using IC 555.
13. Shadow Sensor Alarm using IC741 op-Amp.
14. Sequential Timer (IC-555) for DC Motor Control.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Reference Books

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", PHI Publishers, 8^{th} Edition,2004.
2. J. Millman and C. C. Halkias, "Integrated Electronics: Analog and Digital Circuits and Systems", Tata McGraw-Hill Publishing Company, 1988.
3. R. A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall India, 4^{th} Edition, 2012.
4. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.

5. R. S. Sedha, “Applied Electronics”, S. Chand and Company (P) LTD, Delhi, 1st Edition Reprint 2014.

6. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier Theory and Applications”, McGraw Hill U. S., 1992.

7. P. Ramesh Babu, “Electronic Devices and Circuits”, McGraw Hill Education, India, 3rd Edition, 2012

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Electrical Measurements and Instrumentation (22PCEE3040T)		
Electrical Measurements and Instrumentation Laboratory (22PCEE3040L)		

Prerequisite: Basic Electrical and Electronics Engineering.

Course Objectives

1. To provide basic concepts of errors in measurements and basic fundamentals of measuring systems, philosophy of measurement and standards.
2. To impart skills to classify bridges, measuring instruments and equipment's and also demonstrate digital instruments, advance instruments.
3. To impart basic knowledge of transducer and recorders.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the philosophy of measurement systems, types of errors, and measurement standards.	L2	Understand
CO2	Explain the construction and working principles of analog and digital instruments, bridges, transducers, and recorders.	L2	Understand
CO3	Analyze parameters of electrical quantities measured using analog and digital instruments.	L4	Analyze
CO4	Analyze the performance parameters of DC and AC bridges.	L4	Analyze
CO5	Analyze errors in analog and digital instruments and their impact on measurement accuracy.	L4	Analyze

Electrical Measurements and Instrumentation (22PCEE3040T) Course Contents

Unit-I 08 Hrs.

Introduction to Measurement and Instrumentation: Philosophy of Measurement: Methods of Measurement, Measurement System, Classification of instrument system, Characteristics of instruments and measurement system, Errors in measurement and its analysis, Standards.

Unit-II 09 Hrs.

Analog and Digital Measurement of Electrical Quantities : Construction and Working operation of all types of ammeters and voltmers, construction and working operation of all types of wattmeters, measurement of power in dc and ac circuit, errors & remedies in wattmeter and smart energy meter. Instrument Transformers, extension range of voltmeters and ammeters, Introduction to measurement of speed, frequency and power factor

Concept of digital measurement, block diagram Study of digital voltmeter, frequency meter Power Analyzer and Harmonics Analyzer; Electronic Multimeter

Unit-III 08 Hrs.

Measurement of Parameters : Different methods of measuring low, medium and high resistances, measurement of inductance & capacitance with the help of AC Bridges, Q Meter.

Unit-IV 09 Hrs.

Introduction to Transducers: Definition - different types of transducers – criteria for selection –general characteristics–dynamic characteristics – transducers for measurement of displacement (RVDT &LVDT), speed, angular rotation, altitude, force, torque, humidity and moisture, pressure, strain and temperature (Thermocouple and RTD method), Hall Effect transducer and applications.

Unit-V 08 Hrs.

Display Methods, recorders : Display methods and devices-different types of recorders galvanometric recorders, magnetic recorders, digital recorders, Digital Storage Oscilloscope.

Electrical Measurements and Instrumentation Laboratory (22PCEE3040L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. To plot V-I characteristics of P-N junction diode.
2. To Design and Test Half wave rectifier circuit with and without LC filter and determines the ripple factor and efficiency.
3. Find performance parameter of the full wave- center tap and bridge type rectifier circuits with and without LC filter.
4. To plot forward and reverse characteristics of PN junction diode.
5. To design, assemble and test the wave shaping circuit using diode - clipping and clamping circuits.
6. To Plot I/P and O/P characteristics of BJT (CE Configuration).
7. To Plot DC Load Line for BJT (Voltage Divider biasing circuit).
8. To Plot the Drain characteristics of the N-channel Enhancement type MOSFET.
9. To design and implement different types of oscillators-Build and test Phase Shift Oscillator Circuit.
10. To Design inverting and non-inverting configurations of Op-Amp.
11. To Design and implementation of integrator, differentiator using Op-Amp.
12. To Design of the astable multivibrator using IC 555.
13. Shadow Sensor Alarm using IC741 op-Amp.
14. Sequential Timer (IC-555) for DC Motor Control.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books

1. E. W. Golding, "Electrical Measurements and Measuring instruments", Reem Publication, 23rd edition.
2. C. T. Baldwin, "Fundamentals of Electrical Measurements", Kalyani Publication, 2nd edition.
3. Cooper and Derfllick, "Electronic Instrumentation and Measurements Techniques", Prentice-Hall of India, 3rd edition.

4. J. B. Gupta, “Electrical and Electronic Measurement and Instrumentation”, S. K. Kataria and Son, 14th edition.

5. R. K. Rajput, “Electrical and Electronic Measurement and Instrumentation”, S. Chand.

Reference Books

1. A. K. Sawhney. “Electrical & Electronic Measurement and Instrumentation”, Dhanpant Rai & Co.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Electrical Energy Generation System (22PCEE3050T)		

Prerequisite: Knowledge of Basic Electrical Engineering.

Course Objectives

1. This course aims to develop familiarity with power system.
2. An understanding of basic abstractions of electrical power generations from conventional and non-conventional sources of energy.
3. To Develop familiarity with the operation of various power plants.
4. To Develop an understanding of the environmental aspects of power generation.
5. To Understand the Challenges of using sources of energy efficiently and effectively.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate the knowledge about the electric power generations and their impacts.	L2	Understand
CO2	Analyze the theory and practices of conventional and non-conventional power generation methods.	L4	Analyze
CO3	Determine the operation, maintenance, and working of power plants.	L3	Apply
CO4	Explain the basic physics of wind and solar power generation.	L2	Understand
CO5	Analyze issues related to grid integration of solar and wind energy systems.	L4	Analyze
CO6	Create awareness of the concept of micro-grid and distributed generation systems.	L6	Create

Electrical Energy Generation System (22PCEE3050T)
Course Contents

Unit-I 08 Hrs.

Introduction to Generation System: Importance of Electrical Energy, Conventional and Non-conventional energy Sources, Generation of Electrical Energy, Energy demand growth and supply, Sustainable Development and Role of Renewable Energy Sources. Amount of generation of electric power from Conventional and non- conventional sources of energy in India and world.

Unit-II 08 Hrs.

Hydro Power Station : Schematic arrangement of Hydroelectric Power Station, Constituents of Hydro-electric power plant, Classification of HPS: based on head, Storage and pondage, Hydrology, stream flow, flow duration curve, power duration curve, mass curve, reservoir capacity, Water Power equation (Numerical), pumped storage plant and their utility. Micro hydro plants, Advantages and Limitations of Hydro- electric Plants, Potential of hydropower in India- its development and future prospect.

Unit-III 08 Hrs.

Steam Power Station : Introduction, Line diagram of thermal power station (SPS), Site selection Criteria, size and number of units, general layout, Major equipment and auxiliaries of SPS, General study of steam Turbine. Condenser: Different types of condensers. Construction and Working principle of Condenser, Ad- vantages and Limitations of Steam Power Station.

Unit-IV 08 Hrs.

Nuclear Power Station: Environmental aspects for selecting the sites and locations of nuclear power stations, introduction to nuclear physics: Nuclear fusion and fission, Chain reaction, Components of a nuclear reactor, Various types of reactor, material for moderator and control rods, control of nuclear reactors, Special Precautions for NPS, Advantages and Disadvantages of Nuclear Power Station.

Unit-V 10 Hrs.

Solar, Wind Energy Station and Power plant Economics : Introductions to Solar and Wind energy, solar radiation measurement, Types of Solar Energy Collectors, Developments in photovoltaic, Wind Energy Conversion systems, Types of wind Turbine.

Micro grid: Cost of electrical energy, Terms commonly used in system operation, Operation of micro grid in grid-connected as well as isolated mode, Distributed energy systems and dispersed generation (DG).Application, Merit & Demerit of Solar and wind Stations, Numericals on power plant economics.

Text Books

1. Mehta, V. K., “Electrical Power System”, S. Chand and Company, New Delhi, 2011.
2. Ashfaq Hussain, “Electrical Power System”, CBS Publishers and Distributors, 2015
3. J. B. Gupta, “Electrical Power”, S. K. Kataria and Sons 2012.

Reference Books

1. Nag, P. K., “Power plant Engineering”, Tata McGraw Hill, New Delhi, 2011.
2. Uppal S. L., “Electrical Power”, Khanna Publication, New Delhi, 2011.
3. Solanki Chetan S., “Renewable Energy Technologies”, PHI Learning, New Delhi, 2011
4. B. R. Gupta, “Generation of Electrical Energy”, S. Chand and Company, 7^{th} Edition, New Delhi, 2017.
5. C. L. Wadhwa, “Generation Distribution and Utilization of Electrical Energy”, 7^{th} Edition, New Age International, 2016.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Electrical and Electronics Workshop (22PCEE3060L)		

Prerequisite: Basic Electrical Engineering and Digital Electronics.

Course Objectives

1. Demonstrate safety measures against electric shocks.
2. Identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols.
3. Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings.
4. Identify and test various electronic components.
5. Assemble and test electronic circuits on boards.
6. Work in a team with good interpersonal skills.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate safety measures against electric shocks	L2	Understand
CO2	Identify tools used for electrical wiring, accessories, wires, cables, batteries, and standard symbols	L2	Understand
CO3	Develop connection diagrams and select suitable accessories and materials for simple domestic lighting circuits	L6	Create
CO4	Identify and test various electronic components	L4	Analyze
CO5	Assemble and test electronic circuits on boards	L3	Apply
CO6	Collaborate effectively in a team with good interpersonal skills	L3	Apply

Electrical and Electronics Workshop (22PCEE3060L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

Minimum 5 practical from each group

Group A - Electrical

1. a) Demonstrate the precautionary steps adopted in case of Electrical shocks.
   b) Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB, MCCB and RCCB with ratings.
2. Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring)
3. Wiring of light/fan circuit using Two way switches. (Staircase wiring)
4. Wiring of Fluorescent lamps and light sockets (6A) with a power circuit for controlling power device. (16A socket)
5. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.
6. a) Identify different types of batteries with their specifications.
   b) Demonstrate the Pipe and Plate Earthing Schemes using Charts/Site Visit.

Group B - Electronics

1. Identification of Active and Passive Components
2. Testing of Active and Passive Components.
3. Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc., Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and desoldering station etc.]
4. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping.]
5. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling].
6. Simulation of electronic circuit PCB using software.
7. Assembling an electronic circuit / system on general purpose PCB, test and show the functioning.
   Note: Name of the circuit will be provided by the subject teacher at the time of practical.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Reference Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 3rd Edition, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2019.
3. M.S.Sukhija and T.K.Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford University Press, 1st Edition, 2012.
4. Mitchel Schultz, "Grob's Basic Electronics", McGraw Hill Education, 12th Edition, 2015.
5. V. N. Mittle and Arvind Mittal, "Basic Electrical Engineering", McGraw Hill, 2nd Edition, 2006.
6. Charles A. Harper, "Handbook of Components for Electronics", Laxmi Enterprise, 2020.
7. K. B. Raina, Dr. S. K. Bhattacharya, "Electrical Engineering Materials and Electronic Components", S. K. Kataria and Sons, 10th Edition, 2021.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Universal Human Values (22HMEE3070T)		

Course Objectives

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society, and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify the network, solve electric circuits by applying various network laws and theorems.	L3	Apply
CO2	Solve electric circuits by applying graph theory principles.	L3	Apply
CO3	Solve the first order and second order differential equation to determine the transient and steady state response of circuit.	L3	Apply
CO4	Analyze waveform and circuit using Laplace transform.	L4	Apply
CO5	Design and evaluate two port network, frequency selective circuits.	L6	Create

Universal Human Values (22HMEE3070T)
Course Contents

Unit-I 05 Hrs.

Process for Value Education: Purpose and motivation for the course. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.

Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Unit-II 06 Hrs.

Understanding Harmony in Human Being, in Myself! : Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I am being the doer, seer and enjoyer).

Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health.

Unit-III 06 Hrs.

Understanding Harmony in the Family and Society : Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.

Understanding the meaning of Trust; Difference between intention and competence.

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.

Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit-IV 05 Hrs.

Understanding Harmony in the Nature and Existence : Understanding the harmony in the Nature 19. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature.

Understanding Existence as Co-existence of mutually interacting units in all pervasive space. Holistic

perception of harmony at all levels of existence.

Unit-V 06 Hrs.

Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values. Definitiveness of Ethical Human Conduct.

Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.

Competence in professional ethics:

1. Ability to utilize the professional competence for augmenting universal human order,
2. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,
3. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems.

Strategy for transition from the present state to Universal Human Order:

1. At the level of individual: as socially and ecologically responsible engineers, technologists, and managers,
2. At the level of society: as mutually enriching institutions and organizations.

Text Books

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi,2010.

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews.
7. Economy of Permanence - J C Kumarappa.
8. Bharat Mein Angreji Raj - PanditSunderlal.
9. Rediscovering India - by Dharampal.
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.

11. India Wins Freedom - Maulana Abdul Kalam Azad.

12. Vivekananda - Romain Rolland (English).

13. Gandhi - Romain Rolland (English).

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Semester Project -I (PJEE3080L)		

Course Objectives: Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Describe various/alternate approaches to complete a project.	L2	Understand
CO3	Apply a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Use technical communication skills to present project work in the form of a technical report/paper.	L3	Apply
CO5	Apply teamwork and project management skills to plan, execute, and manage the research study.	L3	Apply

Semester Project -I (PJEE3080L)
Course Contents

Semester Project:

The purpose of introducing semester project at second year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfilment of the requirements of the Second Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(please see attached log book format).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after conformation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide)
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide)

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory

- Implementation details
- Project Outcomes
- Conclusion
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 2.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Departmental committee (including project guide) will evaluate project as per Table 3.

Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/TechFest/Magazine/ before the end of the semester.

Table 1: Log Book Format

S. N.	Week (Start Date : End Date)	Work Done	Sign of Guide	Sign of Coordinator

Table 2: Continuous Assessment Sheet

S. N.	Exam Seat No	Name of Student	Student Attendance (5)	Log Book Maintain (5)	Literature Review (5)	Depth of Understanding (5)	Report (5)	Total (25)

Table 3: Evaluation Sheet

S. N.	Exam Seat No	Name of Student	Project Selection (5)	Design / Simulation / Logic (5)	PCB / Hardware / Programming (5)	Result Verification (5)	Presentation (5)	Total (25)

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Engineering Mathematics - IV (22BSEE4010T)		

Course Objectives

To build the strong foundation in Mathematics of learner needed for the field of Electrical Engineering learner would be able:

1. To understand the concept of Random Variables.
2. To test the hypothesis of samples.
3. To apply the concepts of Linear Algebra.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply theory of probability in identifying and solving relevant problems.	L3	Apply
CO2	Differentiate random variables through the use of cumulative distribution function (CDF), Probability density function (PDF), Probability mass function (PMF) as well as joint, marginal and conditional CDF, PDF and PMF.	L2	Understand
CO3	Understand major types of probability sampling method and indicate when each is preferred.	L2	Understand
CO4	Understand the theory of linear algebra.	L2	Understand
CO5	Apply theory of Eigen systems to principal component analysis.	L3	Apply

Engineering Mathematics - IV (22BSEE4010T)
Course Contents

Unit-I 08 Hrs.

Introduction to Probability and Random Variable: Conditional probability, Joint probability, Baye's theorem, Independence of events, Definition of Random Variable. Discrete and Continuous random variables, probability mass function, probability density function, probability distribution function, Expectation, Variance and Moments of random Variable, Binomial, Poisson and Normal (Gaussian) distributions.

Unit-II 07 Hrs.

Operations on One and Multiple Random Variable: Functions of a random variable and their distribution and density functions, Pairs of random variables, Joint CDF, Joint PDF, Independence, Conditional CDF and PDF, Conditional Expectation, One function of two random variables, two functions of two random variables; joint moments, joint characteristic function, covariance, and correlation-independent, uncorrelated and orthogonal random variables.

Unit-III 04 Hrs.

Sampling Theory and Distribution: Central limit theorem and its significance, Sampling distribution: Population distribution, parameter and statistics, Z distribution, Student's t-distribution, Chi-square distribution.

Unit-IV 06 Hrs.

Test of Hypothesis: Hypothesis testing: Test of significance, null and alternative hypothesis, type I and type II error, factors affecting Type II error, probability of Type II error, power of test, p Value, critical region, level of significance. One tailed and Two tailed Test, Large sample (Z-Test)-Test of significance of Mean of the sample and test of significance difference of means of two samples, Small sample(t-Test)-Test of significance of Mean of the sample and test of significance difference of means of two samples(dependent and independent), Chi-square test: Test of goodness of fit and independence of attributes, contingency table.

Unit-V 08 Hrs.

Basics of Linear Algebra : Vector Spaces, Subspaces, Span, Basis, Dimension, Rank, Linear transformations, Rank nullity theorem, Inner Product Space, Gram Schmidt Orthogonalization Process.

Unit-VI 08 Hrs.

Matrix Theory: Eigenvalues and Eigenvectors, properties of Eigenvalues and Eigenvectors, Cayley-Hamilton theorem, Examples based on verification of Cayley-Hamilton theorem, Similarity of matrices, Diagonalization of matrices, Function of square matrix, Quadratic forms over real field, Reduction of

quadratic form to a diagonal, canonical form, Rank, index and signature of quadratic form, class value of quadratic forms, definite, Semi-definite and indefinite.

Text Books

1. T. Veerarajan, "Probability, Statistics and Random Processes", McGraw Hill.
2. Gareth Williams, Linear Algebra with Application, Jones and Bartlett, 9th Edition, 2017.

Reference Books

1. Papoulis and S. Unnikrishnan Pillai, Probability, Random Variables and Stochastic Processes, 4^{th} Edition 2017, McGraw Hill.
2. Seymour Lipschitz and Marc Lipson, Schaum's Outline of Linear Algebra, Mc-Graw Hill Publication, 3th Edition, 2017.
3. S. C. Gupta and V. K. Kapoor, Fundamental of Mathematical Statistics, Sultan Chand and Sons, 12th Edition 2020.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Electrical Machine-I (22PCEE4020T)		
Electrical Machine-I Laboratory (22PCEE4020L)		

Prerequisite: Magnetic circuit, mutually induced EMF, dynamically induced EMF, Direction of magnetic field in current carrying conductor, Flemings LHR and RHR, Electromechanical energy conversion.

Course Objectives

1. To understand energy conversion process.
2. To understand basic principles operation, performance and control of dc machine and transformer.
3. To understand selection of machines for specific applications.
4. To understand test and analysis the performance of machine.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the energy conversion process.	L2	Understand
CO2	Apply engineering concepts in working and characteristics of DC machines.	L3	Apply
CO3	Analyze the performance of DC machines.	L4	Analyze
CO4	Apply engineering concepts in construction and working of Transformers.	L3	Apply
CO5	Apply selection of appropriate machine for different applications.	L4	Analyze

Electrical Machine-I (22PCEE4020T)
Course Contents

Unit-I 08 Hrs.

Electromechanical Energy Conversion Principle: Energy stored in the magnetic circuit, rotating magnetic field, field energy and mechanical force, energy in single and multiple excited magnetic systems, Physical concept of torque production, Concept of general terms pertaining to rotating machines, Dynamic equations of electromechanical systems and analytical techniques.

Unit-II 08 Hrs.

DC Generator: Construction, main parts, magnetic circuits, poles, yoke, field winding, armature core, Armature windings, Generating action, E.M.F equation, magnetization curve, armature reaction, characteristic of DC generator, demagnetizing and cross magnetizing, compensating winding, commutation process and methods to improve commutation. Losses, power flow diagram and efficiency of DC generator.

Unit-III 09 Hrs.

DC Motor: Type of DC motors, significance of back E.M.F, torque equation, power stages, losses and efficiency, characteristic of DC motors, speed control of DC motors, necessity and types of starters, solid state starters. Applications of various DC machines, troubleshooting of various DC machines, selection procedure, study of relevant Indian Standard Specifications.

Unit-IV 09 Hrs.

Transformers: Concept of ideal transformer., Cargo core and amorphous core transformers, Phasor diagram, equivalent circuit, voltage regulation, Losses in a transformer, their variation with load and efficiency, testing of transformer open circuit and short circuit tests, polarity test. Three phase transformer construction, vector groups, V-V connections, Scott connection, parallel operation and load sharing. Applications of various transformers, Distribution Transformer requirements as per Indian Standard.

Unit-V 08 Hrs.

Special Machines and Applications: Brushless DC Motor (BLDC): Constructional details, working principle, comparison of BLDC motor with conventional DC motor, characteristics and applications, advantages and disadvantages. Permanent Magnet DC Motor (PMDC): Constructional details, working principle, characteristics and applications, advantages and disadvantages. Stepper Motor: Constructional details, working principle, types, characteristics and applications, advantages and disadvantages. Universal Motor, Switched Reluctance Motor.

Electrical Machine-I Laboratory (22PCEE4020L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. Familiarization of the electrical machine laboratory apparatus.
2. Speed Control of DC motor by field resistance control.
3. Speed Control of DC motor by Armature Resistance Control.
4. To study Magnetization Characteristics of D C generator.
5. To study External, Internal Characteristics of D C Generator.
6. Determination of performance characteristic of DC series motor by direct load.
7. Determination of Transformer equivalent circuit from Open Circuit and Short Circuit Test.
8. Determination of performance of single phase transformer by direct load test.
9. Polarity and Ratio test on single phase transformer.
10. Parallel operation of two single phase transformer.
11. Study of phasor and vector group of three phase transformer.
12. Scott connection of two single phase transformer.
13. To study DC Machine characteristics using MATLAB.
14. Load test on single phase transformer using MATLAB.
15. Speed control of BLDC motor using Ardiuno.
16. Direction control of stepper motor using Ardiuno.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books

1. Edward Hughes "Electrical Technology", ELBS, Pearson Education.
2. Ashfaq Husain, "Electrical Machines", Dhanpat Rai and Sons, 2nd Edition, 2018.
3. S. K. Bhattacharya, "Electrical Machine", Tata McGraw Hill, 4th Edition, 2018.
4. D. P. Kothari and I. J. Nagrath, "Electrical Machines", Tata McGraw Hill, 5th Edition, 2017.

5. Bhag S. Guru, Huseyin R. Hiziroglu, “Electrical Machines and Transformers”, Oxford University Press, 3rd Edition, 2000.

6. K. Krishna Reddy, “Electrical Machines-I and II”, SCITECH Publications, 2008.

Reference Books

1. A. E. Clayton and N. N. Hancock, “Performance and Design of Direct Current Machines”, CBS Publishers, 3rd Edition, 2004.

2. A. E. Fitzgerald, Charles Kingsley, Stephen D. Umans, “Electrical Machines”, Tata McGraw Hill, 7th Edition, 2020.

3. A. S. Langsdorf, “Theory and Performance of DC Machines”, Tata McGraw Hill.

4. M. G. Say, “Performance and Design of AC Machines”, CBS Publishers and Distributors, 2002.

5. Smarajit Ghosh, “Electrical Machines”, Pearson Education, 2007.

6. Charles I Hubert, “Electrical Machines Theory, Application, and Control”, Pearson Education, 7th Edition, 2001.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Digital Electronics (22PCEE4030T)		
Digital Electronics Laboratory (22PCEE4030L)		

Prerequisite: Basic Electrical and Electronics Engineering.

Course Objectives

1. Understand the number systems and logic families.
2. Discuss the features of combinational circuits and sequential circuits.
3. Understand flip flops and their applications.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain fundamental concepts and techniques used in digital electronics	L2	Understand
CO2	Design and implement logic circuits using digital components	L6	Create
CO3	Design combinational and sequential logic circuits.	L6	Create
CO4	Explain the process of analog-to-digital and digital-to-analog conversion for solving logical problems	L2	Understand
CO5	Explain fundamentals of semiconductor memories and programmable logic devices	L2	Understand

Digital Electronics (22PCEE4030T)
Course Contents

Unit-I 08 Hrs.

Fundamentals of Digital System and Logic Families: Binary arithmetic, 1's and 2's complements arithmetic, codes, digital logic families RTL, DTL, TTL, ECL, MOS Logic, CMOS logic.

Unit-II 08 Hrs.

Combinational Digital Circuits: Standard representation for logic functions SOP and POS form, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Adders, Subtractors, BCD arithmetic, Multiplexer, De-Multiplexer/Decoders.

Unit-III 09 Hrs.

Sequential circuits and systems : Comparison of combinational and sequential circuits, Flip-flops: SR, T, D, JK, Master-slave JK, converting one flip flop to another, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, Counter: Ripple counter, up-down counter, Synchronous counter , designing of counters, state transition diagram, ring counter, twisted ring counter.

Unit-IV 09 Hrs.

A/D and D/A Converters: Digital to analog converters: weighted resistor/convertor, R-2R Ladder D/A converter, specifications for D/A converters, analog to digital converters, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, specifications of A/D.

Unit-V 08 Hrs.

Semiconductor Memories: Memory organization and operation, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic.

Digital Electronics Laboratory (22PCEE4030L)

List of Laboratory Experiments

Suggested Experiments: (Any 8)

1. Verify the Truth tables of Logic Gates.
2. Simplification of Boolean functions.
3. Verify Universal gates and design EXOR and EXNOR gates using Universal gates.
4. Verification of Boolean Laws and D Morgan's theorem.
5. Design and implementation of Half and Full Adder circuits.
6. Design and implementation of Half and Full substractor circuits.
7. Implement BCD adder using four-bit binary adder IC-7483.
8. Design synchronous MOD N counter using IC-7490.
9. Implementation of multiplexer.
10. Verify the truth table of various flip-flops.
11. Design of Ring Counter, Twisted Ring Counter.
12. Verify Binary to Gray and Gray to Binary conversion using NAND gates only.
13. 3-Bit Adder
14. Verify the truth table of one bit and two bit comparator using logic gates.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books

1. R. P. Jain, "Modern Digital Electronics", Mc Graw Hill Education (India) Pvt Ltd, 2009.
2. M. M. Mano, "Digital logic and Computer Design", Pearson Education India, 2016.

Reference Books

1. A. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall India.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Power System Transmission and Distribution (22PCEE4040T)		
Power System Transmission and Distribution Laboratory (22PCEE4040L)		

Prerequisite:

1. Knowledge of Basic Electrical Energy.
2. Knowledge of Electrical Energy Generation System.
3. Present scenario of power system.

Course Objectives

1. To introduce students to the basic structure and requirements of any electric power supply system.
2. To develop knowledge about nature of power systems engineering and the profession.
3. To develop an understanding of components in a power system and to understand the basic principles involved in these components.
4. To develop professional skills that prepare for modeling and analyzing transmission networks.
5. To develop professional skills required to design electrical power transmission system.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the general structure power system.	L2	Understand
CO2	Apply Practical knowledge in power system.	L3	Apply
CO3	Analyze corrective measure for immediate as well as long term solution to the system problems.	L4	Apply
CO4	Design the transmission lines under various working conditions.	L6	Create
CO5	Analyze the faults in UG cables and the parameters of distribution system network.	L4	Analyze

Power System Transmission and Distribution (22PCEE4040T) Course Contents

Unit-I 08 Hrs.

Transmission System : Electric supply system, A.C power supply scheme, D.C transmission scheme, Comparison of AC and DC transmission system, advantages of A.C. transmission system, Comparison of various transmission system (Two wire dc system, Single phase two wire A.C system, Single phase three wire system, three phase three wire system, Three phase four wire system), Economic choice of transmission voltage, requirements of satisfactory electric supply.

Unit-II 08 Hrs.

Fundamentals of Power Systems: Structure of power systems, Growth of power systems - Indian overview, Interconnections and their advantages. Present Scenario Indian power industry, concept of National GRID, GRID formation. Power factor improvement methods, Advantages of power factor improvement.

Unit-III 08 Hrs.

Mechanical Design of Overhead Transmission Line : Main components of overhead line, conductor materials, line supports, Type of insulators, Testing of Insulators, potential distribution over suspension insulator string, string efficiency, methods of improving string efficiency. Phenomenon of corona, factors affecting corona, advantages and disadvantages of corona, methods of reducing corona, Sag in overhead line, calculation of sag, Effects of wind and ice coating on transmission line.

Unit-IV 09 Hrs.

Transmission Line Parameters: Resistance, Inductance: Definition, Inductance due to internal flux of two wire single phase line of composite conductor line, GMD and GMR, Inductance and Capacitance of single and three phase line with equal and unequal spacing, Skin effect, Proximity Effect, Ferranti effect. Phenomenon of Corona, Corona loss, Factors affecting Corona.

Transmission Line Performance: Characteristics and performance of power transmission lines: Short, Medium, Long lines, Generalized constants, Power flow, regulation, Power circle diagrams, Series and shunt compensation, Surge impedance loading.

Unit-V 09 Hrs.

Distribution System and underground Cables: Classification and Requirements of distribution system, Types of distribution AC and DC, Voltage drop calculations in different distribution system, Tariff, desirable characteristics of tariff, types of tariff, Numericals on tariff.

Underground cable: Introductions, Classification, Types of Cables, IR and Capacitance, Grading, Dielectric stress, Heating, Current rating of cable, Numericals on IR and capacitance of cable.

Power System Transmission and Distribution Laboratory (22PCEE4040L)

List of Laboratory Experiments

Suggested Experiments: (Any 10)

Any 10 experiments to be performed from **Group A:-** Minimum Five Practical's and **Group B:-**Minimum Five Practical's

Group:- A (3- Hardware Base, 2- Simulation)

1. To Determine the Inductance for symmetrical and unsymmetrical configuration of 3 phase Transmission line by using MATLAB Software.
2. To Determine the Capacitance for symmetrical and unsymmetrical configuration of 3 phase Transmission line by using MATLAB Software.
3. To verify the effect of VAR Compensation on receiving end profile of transmission line using Capacitor bank.
4. Study of line conductors and insulators of OHT system.
5. Analysis of surge impedance loading of transmission line.
6. To Determine Regulation and Transmission Efficiency for Short and Medium transmission line.
7. To Determine ABCD parameters of short, medium and long transmission lines.

Group:- B (3- Hardware Base, 2- Simulation)

1. To Study Various Types of Distribution systems.
2. To Design substation models.
3. Case study on different types of Tariff.
4. To Determine Voltage regulation, efficiency and Power factor of long transmission line by using MATLAB Software.
5. To Determine sag of transmission line by using MATLAB Software.
6. Measurement of insulation resistance of power cables.
7. To study control Panel and Metering equipment of Industries.
8. Simulation and analysis of Line to Ground(L-G) fault.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books

1. Mehta, V.K, “Electrical Power System”, S. Chand and Co., New Delhi, 2011.
2. Ashfaq Hussain, “Electrical Power System”, CBS Publishers and Distributors, 2015.
3. J.B. Gupta, “Electrical Power”, SK Kataria and Sons 2012.

Reference Books

1. M. V. Deshpande, Elements of Elect Power, Transmission and Distribution, Tata McGraw- Hill. 2004
2. Uppal, S.L., “Electrical Power”, Khanna Publication, New Delhi, 2011
3. Solanki, Chetan S., “Renewable Energy Technologies”, PHI Learning, New Delhi, 2011
4. B. R. Gupta, “Generation of Electrical Energy”, S. Chand and Co., 7^th Edition, New Delhi, 2017.
5. C.L. Wadhwa, “Generation, Distribution and Utilization of Electrical Energy”, 7^th edition, New Age International, 2016.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Microcontroller and Its Applications (22PCEE4050T)		
Microcontroller and Its Applications Laboratory (22PCEE4050L)		

Prerequisite: Basic Electrical Engineering and Digital Electronics.

Course Objectives

1. To study the Architecture of 8051 microcontroller.
2. To study the addressing modes and instruction set of 8051.
3. To introduce the need and use of Interrupt structure of 8051
4. To develop skill in simple applications development with programming 8051 and to study advanced microprocessor.
5. To introduce Arduino with commonly used peripheral and interfacing

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe the architecture of various micro controller.	L2	Understand
CO2	Write program for 8051 in assembly language and embedded C.	L3	Apply
CO3	Explain the timers and interrupts of a microcontroller.	L2	Understand
CO4	Analyze the architecture of advanced microprocessor.	L4	Analyze
CO5	Apply to interface the IO devices to microcontroller and Arduino.	L3	Apply

Microcontroller and Its Applications (22PCEE4050T)
Course Contents

Unit-I 10 Hrs.

8051 Microcontroller Architecture: Microprocessor vs Microcontroller, Overview of the microcontroller Family, Intel 8051 Functional block diagram, Functions of pins of 8051, Memory organization of 8051, Stack and operation of stack, Stack pointer, Overview of special function registers, Subroutines.

Unit-II 08 Hrs.

Instruction set and Programming : Instruction set of 8051 microcontroller, Assembly Language Programs based on instructions, Addressing modes of 8051.

Unit-III 08 Hrs.

8051 Timers, Interrupts and Programming: Data types in C, 8051 Programming in embedded C, 8051 ports and programming in embedded C. Time delay programming in embedded C. 8051 Timers and counters and its programming in embedded C. 8051 interrupts, Interrupts Programming in embedded C, 8051 Serial port Structure and its programming in embedded C.

Unit-IV 08 Hrs.

8051 Interfacing and Advanced Microprocessor: Interfacing of Switch, LED, with 8051 and its programming in embedded C, Interfacing and programming of LCD, ADC, DAC, Stepper motor and Relay with 8051 in embedded C. Introduction to Architecture of PIC Microcontroller, ARM Processor, ATMEGA Processor.

Unit-V 08 Hrs.

Arduino and its Programming: Introduction to the Arduino, Arduino IDE, Arduino Shields, Arduino Programs, Interfacing Arduino with Analog devices, Interrupts, Communication Device: Serial port, Applications: Interfacing of motor, LCD.

Microcontroller and Its Applications Laboratory (22PCEE4050L)

List of Laboratory Experiments

Suggested Experiments: (Any 8) Minimum 5 practical from each group

Group A

1. Write an Assembly language program to perform 8 bit arithmetic operations Addition and Subtraction.
2. Write an Assembly language program to find larger number from given data bytes stored in memory locations.
3. Write an Assembly language program to find square of number using Look up table concept.
4. Write an Assembly language program to perform 8 bit logical AND, OR operations.
5. Write an Assembly language program to arrange an data in ascending or descending order
6. Write an Assembly language program to transfer data from source to destination locations of memory
7. Write a program blinking of LED using Proteus VSM simulation software
8. Design of temperature meter using Arduino (Innovative)
9. Design of DC voltmeter using Arduino (Innovative)

Group B

1. Implementation of Serial Communication by using 8051 serial ports.
2. Write an embedded C program for interfacing of 8 bit ADC 0809 with 8051 Microcontroller.
3. Write an embedded C program for interfacing of 8 bit DAC 0808 with 8051 to generate various waveforms.
4. Write an embedded C program for stepper motor control by 8051 Microcontroller.
5. Write an embedded C program for interfacing of the relay with 8051.
6. Write an embedded C program for LCD interfacing with 8051 microcontroller.
7. Write a program for switch and LED interfacing using Proteus VSM simulation software.
8. Design of ultrasonic distance meter using Arduino (Innovative).
9. Design of digital ohmmeter using Arduino (Innovative).

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearsons, 2nd Edition, 2014.
2. V Udayashankara and M S Mallikarjuna Swamy, "8051 Microcontroller, Hardware, Software and Applications", TATA McGraw Hill, 1st Edition, 2017.
3. R. Theagrajan,"Microprocessor and Microcontroller", BS Publication, 1st Edition, 2010.
4. K. J. Ayala, "The 8051 Microcontrollers- Architecture, Programming and Applications", Peram International Publications, 2nd Edition, 1998
5. Subrata Ghoshal, "8051 Microcontroller", Pearsons Publishers, 2nd Edition, 2014.
6. Han-Way Huang,"Embedded System Design with C8051", Cengage Learning, 1st Edition, 2009.
7. A.K Ray and K.M. Burchandi, "Advanced Microprocessor and Peripherals Architectures,Programming and Interfacing",second edition,Tata McGraw-Hill, 3rd Edition, 2017.
8. James A. Langbridge "Arduino Sketches: Tools and Techniques for Programming Wizardry", Wiley Publication, 1st Edition, 2015.

Reference Books

1. Scott Mackenzie, "8051 Microcontroller", Pearson Education, 4th Edition, 2006.
2. Intel Microcontroller Data Book.
3. Intel Corporation 1990- 8 bit Embedded Controller Handbook.

Program: Electrical Engineering	S. Y. B. Tech.	Semester: III
Constitution of India (22MCEE3080T)		

Course Objectives

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Summarize various analog and digital circuits.	L2	Understand
CO2	Implement analog and digital circuits to meet stated applications	L3	Apply
CO3	Construct basic analog filters, combinational and sequential circuits	L3	Apply
CO4	Solve the K-map of 2, 3 and 4 variable.	L3	Apply
CO5	Analyze the performance of electronic circuits	L4	Analyze

Constitution of India (22MCEE3080T)
Course Contents

Unit-I 02 Hrs.

Introduction to the Constitution of India: The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights and its limitations.

Unit-II 03 Hrs.

Directive Principles of State Policy: Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.

Unit-III 03 Hrs.

State Executives: Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42^{nd}, 44^{th}, 74^{th}, 76^{th}, 86^{th} and 91^{st} Amendments.

Unit-IV 03 Hrs.

Special Provisions: For SC and ST Special Provision for Women, Children and Backward Classes Emergency Provisions. Human Rights: Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchyats and Co – Operative Societies..

Unit-V 03 Hrs.

Scope and Aims of Engineering Ethics: Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity and Reliability in Engineering.

Text Books

1. Durga Das Basu, "Introduction to the Constitution on India", (Students Edn.) Prentice –Hall EEE, 19^{th} / 20^{th} Edn., 2001
2. Charles E. Haries, Michael S Pritchard and Michael J. Robins, "Engineering Ethics", Thompson Asia, 2003-08-05.

Reference Books

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
2. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice – Hall of India Pvt. Ltd. New Delhi, 2004.
3. Brij Kishore Sharma,"Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.

4. Latest Publications of Indian Institute of Human Rights, New Delhi.

Web Resources:

1. https://www.nptel.ac.in
2. http://www.nspe.org
3. http://www.hnlu.ac.in
4. http://www.preservearticles.com

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Semester Project -II (PJEE4080L)		

Course Objectives Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Describe various/alternate approaches to complete a project.	L2	Understand
CO3	Apply a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Use technical communication skills to present project work in the form of a technical report/paper.	L3	Apply
CO5	Apply teamwork and project management skills to plan, execute, and manage the research study.	L3	Apply

Semester Project -II (PJEE4080L)
Course Contents

Semester Project:

The purpose of introducing semester project at second year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfilment of the requirements of the Second Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(please see attached log book format).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after conformation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide)
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide)

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory

- Implementation details
- Project Outcomes
- Conclusion
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 2.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Departmental committee (including project guide) will evaluate project as per Table 3.

Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/TechFest/Magazine/ before the end of the semester.

Table 1: Log Book Format

S. N.	Week (Start Date : End Date)	Work Done	Sign of Guide	Sign of Coordinator

Table 2: Continuous Assessment Sheet

S. N.	Exam Seat No	Name of Student	Student Attendance (5)	Log Book Maintain (5)	Literature Review (5)	Depth of Understanding (5)	Report (5)	Total (25)

Table 3: Evaluation Sheet

S. N.	Exam Seat No	Name of Student	Project Selection (5)	Design / Simulation / Logic (5)	PCB / Hardware / Programming (5)	Result Verification (5)	Presentation (5)	Total (25)

Program: Electrical Engineering	S. Y. B. Tech.	Semester: IV
Employability Skill Development Program-I (22HMEE4090L)		

Prerequisite: Basic Mathematics, Basic knowledge of C programming.

Course Objectives

1. To enhance the problem solving skills.
2. To improve the basic mathematical skills for solving real life examples.
3. Able to implement the algorithms and draw flowcharts for solving Mathematical and Engineering problems.
4. Demonstrate an understanding of computer programming language concepts.

Course Outcomes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the basic concepts of Quantitative Ability, including profit, loss, time, work, and geometry.	L2	Understand
CO2	Demonstrate the concepts of Quantitative Ability for problem solving.	L3	Apply
CO3	Demonstrate the concept of Variables and Functions through examples.	L3	Apply
CO4	Demonstrate the concept of Multithreading and String Handling.	L3	Apply
CO5	Explain the fundamentals of Object-Oriented Programming.	L2	Understand
CO6	Describe the concepts of Distributed Database.	L2	Understand

Employability Skill Development Program-I (22HMEE4090L) Course Contents

Aptitude **Quantitative Aptitude :** Algebra, Profit and Loss, Average & Allegation / Mixture, Time and Work, Geometry Mensuration, Numbers , Percentage, Permutation and Combination, Probability, Ratios & Proportion, Time and Distance.

Reasoning : Analytical, Puzzles, Blood relationship, Data Interpretation, Data sufficiency

Fundamental of Programming

Variables: Local variables, Global variables, 'global' keyword, Rules of Identities,

Functions : Introduction, Prototype, Classification of functions, No arguments and No return values, With arguments and With return values,

No arguments and With return values : With arguments and No return values, Recursion, Argument type functions, Default arguments functions, Required arguments functions,Keyword arguments functions, Variable arguments function

Operators : Arithmetic Operators, Relational operators, Logical operators, Bitwise operators, Shift operators,

Control Statements : Conditional Control Statements, if, if-else, if-elif-else, nested-if, Loop Control Statements, While, For,

Branching Statements: Break, Continue, pass, return, exit,

Exception Handling: Introduction, The need of exception handling, Getting exceptions,Default exception handler, Handling exception, Try, Except,

Try with multiple except blocks Handling exceptions using Exception class, Finally, block, Releasing resources using Finally block, Raise, Creating a user exception class., Raise exception manually, Exceptions based application

Multithreading : Introduction, Multitasking, Multi tasking v/s Multithreading, threading module, Thread class introduction, Creating thread, The life cycle of a thread, Single-threaded application, Multi-threaded application, Sleep() method. Sleep() v/s run(), Join() v/s Sleep(), Multiple custom threads creation, The execution time of single-threaded application, The execution time of multi-threaded application, Synchronization of threads.

Inner classes Basic syntax of inner class, Advantages of Inner classes, Access class level members of inner classes, Access object level members of inner classes, Local inner classes, Complex inner classes, Accessing data of inner classes.

Regular expressions 're' module, Match(), Search(), find() etc, and actual projects web scrapping

Mail extraction Date extraction, Mobile number extraction, Vehicle number extraction, zoom chat analysis,

Expressions using operators and symbols: Split string into characters, Split string into words, Lambda expressions,

String handling using regex: Introduction to Strings, Indexing and Slicing, Special operators in String

handling, Old style String formatting, String library methods, Quotes and Escape characters in a String representation, String Immutability, Logical programs using Strings

Object Oriented Programming : Introduction to OOPs, Classes, Objects, Structure to OOP application, Contexts of OOP application, Class level members, Object level members, self variable, Constructor and Initialization of object.

Access modifiers : Private, Protected, Public, Program codes. **Encapsulation** Rules, Implementation, Abstraction, Polymorphism

Inheritance Introduction, Types of Inheritance, Single inheritance, Multi-Level inheritance, Method overriding, Object initialization using constructor, Multiple inheritances, Hierarchical inheritance, Method overriding in Multi level inheritance.

Reference Books

1. Quantitative Aptitude for Competitive Examinations by Dr. R S Aggarwal, S Chand Publication
2. Programming Techniques through C, by M. G. Venkateshmurthy, Pearson Publication.
3. A Computer Science Structure Programming Approaches using C, by Behrouz Forouzan, Cengage Learning.
4. Let Us C, by YashwantKanetkar, BPB Publication.

Online Resources:

1. W. Fisher, “Maps of Intellectual Property”, https://cyber.harvard.edu/people/tfisher/IP/IPMaps.htm
2. World Intellectual Property Organisation courses https://www.wipo.int/academy/en/
3. Prof. Feroz Ali, “Patent Drafting for Beginners”, https://onlinecourses.nptel.ac.in/noc24_hs59/preview