MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru–560074

Electrical & Electronics Engineering

III & IV Semester Scheme and Syllabus

(2024 Scheme)

VISION

To empower young minds through technology, research and innovation, to produce technically competent and socially responsible professionals in higher education.

MISSION

1. To deliver excellence in education through innovative teaching, impactful research, and continuous skill development, preparing students to meet global challenges with technical expertise and ethical responsibility.
2. To foster a transformative learning environment that integrates technology, research and practical experience, empowering students to become skilled professionals and socially conscious leaders.
3. To cultivate a culture of lifelong learning and professional excellence by encouraging creativity, research, and community engagement, equipping students with the skills to thrive in a dynamic world.
4. To provide a holistic educational experience that combines advanced technology, hands-on research, and community-focused learning, shaping students into competent, ethical professionals who contribute positively to society.

QUALITY POLICY

Rajarajeswari College of Engineering is committed to imparting quality technical education that nurtures competent, ethical professionals with global relevance. We ensure academic excellence through a dynamic, outcome-based curriculum, experienced faculty, and cutting-edge infrastructure. Continuous improvement is driven by innovation, research and strong industry collaboration. We foster holistic development and a progressive environment that supports lifelong learning, teamwork, and professional growth.

CORE VALUES

Academic Excellence, Integrity, Innovation, Global Competence, Continuous Improvement.

Electrical & Electronics Engineering

DEPARTMENT VISION

To be a center of excellence in Electrical and Electronics Engineering education and research, fostering innovation, entrepreneurship, and sustainable technologies to serve societal and industrial needs in a rapidly evolving global landscape.

DEPARTMENT MISSION

1. To impart high-quality education in Electrical and Electronics Engineering through a dynamic curriculum, experiential learning, and cutting-edge laboratory facilities, fostering academic excellence and professional competence.
2. To promote research, innovation, and industry collaboration by encouraging students and faculty to engage in interdisciplinary projects, pursue patents, and address real-world engineering challenges.
3. To instill ethical values, environmental consciousness, and lifelong learning in students, preparing them to be responsible engineers, entrepreneurs, and leaders who contribute meaningfully to society and sustainable development.

PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems /components / processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: The graduate will succeed in industries/technical profession and/or pursue post graduate program in Electrical & Electronics Engineering and allied fields by providing solid foundation in fundamentals of Mathematics, Science and Electrical & Electronics Engineering using modern tools and equipment to correlate theoretical aspects with practical needs.

PEO2: Graduates will be through professionals equipped with sound leadership, interdisciplinary teamwork, communication skills, and ethical practices along with concerns for environment and societal well being.

PEO3: Graduates will possess the capability to acquire new knowledge through skills of analysis, synthesis and knowledge generation, transmission and distribution in designing electrical systems to solve engineering problems and remain life-long learners in an increasingly technology-dependent society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Solve EEE problems like a pro – Understand the latest technologies and models in the field of advanced engineering.

PSO2: Speak like an Executive – Develop technical skills in presenting modern insights.

PSO3: Work like an innovator – Complete the program with realistic ideas and employability skills.

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Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

Department of Electrical and Electronics Engineering

Scheme of Teaching and Examinations: 2024

(Effective from the Academic Year 2025-26)

Semester: III

S.No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week & Credits					Examination			
					Lecture	Tutorial	Practical	SDA	Credits	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks
					L	T	P	S					
1.	BSC	B24ME301	Mathematics – III for EE (Common to ECE & EEE)	Maths	3	0	0	0	3	50	3	50	100
2.	PCC	B24EE302	Electrical Machines - I	EEE	3	0	0	0	3	50	3	50	100
3.	IPCC	B24EE303	Analog and Digital Electronics (Common to EEE, R&A)	EEE	3	0	2	0	4	50	3	50	100
4.	IPCC	B24EE304	Electric Circuit Analysis	EEE	3	0	2	0	4	50	3	50	100
5.	PCCL	B24EE305L	Electrical Machines – I Lab	EEE	0	0	2	0	1	50	3	50	100
6.	ESC	B24EE36X	ESC/ETC/PLC - III	EEE	3	0	0	0	3	50	3	50	100
7.	UHV	B24SCK307	Social Connect and Responsibility	Any Dept.	0	0	2	0	1	50	3	50	100
8.	AEC/SEC	B24YY38X	Ability Enhancement Course / Skill Enhancement Course – III (Theory/Lab)	EEE	1 0	0 0	0 2		1	50	1 3	50	100
9.	NCMC	B24NCK39X	National Service Scheme / National Cadet Corps / Physical Education/ /Yoga/ Music	HSMC	1	0	0		PP	50		-	50
								TOTAL	20	450		400	850

BSC: Basic Science Course, HSMC: Humanity, Social sciences including Management courses, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course L: Lecture, T: Tutorial, P: Practical S:SDA-Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation, PP/NP: Pass/Not Pass, YY: Programme Code (EC, CS, IS etc), X: 1/2/3/4, K: Indicates Common Course to all the streams of Engineering.

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Engineering Science Course /Emerging Technology Course / Programming Language Course (ESC/ETC/PLC) - III			
B24EE361	Sensors and Transducers	B24EE362	Electrical Power Generation and Economics
B24EE363	Electrical Measurements and Instrumentation	B24EE364	Introduction to AI

Ability Enhancement Course / Skill Enhancement Course (AEC/SEC) – III			
B24EE381	Scilab for Electronic Circuits	B24EE382	Circuit Laboratory using PSpice
B24EE383	Electrical Measurements Lab	B24EE384	Electrical Appliances Lab

Non Credit Mandatory Courses (NCMC)			
B24NCK391	National Service Scheme (NSS)	B24NCK392	National Cadet Corps (NCC)
B24NCK393	Physical Education (PE)	B24NCK394	Yoga
B24NCK395	Music		

All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE), National Cadet Corps (NCC), Music and Yoga (YOG) with the concerned coordinator of the course during the first week of III/IV/V/VI semesters. Colleges are required to submit the Continuous Internal Evaluation (CIE) marks for the activities completed by students under selected course each semester. The students should be allowed to engage in different activities/courses each semester. For example, a student who participates in sports in the 3rd semester could choose to undertake NSS in the next semester and Yoga in another semester. This approach aligns with the student-centric focus of the National Education Policy (NEP) 2022 and helps distribute the workload related Physical Education/NSS/Yoga/NCC/Music of more evenly across different departments. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities.

These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Dean-Academics **Principal**

MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

Department of Electrical and Electronics Engineering

Scheme of Teaching and Examinations: 2024

(Effective from the Academic Year 2025-26)

Semester: IV

S.No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week & Credits					Examination			
					Lecture	Tutorial	Practical	SDA	Credits	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks
					L	T	P	S					
1.	PCC	B24EE401	Electrical Machines – II	EEE	3	0	0	0	3	50	3	50	100
2.	PCC	B24EC402	Electromagnetic Field Theory (Common to ECE & EEE)	EEE, ECE/ECE	3	0	0	0	3	50	3	50	100
3.	IPCC	B24EE403	Transmission and Distribution	EEE	3	0	2	0	4	50	3	50	100
4.	IPCC	B24EE404	Microcontroller and ARM Processor	EEE	3	0	2	0	4	50	3	50	100
5.	PCCL	B24EE405L	Electrical Machines – II Lab	EEE	0	0	2	0	1	50	3	50	100
6.	ESC	B24YY46X	ESC/ETC/PLC - IV	EE/EC	3	0	0	0	3	50	3	50	100
7.	UHV	B24UHK407	Universal Human values	Any Dept.	1	0	0	0	1	50	1	50	100
8.	AEC/SEC	B24YY48X	Ability Enhancement Course / Skill Enhancement Course – III (Theory/Lab)	EEE	1 0	0 0	0 2	0	1	50	1 3	50	100
9.	NCMC	B24NCK49X	National Service Scheme / National Cadet Corps / Physical Education / Yoga/ Music	HSMC	1	0	0		0	50		-	50
								TOTAL	20	450		400	850

BSC: Basic Science Course, HSMC: Humanity, Social sciences including Management courses, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course L: Lecture, T: Tutorial, P: Practical S:SDA-Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation, PP/NP: Pass/Not Pass, YY: Programme Code (EC, CS, IS etc), X: 1/2/3/4**,** K: Indicates Common Course to all the streams of Engineering.

Engineering Science Course /Emerging Technology Course / Programming language Course (ESC/ETC/PLC) - IV			
B24EE461	Electrical Engineering Materials	B24EE462	Linear Integrated Circuits and Applications
B24EE463	IoT Applications for Electrical Engineering	B24EC464	JAVA Programming (Common to ECE, EEE, R&A)

Ability Enhancement Course / Skill Enhancement Course (AEC/SEC) – IV			
B24EE481	Project on Renewable Energy Sources	B24EE482	PCB Design Laboratory
B24EE483	MATLAB for Transformers and Generators	B24EE484	Arduino and Raspberry Pi Lab (Common to ECE, EEE, R&A)

Non Credit Mandatory Courses (NCMC)			
B24NCK491	National Service Scheme (NSS)	B24NCK492	National Cadet Corps (NCC)
B24NCK493	Physical Education (PE)	B24NCK494	Yoga
B24NCK495	Music		

All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE), National Cadet Corps (NCC), Music and Yoga (YOG) with the concerned coordinator of the course during the first week of III/IV/V/VI semesters. Colleges are required to submit the Continuous Internal Evaluation (CIE) marks for the activities completed by students under selected course each semester. The students should be allowed to engage in different activities/courses each semester. For example, a student who participates in sports in the 3rd semester could choose to undertake NSS in the next semester and Yoga in another semester. This approach aligns with the student-centric focus of the National Education Policy (NEP) 2022 and helps distribute the workload related Physical Education/NSS/Yoga/NCC/Music of more evenly across different departments. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. **These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.**

Dean-Academics **Principal**

III - Semester Syllabus

SEMESTER-III					
Mathematics-III for EE **Category: BSC** **(Common to EEE, ECE)**					
Course Code	:	B24ME301	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis and to enable the student to express periodic functions using the Fourier series.
2.	Analyze signals in terms of Fourier transforms and z transforms.
3.	Have an insight into solving ordinary differential equations by using Laplace transform techniques.
4.	To introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Engineering and social life situations.
5.	To understand the random process for use in communication &analyzing data in engineering.

Module-1:Fourier series	**No. of Hours**
Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period $2\pi$and with arbitrary period: periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave. Half-range Fourier series. Triangle and half range expansions, Practical harmonic analysis. **Self-study:** Typical waveforms, complex form of Fourier series **Applications:** Analyze and predict the behavior of circuits and systems, Vibration analysis.	9
Module-2:FourierTransforms and Z-transforms	**No. of Hours**
Infinite Fourier transforms Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. Z-transform-definition, Standard Z-transforms, Damping and shifting rules, Problems. Initial value and final value theorems, Inverse Z-transform and applications to solve difference equations. **Self-study:** Convolution theorems of Fourier Transforms. **Applications:** Digital Signal Processing (DSP), Control Systems Engineering.	9
Module 3:Laplace Transforms	**No. of Hours**
Definition and Laplace transforms of elementary functions (statements only). Problems on Laplace's Transform of $e^{at}f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$. Laplace transforms of Periodic functions (statement only) and unit-step function – problems. Inverse Laplace transforms definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) problems. Laplace transforms of derivatives, solution of differential equations. **Self-study:** Solution of simultaneous first-order differential equations. **Applications:** Signals and systems, Control systems, LR, CR & LCR circuits.	9
Module-4: Probability Distributions	**No. of Hours**
Random variables-discrete and continuous Probability distribution function, cumulative distribution function, mean and variance, Binomial, Poisson, Exponential and Normal distribution (without proofs for mean and SD) – Problems. **Sampling Theory**: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Student's t-distribution, Chi-square distribution as a test of goodness of fit. **Self-study:** Test of hypothesis for means, single proportions only. **Applications:** Quality control, Signal processing, Reliability analysis.	9
Module-5: Two dimensional Random variables	**No. of Hours**
Joint probability mass function, Marginal probability function, conditional probability function. Random Process: Classification of random process, description of random process, stationary random process – first order, second order and Strict-sense stationary processes, Autocorrelation and Cross-correlation functions. **Self-study:** covariance, correlation coefficient.**Application:** Bayesian network.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing, and field theory.
CO2	To use Fourier transforms to analyze problems involving continuous-timesignals. To apply Z-Transform techniques to solve difference equations.
CO3	To understand the concept of Laplace transform and to solve initial value problems.
CO4	Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field. Demonstrate the validity of testing the hypothesis.
CO5	To understand the random process for use in communication &analyzing data in engineering.

Text Books	
1.	B.S.Grewal:"Higher Engineering Mathematics", Khanna publishers,44thEd.2018
2.	E.Kreyszig:"Advanced Engineering Mathematics", John Wiley & Sons,8thEd.(Reprint),2016
3.	E.Kreyszig&V. Ramana: Advanced Engineering Mathematics",10th edition

Reference Text Books	
1.	V. Ramana: "Higher Engineering Mathematics", McGraw-Hill Education, 11th Edition.
2.	E.Kreyszig&V. Ramana: Advanced Engineering Mathematics",10th edition

Web links and Video lectures (e-Resources)

1. https://nptel.ac.in/courses/12286025
2. VTUEDUSATPROGRAMME –20
3. http://www.class-central.com/subject/math(MOOCs)

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO8	PO11
CO1	3	3	3	1	-	-	-	-	1	-	2
CO2	3	3	3	1	-	-	-	-	1	-	2
CO3	3	3	3	1	-	-	-	-	1	-	2
CO4	3	3	2	2	-	-	-	-	1	-	2
CO5	3	3	2	2	-	-	-	-	1	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
ELECTRICAL MACHINES - I **Category: PCC**					
Course Code	:	B24EE302	CIE	:	50 Marks
Teaching Hours/Week L:T:P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand the construction and operation of single-phase and three-phase transformers.
2.	Learn testing procedures and evaluate transformer performance parameters.
3.	Study construction, working, and characteristics of DC generators.
4.	Analyze the operation and performance of synchronous generators.
5.	Explore salient pole alternators and methods of synchronization and load sharing

Module - 1	**No. of Hours**
Single phase Transformers: Necessity of transformer, principle of operation, Types and construction, EMF equation, equivalent circuit, Operation of practical transformer under no-load and on-load with phasor diagrams. Losses and methods of reducing losses, efficiency and condition for maximum efficiency. Polarity test, Sumpner's test. Open circuit and Short circuit tests, calculation of equivalent circuit parameters. Predetermination of efficiency, voltage regulation and its significance. Numerical.	9
Module - 2	**No. of Hours**
Three-phase Transformers: Introduction, Constructional features of three-phase transformers. Transformer connection for three phase operation– star/star, delta/delta and star/delta, comparative features. Labelling of three-phase transformer terminals. Parallel Operation of Transformers: Necessity of Parallel operation, conditions for parallel operation– Single phase and three phase. Load sharing in case of similar and dissimilar transformers. Numerical. Auto transformers and Tap changing transformers: Introduction to autotransformer-copper economy, equivalent circuit, no load and on load tap changing transformers. Numerical.	9
Module - 3	**No. of Hours**
Three-Winding Transformers & Cooling of Transformers: Three-winding transformers. Cooling of transformers. **DC Generator**: Principle of operation, constructional details, induced EMF expression, types of generators, armature reaction, and load characteristics. Commutation, types of Commutation, commutation difficulties, interpoles, compensating winding and equalizer rings.	9
Module– 4	**No. of Hours**
Synchronous Generators: Construction, working, Armature windings, winding factors, EMF equation. Harmonics–causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit. Synchronous Generators Analysis: Open circuit and short circuit characteristics, Assessment of reactance-short circuit ratio, Alternator on load. Voltage regulation. Voltage regulation by EMF and MMF methods. Excitation control for constant terminal voltage. Numerical.	9
Module– 5	**No. of Hours**
Synchronous Generators (Salient Pole): Effects of saliency, two-reaction theory, Parallel operation of generators and load sharing. Methods of Synchronization, Synchronizing power. Performance of Synchronous Generators: Power angle characteristic (salient and non salient pole), power angle diagram, reluctance power, Capability curve for large turbo generators. Hunting and damper windings. Numerical	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe the working and phasor diagrams of various transformers.
CO2	Conduct standard tests and evaluate efficiency and voltage regulation.
CO3	Explain types and characteristics of DC generators with performance analysis.
CO4	Determine voltage regulation of alternators using EMF and MMF methods.
CO5	Analyze salient pole alternators, synchronization, and parallel operation.

Text Books	
1.	Electric Machines, D. P. Kothari, et al, 4 th Edition, 2011..
2.	Principals of Electrical Machines, V.K Mehta, Rohit Mehta, S Chand, 2nd edition, 2009

Reference Books	
1.	Reference Books 1. Electric Machines, Mulukuntla S. Sarma, at el, Cengage, 1st Edition, 2009.
2.	Electrical Machines, Drives and Power systems, Theodore Wildi, Pearson, 6th Edition, 2014.
3.	Principals of Electrical Machines, V.K Mehta, Rohit Mehta, S Chand, 2nd edition, 2009
4.	Electric Machines, D. P. Kothari, et al, 4 th Edition, 2011

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in

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4. **Part-B** contains total 10 questions.
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CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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CO2	3	3	2	3	2	-	1	-	1	1	2
CO3	3	3	2	2	1	-	1	-	-	1	1
CO4	3	3	2	3	2	-	1	-	1	1	2
CO5	3	2	2	2	2	-	1	-	1	1	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
ANALOG AND DIGITAL ELECTRONIC CIRCUITS **Category: IPCC** **(Common to EEE & R&A)**					
Course Code	:	B24EE303	CIE	:	50 Marks
Teaching Hours/Week (L:T:P)	:	3:0:2	SEE	:	50 Marks
Total Hours	:	45(T)+15(P)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand the basics and applications of diodes and transistors
2.	To understand FETs and MOSFETs with their characteristics and biasing, and to analyze and design various feedback and oscillator circuits for electronic applications.
3.	To Illustrate simplification of Algebraic equations using Karnaugh Maps and Quine-McClusky Techniques.
4.	To Design Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators.
5.	To Describe Latches and Flip-flops, Registers and Counters.

Module - 1	**No. of Hours**
Diode Applications - Clipping circuits, Clamping Circuits **Bipolar Junction Transistor (BJT):** Transistor characteristics, transistor as an amplifier, CB, CE, CC configurations, the operating point, BJT Biasing:Fixed bias ,Collector to base Bias , voltage divider bias, bias compensation, Stability, CE amplifier response, gain bandwidth product, Emitter follower, RC coupled amplifier, two cascaded CE and multistage CE amplifiers	9
Module - 2	**No. of Hours**
Junction Field Effect Transistor (FET): FET Construction, Principle of Operation, VI Characteristics, MOSFET- Depletion and Enhancement MOSTET, FET biasing. **Feedback and Oscillator Circuits:**Feedback concepts, Feedback connection types, Oscillator operation, RC Phase shift oscillator, Wein bridge oscillator, Tuned Oscillator circuit, Crystal oscillator.	9
Module - 3	**No. of Hours**
Principles of combinational logic: Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specific functions (Don't care terms) Simplifying Max term equations, Quine-McClusky techniques 4 variables.	9
Module– 4	**No. of Hours**
Analysis and design of combinational logic: Decoders, Encoders, Digital multiplexers, Adders and subtractors, Look ahead carry, Binary comparators	9
Module– 5	**No. of Hours**
Flip-Flops and its Applications: Basic Bitable elements, Latches, The master-slave flip flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Characteristic Equations, Shift Registers, Binary ripple counters and synchronous binary counters	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyse clippers, clampers, and different biasing of transistors
CO2	Understand and analyze FETs and MOSFETs, their biasing, and apply feedback principles to design and analyze various oscillator circuits
CO3	Simplify digital circuits using Karnaugh Map , and Quine-McClusky Method
CO4	Design the combinational logic circuits
CO5	Explain flip flops and make use in designing different registers and counters.

PRACTICAL COMPONENT OF IPCC

Sl. No	**Experiments** **(to be carried out using discrete components)**
1.	To construct and observe clipping and clamping circuits for different configurations

2.	To construct and find bandwidth of RC coupled amplifier
3.	To conduct an experiment on a given JFET and obtain 1)Drain Characteristics 2) Transfer Characteristics
4.	To construct and check oscillation frequency for RC phase shift oscillator.
5.	Design and implement (i) Half Adder & Full Adder using i) basic gates. ii) NAND gates (ii) Half Subtractor& Full Subtractor using i) basic gates ii) NAND gates.
6.	Design and implement 4-bitParallelAdder/Subtractor using IC 7483.
7.	Design and Implementation of 1-bit Comparator
8.	Realize4-variable function using IC74151 (8:1MUX)
9.	Realize the following flip-flops using NAND Gates. JK, D Flip-Flops
10.	Realize 4 bit Shift Registers: SISO, SIPO, PIPO, PISO
11.	Realize 3 bit synchronous counter using flip flops

Text Books	
1.	Robert L. Boylestad and Louis Nashelsky, "Electronics devices and Circuit theory", Pearson, 10th Edition, 2012, ISBN: 978-81-317-6459-6.
2.	John M Yarbrough,-Digital Logic Applications and Design, Thomson Learning, 2001.

Reference Books	
1.	Analog Electronic Circuits: A simplified approach by U.B. Mahadevaswamy, Pearson Education India, 2010
2.	Donald D. Givone, —Digital Principles and Design, McGraw Hill, 2002.
3.	David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

The CIE marks for the theory component of the Integrated Course (IC) shall be 30 marks and for the laboratory component 20 marks.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes / Weekly test / project work for (20+20) marks, scaled down to **20 marks.**
4. Total marks scored **(30+20 = 50 marks)** scaled down to **25.**

CIE FOR THE PRACTICAL COMPONENT OF IC:

1. On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.
2. Each experiment is evaluated for 10 marks and scaled down to **5 marks.**
3. Laboratory test at the end of the 15th week of the semester / after completion of all the experiments shall be conducted for **50 marks** and scaled down to **20 marks.**
4. Total marks scored for lab component: **05+20=25 marks**.
5. The minimum marks to be secured in CIE to appear for SEE shall be 10(40% of maximum marks 25) in the theory and 10(40% of Maximum marks 25) in the practical.

6. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

Theory				
IA Test	**Exam conducted for**	**Scaled down to**	**Average of best two tests**	**Total**
IA-1	**50**	**30**	**30**	**50/2=25**
IA-2	**50**	**30**		
IA-3	**50**	**30**		
Two Assignments	**2×10=20**	**10**	**10**	
Two Quizzes	**2×10=20**	**10**	**10**	

LAB			
Continuous performance and record writing	**Each experiments evaluated for 10 marks**	**Scaled down to 05 marks**	**5+20=25**
Internal Test + Viva voce	**Exam conducted for 50 marks**	**Scaled down to 20 marks**	

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks.**
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	2	-	1	1	1	-	2
CO2	3	3	3	-	2	-	1	1	1	-	2
CO3	3	3	2	-	3	-	1	1	1	-	2
CO4	3	2	3	-	3	-	1	1	1	-	2
CO5	3	2	2	-	2	-	1	1	1	-	2

Level3- High, Level2- Moderate,Level1- Low

SEMESTER-III					
ELECTRIC CIRCUIT ANALYSIS **Category: IPCC**					
CourseCode	:	B24EE304	CIE	:	50 Marks
TeachingHoursL:T : P	:	3:0:2	SEE	:	50 Marks
TotalHours	:	45(T)+15(P)	Total	:	100 Marks
Credits	:	4	SEEDuration	:	3 Hrs

Course Objectives	
1.	To familiarize the basic laws, source transformations and the methods of analyzing electrical circuits.
2.	To explain the use of network theorems
3.	To explain the concept of resonance. and understand the concept of magnetic circuit
4.	To impart basic knowledge on network analysis using Laplace transforms. importance of initial conditions, their evaluation and transient analysis of R-L and R-C circuits and
5.	To familiarize the analysis of three-phase circuits, two port networks and networks with non-sinusoidal inputs.

Module–1: Basic Concepts	**No. of Hours**
Active and passive elements, Concept ofideal and practical sources. star – delta transformation. Analysis of networks by(i)Network reduction method(ii) Mesh and Node voltage methods for ac and DC circuits with Independent and dependent sources. Concept of Super-Mesh and Supernode analysis Duality.	9
Module–2: Network Theorems	**No. of Hours**
Super Position theorem, Thevenin's theorem, Norton's theorem, and Maximum power transfer Theorem. Analysis of networks (only with independent AC and DC sources).	9
Module–3: Resonant Circuits and coupled circuits	**No. of Hours**
Analysis of simple series RLC and parallel RLC circuits under resonances. Problems on Resonant frequency, Bandwidth and Quality factor at resonance Self and mutual inductance Coefficient of coupling–Dotrule- Analysis of coupled circuits– Single Tuned circuits	9
Module–4: Transient response analysis	**No. of Hours**
Laplace transformation definition, Waveform synthesis. Initial and Final value theorems. Transient response of RL, RC and RLC circuits using Laplace transform for Source free, Step input and Sinusoidal input.	9
Module–5: Three Phase Systems and Two Port Networks	**No. of Hours**
Unbalanced Three Phase Systems: Analysis of three phase systems, calculation of real and reactive Powers and analysis as applicable to star/delta connected load. Two Port networks: Definition, Open circuit impedance, Short circuit admittance, h-parameters and Transmission parameters and their evaluation for Simple circuits.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using source shifting, source transformation and Network reduction using transformations.
CO2	Solve complex electric circuits using network theorems.
CO3	Discuss resonance in series and parallel circuits and also the importance of initial conditions and their evaluation.
CO4	Synthesize typical waveforms using Laplace transformation.
CO5	Solve unbalanced three phase systems and also evaluate the performance of two port networks.

PRACTICAL COMPONENT OF IPCC

Sl. No	Experiments (to be carried out using discrete components)
1.	Study of the effect of Open and Short circuits in simple circuits.
2.	Determination of resonant frequency, bandwidth, and Q of a series circuit.
3.	Determination of resonant frequency, bandwidth, and Q of a parallel circuit.
4.	Verification of Thevenin's theorem.
5.	Verification of Norton's theorem.
6.	Verification of Super position theorem.
7.	Verification of maximum Power transfer theorem.
8.	Power factor correction.
9.	Measurement of time constant of an RC circuit.
10.	Measurement of power in three phase Circuits using two watt meter method.

Text Books	
1.	Engineering Circuit Analysis, William H Haytetal, McGrawHill , 8th Edition,2014.
2.	Circuits Theory (Analysis and synthesis), ChakrabartiA, DhanpatRai & Sons, New Delhi, 2020.

Reference Text Books	
1.	Network Analysis, M.E. Vanvalkenburg, Pearson, 3rd Edition, 2014.
2.	Fundamentals of Electric Circuits, Charles K Alexander Matthew N O Sadiku ,McGrawHill, 5th Edition,2013.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

The CIE marks for the theory component of the Integrated Course (IC) shall be 30 marks and for the laboratory component 20 marks.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes / Weekly test / project work for (20+20) marks, scaled down to **20 marks.**
4. Total marks scored **(30+20 = 50 marks)** scaled down to **25.**

CIE FOR THE PRACTICAL COMPONENT OF IC:

1. On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.
2. Each experiment is evaluated for 10 marks and scaled down to **5 marks.**
3. Laboratory test at the end of the 15th week of the semester / after completion of all the experiments shall be conducted for **50 marks** and scaled down to **20 marks.**
4. Total marks scored for lab component: **05+20=25 marks**.

5. The minimum marks to be secured in CIE to appear for SEE shall be 10(40% of maximum marks 25) in the theory and 10(40% of Maximum marks 25) in the practical.
6. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

Theory				
IA Test	**Exam conducted for**	**Scaled down to**	**Average of best two tests**	**Total**
IA-1	**50**	**30**	**30**	**50/2=25**
IA-2	**50**	**30**		
IA-3	**50**	**30**		
Two Assignments	**2×10=20**	**10**	**10**	
Two Quizzes	**2×10=20**	**10**	**10**	

LAB			
Continuous performance and record writing	**Each experiments evaluated for 10 marks**	**Scaled down to 05 marks**	**5+20=25**
Internal Test + Viva voce	**Exam conducted for 50 marks**	**Scaled down to 20 marks**	

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks.**
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	-	-	-	-	-	1
CO2	3	3	3	2	2	-	-	-	-	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-
CO4	3	3	2	3	2	-	-	-	-	-	2
CO5	3	3	2	2	2	-	-	-	-	1	1

Level3 -High, Level2- Moderate, Level1 - Low

SEMESTER III					
ELECTRICAL MACHINES – I LAB **Category: PCCL**					
Course Code	:	B24EE305L	CIE	:	50 Marks
Teaching Hours/Week L:T:P	:	0:0:2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	To study and perform essential tests on transformers and synchronous generators.
2.	To analyze efficiency, regulation, and losses using practical and simulation methods.
3.	To examine transformer behavior under various load and connection conditions.
4.	To investigate alternator characteristics under varying excitation and bus conditions.
5.	To model and simulate electrical machines using MATLAB/Simscape for performance analysis.

PRACTICAL COMPONENT Using suitable hardware, demonstrate the operation of the following circuits:	
1.	Open Circuit and Short circuit tests on single phase step up or step down transformer and pre- determination of (i) Efficiency and regulation (ii) Calculation of parameters for equivalent circuit.
2.	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.
3.	Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load.
4.	Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.
5.	Comparison of performance of 3 single-phase transformers in delta – delta and V – V (open delta) connection under load.
6.	Separation of hysteresis and eddy current losses in single phase transformer.
7.	Investigate the voltage and current ratios of a multi-tapped transformer and verify the ideal transformer ratio
8.	Voltage regulation of an alternator by EMF and MMF methods.
9.	Power angle curve of synchronous generator or Direct load test on three phase synchronous generator to determine efficiency and regulation
10.	Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.
11.	Model transformer in Simscape for Automatic Voltage Regulation.
12.	Simulate power angle curve of generator in MATLAB.

Course outcomes: At the end of the course the student will be able to	
CO1	Understand and perform key transformer and synchronous generator experiments for evaluating performance.
CO2	Analyze efficiency, voltage regulation, and losses of single-phase and three-phase transformers.
CO3	Investigate the behavior of synchronous generators under various load and excitation conditions.
CO4	Explore advanced transformer and generator testing techniques including parallel operation and load simulations.
CO5	Apply simulation tools like MATLAB/Simscape to model and study machine behavior and control.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	3	2	-	1	2	1	1	1
CO2	3	3	2	3	3	-	1	2	1	1	2
CO3	3	3	2	2	2	-	1	2	-	1	1
CO4	3	3	2	2	2	-	1	2	1	1	-
CO5	3	2	2	2	3	-	1	2	-	1	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
SENSORS AND TRANSDUCERS **Category: EPC/ETC/PLC-III**					
Course Code	:	B24EE361	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand the use of gauges and transducers to measure pressure, direction, distance and electromagnetic radiations
2.	To understand the concept of light and associated radiation.
3.	To understand the use of temperature sensors and transducers.
4.	To understand the working principle of audio electrical sensors, audio transducers
5.	To understand the measurement of solids, liquids and environmental quantities.

Module – 1	**No. of Hours**
Strain and Pressure: Mechanical strain, Interferometry, Fibre optic methods, pressure gauges, low gas pressures, Ionization gauges, Transducer use. Position, direction, distance, and motion: Position, Direction, Distance measurement, Distance travelled, Accelerometer systems, Rotation.	9
Module – 2	**No. of Hours**
Light and associated radiation: Nature of light, Colour temperature, Light flux, Photosensors, Photoresistors and photoconductors, Photodiodes, Phototransistors, Photovoltaic devices, Fibre – optic applications, Light transducers, Solid-state transducers, Liquid crystal displays (LCD), Light valves, Image transducers, Radio waves.	9
Module – 3	**No. of Hours**
Temperature sensors and thermal transducers: Heat and temperature, The bimetallic strip, Liquid and gas expansion, Thermocouples, Metal – resistance sensors, Thermistors, Radiant heat energy sensing, Pyroelectric detectors, Thermal transducers, Thermal to electrical transducers.	9
Module – 4	**No. of Hours**
Sound, infrasound and ultrasound: Principles, Audio electrical sensors and transducers, Electrical to audio transducers.	9
Module – 5	**No. of Hours**
Solids, liquids and gases: Mass and volume, Electronic sensors, Proximity detectors, Liquid levels, Liquid flow sensors, Timing, Gases, Viscosity. Environmental Sensors: Environmental quantities, Time, Moisture, Acidity/alkalinity, Wind chill, Radioactive count rate, Surveying and security, Animal fat thickness, Water purity, Air purity, Smoke and fire detectors, Building acoustics.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Use gauges and transducers to measure pressure, direction and distance.
CO2	Discuss the use of light transducers and other devices used for the measurement of electromagnetic radiations.
CO3	Explain the working of different temperature sensing devices.
CO4	Analyze the principles and applications of audio electrical sensors and transducers used for the measurement of sound.
CO5	Discuss the use of sensors for the measurement of mass, volume and environmental quantities.

Text Books	
1.	Sensors and Transducers Ian R. Sinclair Newnes 3 rd Edition, 2001

Web links and Video lectures (e-Resources)
1.www.nptel.ac.in 2. https://www.eeweb.com/

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the

academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	1	1	-	-	2	-	2	1
CO2	1	2	1	1	1	-	-	-	-	2	-
CO3	2	-	-	1	1	-	-	-	-	2	-
CO4	2	2	-	1	1	-	-	-	-	2	-
CO5	1	-	-	1	1	-	-	-	-	2	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
ELECTRICAL POWER GENERATION AND ECONOMICS **Category: ESC/ETC/PLC-III**					
CourseCode	:	B24EE362	CIE	:	50 Marks
TeachingHoursL:T : P	:	3:0:0	SEE	:	50 Marks
TotalHours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEEDuration	:	3 Hrs

Course Objectives	
1.	To study the different types of power generation from Conventional Energy Sources, basic design principles of hydro and water turbines
2.	To acquire the knowledge of steam and gas power plants
3.	To learn the importance of Nuclear power plant and its applications
4.	To learn the importance of Hydrogen energy generation, Piezo electricity generation and its applications
5.	To understand the importance of economic aspects of power generation and also the importance of power factor.

Module–1: Hydro electric Power Plants	**No. of Hours**
Energy Scenario: Introduction to conventional and non-conventional sources of energy, Energy scenario, green-house effect. **Hydroelectric Power Plants:** Merits and demerits of hydroelectric power plants, Selection of site. General arrangement of hydro plant, elements of the plant, Classification of the plants based on water flow regulation, small hydro and pumped storage plants. **Water turbines**–Pelton wheel, Francis and Kaplan turbines. Characteristics of water turbines, selection of water turbines.	9
Module–2: Thermal Power Plants	**No. of Hours**
Steam (Thermal)Power Plants: Introduction, Schematic arrangement and working of steam power plant, Basic Rankine cycle, advantages and disadvantages, choice of site, efficiency of steam power station, fuel and ash handling, draught system, feed water treatment, steam power plant auxiliaries. Scenario of Thermal Energy generation. **Gas turbine Plants**: Introduction, Merits and demerits, site selection, Fuels for gas turbines, Elements of simple gas turbine power plant.	9
Module–3: Nuclear Power Plants	**No. of Hours**
Nuclear Power Plants: Introduction, Scenario of Nuclear power generation. Basics of nuclear energy conversion, Merits and demerits, selection of site, Layout and sub systems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU type Reactor, Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, disposal of nuclear waste.	9
Module–4: Hydrogen Energy Generation, Piezoelectric Energy	**No. of Hours**
Hydrogen Energy Generation: Introduction, benefits, hydrogen production technologies, uses, applications. **Piezoelectric Energy**: Introduction, Total power production in India, the piezoelectric effect, Characteristics of piezo electricity, Factors leading to requirement of piezo electricity, Important components of piezoelectric tile, Block diagram of piezoelectric tile, applications of piezoelectricity.	9
Module–5: Economics in Power Plant Generation	**No. of Hours**
Power Plant Economics: Introduction, Classification of costs, Fixed and Operating costs of Hydro, Thermal and Nuclear Plants, Economics of Power generation and associated definitions, Load factor, diversity factor, Numerical. Tariffs, types, types of consumers and their tariff. Power factor, disadvantages and causes of low power factor, methods and advantages of improving power factor improvement, Simple Numerical.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe the working of hydroelectric power plant, types and the role of turbines in hydropower generation.
CO2	Explain the working of thermal power plant, components, layout and environmental issues

	associated
CO3	Discuss the working of nuclear power plants, types of reactor sand environmental societal issues.
CO4	Learn the importance of hydrogen energy & Piezoelectricity generation and its applications.
CO5	Discuss the importance of economics in power generation and need of power factor improvement.

Text Books:	
1.	Power Plant Engineering, P.K. Nag, McGraw Hill, 4th Edition, 2014 2
2.	Generation of Electrical Energy, B.R.Gupta, S. Chand, 2015

Reference Books	
1.	A Course in Power Systems, J.B. Gupta, Katson,2008
2.	Electrical Power Distribution Systems, V.Kamaraju, McGrawHill, 1st Edition,2009
3.	Generation of Electrical Energy S. Chand 2015 B.R.Gupta 7th Edition,2017S.Chand Publishers.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	2	-	1	1	-	1	-	-
CO2	3	1	1	3	-	1	1	-	1	-	-
CO3	3	1	1	2	-	1	1	-	1	-	-
CO4	3	1	1	2	-	1	1	-	1	-	-
CO5	3	1	1	2	-	1	1	-	1	-	1

Level3-High, Level 2-Moderate, Level 1- Low

SEMESTER-III					
ELECTRICAL MEASUREMENTS AND INSTRUMENTATION **Category: ESC/ETC/PLC-III**					
Course Code	:	B24EE363	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand the significance and methods of Measurements, elements of generalised measurement system and errors in measurements
2.	To measure resistance, inductance, capacitance by use of different bridges
3.	To study the construction, working and characteristics of various instrument transformers
4.	To work the knowledge of electronic instruments
5.	To provid the working knowledge of display devices and recording devices

Module – 1	**No.of Hours**
Measurements and Measurement systems: Introduction, significance and methods of Measurements, Instruments and measurement systems, Mechanical, electrical and electronic instruments. Classification of instruments. Types of Instrumentation systems, information and signal processing. Elements of generalised measurement system. Input-output configurations of measuring instruments and measurement systems. Methods of correction for interfering and modifying inputs, errors in measurements, Accuracy and precision.	9
Module – 2	**No.of Hours**
Measurement of Resistance, Inductance and capacitance: Wheatstone bridge-sensitivity analysis, limitations, kelvin's double bridge, Maxwells bridge, Desauty's bridge, schering Bridge, source and detectors, minimization of AC bridge errors, Hay's bridge , Anderson's bridge (Derivations and Numerical as applicable).	9
Module – 3	**No.of Hours**
Instrument Transformers: Introduction, Use of Instrument transformers. Current transformer (CT)- Relationships in CT, Errors in CT, characteristics of CT, causes and reduction of errors in CT, Potential transformer (PT)- Relationships in PT, Errors in PT, characteristics of PT, reduction of errors in PT. **Data Acquisition System (DAS):** Introduction, Single channel, Multi channel DAS, Computer based DAS.	9
Module – 4	**No.of Hours**
Electronic and Digital Instruments: Introduction. Essentials of electronic instruments, Advantages of electronic instruments. Electronic multimeters. Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM and Successive - approximation DVM. Principle of working of electronic energy meter (with block diagram), extra features offered by present day meters and their significance in billing.	9
Module – 5	**No.of Hours**
Display Devices: Introduction, character formats, segment displays, Dot matrix displays, Bar graph displays. Cathode ray tubes, Light emitting diodes, Liquid crystal displays. **Recording Devices**: Introduction, Strip chart recorders, Null balance recorders, Potentiometer type recorders, Bridge type recorders, LVDT type recorders, Circular chart and xy recorders.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the significance and methods of Measurements, elements of generalised measurement system and errors in measurements.
CO2	Measure the resistance, inductance and capacitance by different methods.
CO3	Explain the construction, working and characteristics of various instrument transformers.
CO4	Explain the working of different electronic and digital instruments.
CO5	Apply the working knowledge of display devices and recording devices.

Text Books	
1.	Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co, 10th Edition
2.	A Course in Electronics and Electrical Measurements and Instrumentation, J. B. Gupta, Katson

	Books, 2013

Reference Text Books	
1.	Electrical and Electronic Measurements and Instrumentation, R.K. Rajput, S Chand, 5th Edition, 2012
2.	Electrical Measuring Instruments and Measurements, S.C. Bhargava, BS Publications, 2013
3.	Modern Electronic Instrumentation and Measuring Techniques, Cooper D and A.D. Heifrick, Pearson, First Edition, 2015
4.	Electronic Instrumentation and Measurements, David A Bell, Oxford University, 3rd Edition, 2013
5.	Electronic Instrumentation, H.S.Kalsi, Mc Graw Hill, 3rd Edition,2010

Web links and Video lectures (e-Resources)
1.www.nptel.ac.in 2. https://www.eeweb.com/

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	2	2	–	–	–	–	2	–
CO2	3	1	1	3	3	–	–	–	–	2	–
CO3	3	1	1	2	2	–	–	–	–	2	–
CO4	3	1	1	2	3	–	–	–	–	2	–
CO5	2	1	1	1	2	–	–	–	–	2	–

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
INTRODUCTION TO AI **Category: ESC/ETC/PLC-III**					
Course Code	:	B24EE364	CIE	:	50 Marks
Teaching Hours/Week L:T:P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Learn the basics of AI, its applications, and how intelligent agents perceive, reason, and act in different environments.
2.	Understand and apply informed and uninformed search algorithms to solve problems efficiently.
3.	Develop skills to represent problems as state-space models and solve them effectively using search techniques.
4.	Explore propositional logic, first-order logic, and reasoning methods to represent and process knowledge.
5.	Gain an introduction to machine learning algorithms and techniques to reason under uncertainty.

Module - 1	**No. of Hours**
AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.	9
Module - 2	**No. of Hours**
Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing - Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.	9
Module - 3	**No. of Hours**
Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Baye's probabilistic interferences and dempstershafer theory	9
Module– 4	**No. of Hours**
First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods ,Reinforcement Learning.	9
Module– 5	**No. of Hours**
Expert systems:- Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, knowledge engineering, scope of knowledge, difficulties, in knowledge acquisition methods of knowledge acquisition, machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand concepts of Artificial Intelligence and different types of intelligent agents
CO2	Understand the working of various informed and uninformed searching algorithms
CO3	Formulate problems as state space search problem & efficiently solve them.
CO4	Understand concept of knowledge representation i.e. propositional logic, first order logic.
CO5	Reasoning with uncertainty and Machine learning algorithms.

Text Books	
1.	S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", SecondEdition, Pearson Education
2.	David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press.

Reference Books	
1.	G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", 4th Edition, Pearson Education
2.	J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	1	-	1	-	1
CO2	3	3	2	-	-	-	1	-	1	-	1
CO3	3	3	3	-	-	-	1	-	2	-	1
CO4	3	2	2	-	-	-	1	-	2	-	1
CO5	3	3	3	-	-	-	1	-	2	-	1

Level3 -High, Level2- Moderate, Level1 - Low

SEMESTER-III					
SCILAB FOR ELECTRONIC CIRCUITS **Category: AEC/SEC-III**					
CourseCode	:	B24EE381	CIE	:	50 Marks
TeachingHoursL:T : P	:	0 :0:2	SEE	:	50 Marks
TotalHours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEEDuration	:	3 Hrs

Course Objectives	
1.	To understand and analyze transistor biasing configurations such as common-base, fixed bias, and self-bias circuits to determine operating point and current parameters for BJT and FET devices
2.	To apply the concepts of transistor models and small-signal parameters to calculate voltage gain, impedance, and output voltage in amplifier circuits using h-parameters and other analytical methods
3.	To design and evaluate analog electronic circuits such as RC phase shift oscillators, Wien-bridge oscillators, Zener shunt regulators, and Schmitt Trigger circuits based on given specifications using standard design procedures

Sl. No	**List of Experiments**
1.	Determine the base, emitter, collector current of Common Base configure, given alpha value.
2	Determine operating point of Fixed Bias circuit, given transistor gain, base to emitter voltage
3.	Determine ouput voltage of circuit given Vbe fortransistorsQ1,Q2
4.	Determine value of drain current Id and gate source voltage Vgs for self bias circuit
5.	Find Freq of RC phase shift oscillator if the3 resistances are equal and 3capacitanceare equal
6.	Given N-channel JFET determine the value of Rsto achieve self bias condition
7.	Find the capacitance value in Wien-bridge oscillator given value of Rand Freq of oscillation
8.	Design Zener Shunt voltage regulator with given specifications
9.	Determine input, output impedance voltage and current gain given h-parameters of transistor
10.	Design Schmitt Trigger circuit using 2silicon NPN transistors with given configuration

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyze and calculate the current parameters (base, emitter, collector) and operating points in various transistor biasing configurations such as common-base, fixed bias, and self-bias circuits.
CO2	Determine key electrical characteristics such as voltage gain, impedance, and output voltage using transistor parameters and small-signal models.
CO3	Design and analyze analog circuits like RC phase shift oscillators, Wien-bridge oscillators, Zener shunt regulators, and Schmitt Trigger circuits for specified performance, considering practical component values.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	–	–	–	–	1	–
CO2	3	3	2	2	1	–	–	–	–	1	–
CO3	3	2	3	2	2	1	1	1	2	2	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
CIRCUIT LABORATORY USING PSPICE **CATEGORY: AEC/SEC-III**					
Course Code	:	B24EE382	CIE	:	50 Marks
Teaching Hours L : T : P	:	0 : 0 : 2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	To impart fundamental knowledge of electrical circuits and verify basic laws using simulation tools.
2.	To develop analytical skills through mesh/nodal analysis and evaluation of two-port network parameters.
3.	To explore and analyze resonant circuits and parameter effects in a virtual environment.

Sl. No	**List of Experiments**
1.	Simulate Series RL & RC circuit and observe phase difference between waveforms of voltage and current.
2.	Simulation and verification of Kirchhoff's Current Law & Kirchhoff's Voltage Law.
3.	Simulation of Mesh analysis for a given circuit.
4.	Simulation of Nodal analysis for a given circuit.
5.	Determination of Z & Y parameters of a given two-port network.
6.	Simulate and verify Super Positions theorem.
7.	Simulation and verification Reciprocity theorem.
8.	Simulation and verification Thevenin's and Norton's theorem.
9.	Simulation and verification Maximum Power Transfer theorem.
10.	Simulation and verification Millman's theorem
11.	Simulation of Series and Parallel Resonance circuit.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Simulate and analyze basic electrical circuits and verify fundamental laws and theorems such as KCL, KVL, Thevenin's, and Norton's theorems using circuit simulation tools.
CO2	Apply mesh and nodal analysis techniques, and determine two-port network parameters (Z and Y) through virtual experimentation
CO3	Investigate the behavior of resonant circuits and explore the effects of varying circuit parameters in a safe, self-paced virtual environment

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	**Scale down to**	**Total Marks**
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

SEMESTER-III					
ELECTRICAL MEASUREMENTS LAB **Category:AEC/SEC-III**					
Course Code	:	B24EE383	CIE	:	50 Marks
Teaching Hours L : T : P	:	0 : 0 : 2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand and perform accurate measurement of resistance, inductance, and capacitance using standard bridge methods
2.	To measure earth resistance and evaluate power in a balanced three-phase system using appropriate techniques
3.	To calibrate single-phase energy meters and assess their accuracy in practical scenarios
4.	To design and analyze basic analog electronic circuits using operational amplifiers
5.	To simulate and interpret amplifier, oscillator, rectifier, and waveform-shaping circuits using circuit simulation tools

Sl. No	**List of Experiments**
1.	Measurement of low resistance using Kelvin's double bridge.
2.	Measurement of earth resistance using Megga
3.	Measurement of inductance using Maxwell Inductance-Capacitance bridge & determination of Q-factor
4.	Measurement of capacitance using De-Sauty's bridge & determination of dissipation factor.
5.	Measurement of active and reactive power in balanced 3-phase circuit using two-watt meter method
6.	Adjustment & calibration of 1-phase energy meter
7.	Inverting, non-inverting using op -amps b) RC phase shift oscillator using op amps
8.	RC coupled amplifier-frequency response for variation of bias & coupling using simulation package
9.	Rectifier circuits-Bridge rectifier, diode clipping & clamping circuits using simulation package.
10.	Schmitt trigger – inverting and non inverting using simulation package

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the principles of measuring low-value resistances, inductance, and capacitance using standard bridges, and analyze quality and dissipation factors of components.
CO2	Understand the method of earth resistance measurement and analyze active and reactive power in balanced three-phase electrical systems.
CO3	Analyze the performance characteristics of single-phase energy meters through calibration and testing procedures.
CO4	Compute voltage gain, frequency, and threshold levels in op-amp-based circuits such as amplifiers, oscillators, and Schmitt triggers.
CO5	Apply simulation tools to amplifier, rectifier, clipping, and clamping circuits and analyze their frequency response characteristics.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	3	2	-	-	-	2	-	1
CO2	3	3	2	3	2	-	-	-	2	-	1
CO3	3	3	3	2	2	2	-	-	2	-	1
CO4	2	2	2	3	3	-	-	-	3	-	1
CO5	2	2	2	2	3	-	-	-	3	2	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-III					
ELECTRICAL APPLIANCES LAB **Category: AEC/SEC-III**					
Course Code	:	B24EE384	CIE	:	50 Marks
Teaching Hours L : T : P	:	0 : 0 : 2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	To learn the working principles of various electrical appliances.
2.	To develop skills for wiring, testing, and maintaining appliances.
3.	To troubleshoot and repair common faults in electrical appliances.
4.	To understand the safety measures and precautions in handling electrical devices.

Sl. No	**List of Experiments**
1.	Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
2.	Staircase wiring
3.	Fluorescent Lamp wiring with introduction to CFL and LED types.
4.	Energy meter wiring and related calculations/ calibration
5.	Soldering simple electronic circuits and checking continuity.
6.	Assembling and testing electronic components on a small PCB.
7.	Study of Iron Box wiring and assembly
8.	Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
9.	Study of emergency lamp wiring
10.	Study of Electric Bell and Buzzer Mechanisms
11.	Study of Electric Mixers and Grinders
12.	Measurement of earth resistance using megger

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the construction and operating principles of commonly used household electrical appliances.
CO2	Analyze and assess the performance of electrical devices such as fans, heaters, pumps, and lighting systems.
CO3	Apply appropriate wiring and connection techniques for electrical components like tube lights, switches, and regulators.
CO4	Diagnose and rectify faults in household electrical appliances while ensuring safety and reliability.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	2	-	-	-	-	-	2
CO2	3	3	2	2	3	1	-	-	1	1	2
CO3	3	2	3	1	2	1	-	-	2	2	2
CO4	3	3	3	3	3	1	-	1	2	2	3

Level 3 - High, Level 2 - Moderate, Level 1 - Low

IV - Semester Syllabus

SEMESTER-IV					
ELECTRICAL MACHINES - II **Category: PCC**					
Course Code	:	B24EE401	CIE	:	50 Marks
Teaching Hours/Week L:T:P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To study the constructional features of Motors and select a suitable drive for specific Application.
2.	To study the constructional features of Three Phase induction Motors.
3.	To study different test to be conducted for the assessment of the performance characteristics of motors.
4.	To study the speed control of motor by a different methods.
5.	Explain the construction and operation of Synchronous motor and special motors.

Module – 1: DC Motors	**No. of Hours**
Construction and working principle. Back E.M.F and its significance, Torque equation, Classification, Characteristics of shunt, series & compound motors, Speed control of shunt motor, Application of motors. Losses and Efficiency- Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency. Testing of DC Motors: Direct & indirect methods of testing of DC motors- Swinburne's test, Field's test, merits and demerits of tests. (numerical as applicable).	9
Module – 2: Three Phase Induction Motors	**No. of Hours**
Concept and generation of rotating magnetic field, Principle of operation, construction, classification and types; squirrel-cage, slip-ring. Slip and its significance, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, Maximum torque, (numerical as applicable)	9
Module – 3: Performance of Three-Phase Induction Motor	**No. of Hours**
Phasor diagram of induction motor on no-load and on load, equivalent circuit, losses, efficiency, No-load and blocked rotor tests. Performance of the motor from the equivalent circuit. Cogging and crawling. High torque rotors-double cage and deep rotor bars. Induction motor working as induction generator, construction and working of doubly fed induction generator. (numerical as applicable)	9
Module– 4: Starting and Speed Control of Three-Phase Induction Motors	**No. of Hours**
Necessity of starter. Direct on line, Star-Delta, and autotransformer starting. Rotor resistance starting. Speed control by frequency. Single-Phase Induction Motor: Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start and capacitor run and shaded pole motors. Comparison of single phase motors and applications. (numerical as applicable)	9
Module– 5: Synchronous Motor	**No. of Hours**
Principle of operation, phasor diagrams, torque and torque angle, effect of change in load, effect of change in excitation. V and inverted V curves. Synchronous condenser, Other Motors: Construction and operation of Universal motor, AC servomotor, Linear induction motor, PMSM, SRM and BLDC	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the construction and operation, characteristics, Testing of DC Motors and determine losses and efficiency.
CO2	Understand the construction and operation, classification and types of Three phase Induction motors
CO3	Describe the performance characteristics and applications of three phase Induction motors and V and inverted V curves of synchronous motors
CO4	Demonstrate and explain Speed Control methods of three phase induction motor and types of single-phase induction motors.
C05	Construction and operation of Universal motor, AC servomotor, Linear induction motor, PMSM, SRM and BLDC motors

Text Books	
1.	Electric Machines, D. P. Kothari, I. J. Nagrath, McGraw Hill, 4th edition, 2011.
2.	Theory of Alternating Current Machines, Alexander Langsdorf, McGraw Hill, 2nd Edition, 2001
3.	Electric Machines, AshfaqHussain, DhanpatRai& Co, 2nd Edition, 2013.

Reference Books	
1.	Electrical Machines, Drives and Power systems, Theodore Wildi, Pearson, 6th Edition, 2014
2.	Electrical Machines, M.V. Deshpande, PHI Learning, 2013
3.	Electric Machinery and Transformers, Bhag S. Guru at el, Oxford University Press, 3rd Edition, 2012
4	Electric Machinery and Transformers, Irving Kosow, Pearson, 2nd Edition, 2012

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	3	2	–	–	–	–	1	2
CO2	3	2	2	2	2	–	–	–	–	1	1
CO3	3	3	2	2	2	–	–	–	1	1	1
CO4	3	2	2	2	3	–	–	–	–	1	1
CO5	3	2	2	2	3	–	–	–	–	1	1

Level3 -High, Level2- Moderate, Level1 - Low

SEMESTER-IV					
ELECTROMAGNETIC FIELD THEORY (Common to ECE & EEE) Category: PCC					
Course Code	:	B24EC402	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To prepare students with fundamental knowledge of electrostatics.
2.	To introduce the concepts and laws related to static magnetic fields.
3.	To equip students with a basic foundation in Maxwell's Equations.
4.	To introduce the concept of Wave propagation in various mediums.

Module– 1: Electrostatics	**No. of Hours**
Introduction: Review of vector calculus, Coordinate systems. Coulomb's Law in Vector Form, Electric Field Intensity, Electric Flux Density T1: 1.1 – 1.9, 2.1 –2.2, 2.4 – 2.5, 3.1	9
Module– 2: Electrostatics (Contd..)	**No. of Hours**
Gauss Law –Applications-(Charge distributions-line, surface, volume), Divergence theorem, Maxwell's First equation (Electrostatics), Definition of Potential difference and potential, Potential gradient, Electric Dipole, Electric current, Current density, Continuity equation for current, Poissons and Laplace equation T1: – 3.2 - 3.3, 3.4.2, 3.4.3, 3.5, 4.3,4.6, 4.7,5.1, 5.2 ,6.1	9
Module– 3: Magneto statics	**No. of Hours**
Biot-Savart's law, Magnetic field intensity due to straight line conductor, Ampere's Circuital law, magnetic field intensity due to Co-axial cable, Stokes Theorem, Magnetic flux, Magnetic flux density, Scalar and vector magnetic potential, Inductance of co-axial cable T1:7.1,7.2.1, 7.2.2, 7.2.3, 7.2.4, 7.3, 7.4, 7.5, 7.6, 8.10	9
Module– 4: Time Varying Field	**No. of Hours**
Force On A Moving Charge, Force on differential current elements, Force between differential current elements, Numerical problems, Magnetic Boundary conditions, Numerical problems Faraday's law, Displacement current, Limitations of Ampere's law, Maxwell's equations, T1: 8.1,8.2,8.3,8.7,9.1, 9.2, 9.3, 9.4	9
Module– 5: Uniform Plane Wave	**No. of Hours**
Uniform Plane Wave: Wave propagation in free space, Wave Propagation in Dielectric, Conducting Media, Poynting theorem and Wave power, Propagation in Good Conductors T1: 11.1, 11.2.1, 11.2.2, 11.3, 11.4	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply the concept of electrostatics to measure Electric Force, Field Intensity, Flux density, Total charge
CO2	Understand the concepts of Laplace & Poisson's Equation, and the applications of Electrostatics.
CO3	Apply the concept of magnetostatics to measure Magnetic Force, Field Intensity, Flux density Vector magnetic Potential and Boundary conditions.
CO4	Apply Maxwell's Equations on Time varying field problems.
CO5	Assess the Wave propagation in various mediums.

Text Books	
1.	"Engineering Electromagnetics", William H HaytJr, J.A. Buck, 9th Edition, Tata McGraw Hill, 2006, Special Indian Edition 2014.
2.	'Principles of Electromagnetics", Matthew N. O. Sadiku, S. V. Kulkarni, 6th Edition, Oxford University Press, 2007, 6th Impression 2018.

Reference Books	
1.	"Electromagnetic waves and radiating systems", Edward C Jordan, Keith G Balmain, , 2nd Edition PHI, 2005.
2.	"Electromagnetics and Applications" John D. Kraus, 2nd Edition
3.	"Elements of Engineering Electromagnetics" NannapaneniNarayanaRao, 6thEdition, Pearson Education.
4.	"Principles of Electromagnetics"Sadiku and Kulkarni, 6th Edition Oxford University Press 2015.

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in/courses/108106073/
2. http://qeee.in/coursepack/generate_books/generated_books/1975/

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. A ny two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	2	1	-	-	-	-	1	1
CO2	3	1	1	2	1	-	-	-	-	1	1
CO3	3	1	1	2	1	-	-	-	-	1	1
CO4	3	1	1	2	1	-	-	-	-	1	1
CO5	3	1	1	2	1	-	-	-	-	1	1

Level-1-High, Level-2-Moderate, Level-3-Low

SEMESTER-IV					
TRANSMISSION AND DISTRIBUTION **Category: IPCC**					
Course Code	:	B24EE403	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:2	SEE	:	50 Marks
Total Hours	:	45(T)+15(P)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand the structure and components of electrical power systems, including generation, transmission, and distribution networks, and explain the significance of high-voltage transmission, sag, and insulators
2.	To understand and compute the inductance and capacitance parameters of transmission lines under various configurations using GMR and GMD concepts
3.	To analyze the performance of transmission lines using models and parameters such as regulation, efficiency, ABCD constants, and the Ferranti effect
4.	To understand the phenomenon of corona and evaluate its impact, along with the construction, characteristics, and specifications of underground cables
5.	To understand and evaluate AC distribution systems, analyze the reliability and quality of distribution networks, and assess the impact of system limitations

Module – 1	**No. of Hours**
Introduction to Power System: Structure of electric power system: generation, transmission and distribution. Advantages of higher voltage transmission: HVAC, EHVAC, UHVAC and HVDC. Interconnection. Feeders, distributors and service mains. A brief introduction to types of supporting structures and line conductors- Importance of sag, Sag calculation – supports at same and different levels, effect of wind and ice. **Overhead Line Insulators:** A brief introduction to types of insulators, material used- porcelain, toughened glass and polymer (composite). Potential distribution over a string of suspension insulators. String efficiency, Methods of increasing string efficiency. Arcing horns.	9
Module – 2	**No. of Hours**
Line Parameters: Introduction to line parameters- resistance, inductance and capacitance. Calculation of inductance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite – conductors, geometric mean radius (GMR) and geometric mean distance (GMD). Calculation of capacitance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Capacitance of composite – conductor, geometric mean radius (GMR) and geometric mean distance (GMD). Advantages of single circuit and double circuit lines	9
Module – 3	**No. of Hours**
Performance of Transmission Lines: Classification of lines – short, medium and long. Current and voltage relations, line regulation and Ferranti effect in short length lines, medium length lines considering Nominal T and nominal circuits, and long lines considering hyperbolic form equations. Equivalent circuit of a long line. ABCD constants in all cases.	9
Module – 4	**No. of Hours**
Corona: Phenomena, disruptive and visual critical voltages, corona loss. Advantages and disadvantages of corona. Methods of reducing corona. **Underground Cable:** Types of cables, constructional features, insulation resistance, thermal rating, charging current, grading of cables – capacitance and inter-sheath. Dielectric loss. Comparison between ac and DC cables. Limitations of cables. Specification of power cables.	9
Module – 5	**No. of Hours**
Distribution: Primary AC distribution systems – Radial feeders, parallel feeders, loop feeders and interconnected network system. Secondary AC distribution systems – Three phase 4 wire system and single phase 2 wire distribution, AC distributors with concentrated loads. Effect of disconnection of neutral in a 3 phase four wire system. **Reliability and Quality of Distribution System:** Introduction, definition of reliability, failure, probability concepts, limitation of distribution systems, power quality, Reliability aids.	9

PRACTICAL COMPONENT OF IPCC Using suitable simulation software, demonstrate the operation of the following circuits:	
Sl. No	**Experiments**
1.	Design and Analysis of sag in conductors at same and different level supports.
2.	Design and Analysis of sag on effect of ice covering and wind pressure.
3.	Analysis of string Efficiency based on number of insulator connected
4.	Determine the insulation resistance and capacitance in underground single core cable.
5.	To determine the visual critical voltage along the line conductors.
6.	Design of short transmission line Model .
7.	Determine the ABCD Transmission line parameters.
8.	Performance analysis of T/ π method medium transmission line.
9.	Computation of Transmission line parameters GMR for Inductance and Capacitance for single phase line
10.	Computation of Transmission line parameters GMR for Inductance and Capacitance for three phase line.
11.	Simulation using SCI lab/MATlab

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the structure of electric power systems and analyze the role of high-voltage transmission, insulators, and sag calculations.
CO2	Compute and analyze transmission line parameters such as inductance and capacitance for different conductor configurations using GMR and GMD.
CO3	Analyze and evaluate the performance of short, medium, and long transmission lines using appropriate equivalent circuit models and ABCD constants.
CO4	Understand the causes and effects of corona, and apply knowledge to analyze and evaluate the construction and grading of underground cables.
CO5	Analyze primary and secondary distribution systems, and evaluate the reliability and power quality of distribution networks under different load conditions.

Text Books	
1.	A Course in Electrical Power, Sony Gupta and Bhatnagar, Dhanpat Rai
2.	Principles of Power System, V.K. Mehta, Rohit Mehta, S. Chand, 1st Edition 2013

Reference Text Books	
1.	Power System Analysis and Design, J. Duncan Gloverat el, Cengage Learning, 4th Edition 2008
2.	Electrical power Generation, Transmission and Distribution, S.N. Singh, PHI, 2nd Edition,2009
3.	Electrical Power, S.L.Uppal, Khanna Publication

Web links and Video lectures (e-Resources)
• www.nptel.ac.in

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

The CIE marks for the theory component of the Integrated Course (IC) shall be 30 marks and for the laboratory component 20 marks.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes / Weekly test / project work for (20+20) marks, scaled down to **20 marks.**
4. Total marks scored **(30+20 = 50 marks)** scaled down to **25.**

CIE FOR THE PRACTICAL COMPONENT OF IC:

1. On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.
2. Each experiment is evaluated for 10 marks and scaled down to **5 marks.**
3. Laboratory test at the end of the 15th week of the semester / after completion of all the experiments shall be conducted for **50 marks** and scaled down to **20 marks.**
4. Total marks scored for lab component: **05+20=25 marks**.
5. The minimum marks to be secured in CIE to appear for SEE shall be 10(40% of maximum marks 25) in the theory and 10(40% of Maximum marks 25) in the practical.
6. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

Theory				
IA Test	**Exam conducted for**	**Scaled down to**	**Average of best two tests**	**Total**
IA-1	**50**	**30**	**30**	**50/2=25**
IA-2	**50**	**30**		
IA-3	**50**	**30**		
Two Assignments	**2×10=20**	**10**	**10**	
Two Quizzes	**2×10=20**	**10**	**10**	

LAB			
Continuous performance and record writing	**Each experiments evaluated for 10 marks**	**Scaled down to 05 marks**	**5+20=25**
Internal Test + Viva voce	**Exam conducted for 50 marks**	**Scaled down to 20 marks**	

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks.**
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	2	1	-	1	-	1	1
CO2	3	3	2	2	2	1	-	1	-	1	1
CO3	3	3	2	2	2	1	-	1	-	1	1
CO4	3	2	2	2	2	1	-	1	-	1	1
CO5	3	3	2	2	3	1	-	1	-	1	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-IV					
MICROCONTROLLER & ARM PROCESSOR (Common to EEE & R&A) Category: IPCC					
Course Code	:	B24EE404	CIE	:	50 Marks
Teaching Hours/Week (L:T:P)	:	3:0:2	SEE	:	50 Marks
Total Hours	:	45(T) +15(P)	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Objectives	
1.	To learn the basic structure, memory, registers, flags, I/O ports, and interfacing features of the 8051 microcontrollers.
2.	To gain skills in writing and running 8051 assembly programs using arithmetic, logic, and control instructions.
3.	To learn how to program the 8051 in C for data handling, I/O control, and timer applications.
4.	To understand serial communication, interrupts, and how to connect 8051 with devices like motors.
5.	To get an overview of ARM processor architecture, types, and its role in embedded systems

Module– 1: 8051 Microcontroller Basics	**No. of Hours**
Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051, Interfacing with External ROM And RAM.8051 Addressing Modes.	9
Module– 2: Assembly Programming and Instruction of 8051	**No. of Hours**
Introduction to 8051 assembly programming, Assembling and running an 8051program, data types and Assembler directives, Arithmetic, logic instructions andprograms, Jump, loop and call instructions, IO port programming	9
Module– 3: 8051 Programming in C	**No. of Hours**
8051 Programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C **8051 Timer Programming inC:** Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C.	**9**
Module– 4: Serial port, interrupt and Interfacing	**No. of Hours**
8051 Serial Port Programming in Assembly and C: Basics of serial communication, 8051 connections to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C. **8051 Interrupt Programming in Assembly and C:** 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C. **Interfacing 8051**: Interfacing of 8051 to DC motor and Stepper motor	9
Module– 5: ARM Processor Fundamentals	**No. of Hours**
Introduction to ARM - ARM Architecture - Operation and control – ARM Processor and Microcontroller Families - List and comparison of ARM cores and ARM cortex – Embedded system hardware and software.	9

PRACTICALCOMPONENTOFIPCC Using suitable hardware and simulation software, demonstrate the operation of the following circuits:	
Sl. No	**Experiments**
1.	ALP to do Arithmetic Operations: addition ,subtraction, multiplication anddivision
2.	ALP to find the sum of first 10 integer numbers.
3.	ALP to find the largest number
4.	ALP to arrange the numbers in ascending and descending order
5.	ALP to exchange data
6.	ALP to perform hexa decimal up counter and down counter
7.	ALP to perform BCD up counter and down counter
8.	Program to generate delay

9.	Stepper motor interface.
10.	DC motor interface
11.	Study of ARM evaluation system

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the architecture, internal memory structure, special function registers, and addressing modes of the 8051 microcontroller to support embedded system development.
CO2	Develop and simulate assembly language programs for the 8051 microcontroller using arithmetic, logic, jump, loop, call, and I/O instructions.
CO3	Write and execute C programs for the 8051 microcontroller to perform data processing, delay generation, I/O control, data conversion, and code memory access
CO4	Implement serial communication, interrupt handling, and peripheral interfacing such as DC and stepper motors using both assembly and C programming for the 8051.
CO5	Explain the fundamentals of ARM processors, including architecture, core families, and the role of hardware and software in embedded systems.

Text Books	
1.	The 8051 Microcontroller and Embedded Systems Using Assembly and C Muhammad Ali Mazadi Pearson 2nd Edition, 2008.
2.	Hall D. V., "Microprocessor and Interfacing-Programming and Hardware", 3rd edition., Tata McGraw-Hill Publishing Company Limited, 2008.
3.	ARM Architecture Reference Manual, 2nd Edition, Published 2001, edited by David Seal. Addison-Wesley. The definitive reference for the ARM architecturedefinition.

Reference Books	
1.	Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey '8051 Microcontroller and Embedded Systems using Assembly and C Programming'
2.	he 8051 Microcontroller Kenneth Ayala Cengage Learning 3rd Edition,
3.	2005ARM Assembly Language, Fundamentals and Techniques, William Hohl, CRC Press.

Web links and Video lectures (e-Resources)
1. https://archive.nptel.ac.in/courses/106/105/106105193/

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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The CIE marks for the theory component of the Integrated Course (IC) shall be 30 marks and for the laboratory component 20 marks.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes / Weekly test / project work for (20+20) marks, scaled down to **20 marks.**
4. Total marks scored **(30+20 = 50 marks)** scaled down to **25.**

CIE FOR THE PRACTICAL COMPONENT OF IC:

1. On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.

2. Each experiment is evaluated for 10 marks and scaled down to **5 marks.**
3. Laboratory test at the end of the 15th week of the semester / after completion of all the experiments shall be conducted for **50 marks** and scaled down to **20 marks.**
4. Total marks scored for lab component: **05+20=25 marks**.
5. The minimum marks to be secured in CIE to appear for SEE shall be 10(40% of maximum marks 25) in the theory and 10(40% of Maximum marks 25) in the practical.
6. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

Theory				
IA Test	**Exam conducted for**	**Scaled down to**	**Average of best two tests**	**Total**
IA-1	**50**	**30**	**30**	**50/2=25**
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IA-3	**50**	**30**		
Two Assignments	**2×10=20**	**10**	**10**	
Two Quizzes	**2×10=20**	**10**	**10**	

LAB			
Continuous performance and record writing	**Each experiments evaluated for 10 marks**	**Scaled down to 05 marks**	**5+20=25**
Internal Test + Viva voce	**Exam conducted for 50 marks**	**Scaled down to 20 marks**	

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks.**
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	1	2	-	-	1	-	1	-
CO2	3	1	1	2	2	-	-	1	-	1	-
CO3	3	1	1	2	3	-	-	1	-	1	-
CO4	3	1	1	2	3	-	-	1	-	1	-
CO5	3	1	1	1	2	-	-	1	-	1	-

Level-3 -High, Level-2- Moderate, Level-1 - Low

SEMESTER-IV					
ELECTRICAL MACHINES - II LAB **CATEGORY: PCCL**					
Course Code	:	B24EE405L	CIE	:	50 Marks
Teaching Hours/Week L:T:P	:	0:0:2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	Perform tests on DC Machines to determine their characteristic
2.	Control the DC Motors using different methods.
3.	Pre-determination the performance characteristics of DC Machine
4.	Conduct load test on single-phase and three-phase Induction Motor and draw performance characteristics.
5.	Conduct test on Induction Motor and synchronous motor determine performance characteristics

List of Experiments	
1.	Load test on DC shunt motor to draw speed–torque and horse power–efficiency characteristics.
2.	Speed control of DC shunt motor by armature and field control.
3.	Swinburne's Test on DC motor
4.	Regenerative test on DC shunt machines.
5.	Load test on three phase induction motor.
6.	No-load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) circle diagram. Determination of performance parameters at different load conditions
7.	Load test on induction generator.
8.	Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.
9.	Conduct suitable tests to draw the equivalent circuit of single phase induction motor and determine performance parameters.
10.	Conduct an experiment to draw V and Inverted V curves of synchronous motor at no load and load conditions.
11.	Analyze current and load torque of DC Shunt Motor using Simscape
12.	Model 3-phase induction motor using MATLAB and Simulink

Course outcomes (Course Skill Set): At the end of the course the student will be able to:	
CO1	Experimentally analyze and interpret the speed–torque, efficiency, and performance curves of DC machines
CO2	Apply and evaluate armature and field control methods for controlling DC motor speed and torque.
CO3	Estimate the performance characteristics of DC machines using indirect test methods such as Swinburne's and regenerative testing.
CO4	Perform load tests on single-phase and three-phase induction motors and plot key performance characteristics including torque, current, and efficiency.
CO5	Conduct standard tests on induction and synchronous motors to determine equivalent circuit parameters and draw performance curves such as V and inverted V curves.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	3	2	-	-	2	-	2	1
CO2	3	1	1	2	2	-	-	2	-	1	1
CO3	3	1	1	3	2	-	-	2	-	1	2
CO4	3	1	1	2	2	-	-	2	-	1	1
CO5	3	1	1	2	2	-	-	2	-	1	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-IV					
ELECTRICAL ENGINEERING MATERIALS **Category: ESC/ETC/PLC-IV**					
Course Code	:	B24EE461	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand classification of electrical materials and its property
2.	To analyze electrical, thermal and mechanical property of commonly use high resistivity materials
3.	To examine special dielectric materials and their practical applications
4.	To classify insulating materials based on their physical state and properties
5.	To study properties and application of magnetically soft and hard materials

Module – 1: Conducting Materials	**No.of Hours**
Introduction – classification of materials – Metals and Non metals, physical, thermal, mechanical and electrical properties of materials – classification of electrical materials – concept of atom – electron configuration of atom, conductors, general properties of conductors, factors effecting, resistivity of electrical material-electrical/mechanical/thermal properties of copper, aluminium, iron, steel, lead, tin and their alloys – applications.	9
Module – 2: Semiconductors And High Resistivity Conductors	**No.of Hours**
Introduction – semiconductor materials – characteristics of semiconductors – atomic structure p Intrinsic and extrinsic semi condcutors – preparation of semiconductors – Germanium and silicon – doping materials P type and N type crystals – Diode and transistor, their application. High Resistivity materials – electrical / thermal / mechanical properties of Manganin, Constantan, Nichrome, Tungsten, Carbon and Graphite and their applications in electrical equipment.	9
Module – 3: Dielectrics	**No.of Hours**
Introduction – solid, liquid and gaseous dielectrics, leakage current, permittivity, dielectric constant, dielectric loss – loss angle – loss constant, Breakdown voltage and dielectric strength of – solid, liquid and gaseous dielectrics, effect of break down – electrical and thermal effects. Polarisation – electric, ionic and dipolar polarization. Effect of temperature and frequency on dielectric constant of polar dielectrics. Ferro electric materials and their application, piezo electric property, piezo electric materials and their applications.	9
Module – 4: Insulating Materials	**No.of Hours**
Introduction – characteristics of a good electrical insulating materials – classification of insulating materials – electrical, thermal, chemical and mechanical properties of solid insulating materials, electrical, thermal and mechanical properties of Micanite, Asbestos, Bakelite, rubber, plastics, thermo plastics. Resins, polystyrene, PVC, porcelain, glass, cotton and paper. Liquid insulating materials – Mineral oils, synthetic liquids, fluorinated liquids – their electrical, thermal and chemical properties – transformer oil – properties – effect of moisture on insulation properties . Gaseous insulators – classification based on dielectric strength – dielectric loss, chemical stability properties and their applications .	9
Module – 5: Magnetic materials and special purpose materials	**No.of Hours**
Introduction – classification of magnetic materials, Ferro magnetism – properties of ferro magnetic materials – properties of magnetically soft materials, iron, silicon steel, permalloy, mumetal, perminvar, alnico – magnetic properties of ferrites. B-H curves of soft magnetic materials – effect of temperature – heat treatment and grain orientation on magnetic properties – losses in magnetic materials – Hysterisis loss – factors affecting permeability and hysteresis loss. Special purpose materials: Soldering materials – properties, materials for hard soldering and soft soldering. Fuse materials – properties of fuse materials- re-wirable fuses, HRC fuses Contact materials – classification, materials for light and moderately loaded contacts.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the classification of different forms of materials and their properties.
CO2	Analyze the performance of materials based on their thermal, electrical and mechanical properties for engineering use.
CO3	Describe the properties and application of special dielectric materials in modern technology.
CO4	Apply the knowledge of insulation materials in electrical components.
CO5	Identify and evaluate materials used for soldering, fuses, and electrical contacts with respect to their properties and application.

Text Books	
1.	R.K.Rajput , "Electrical engineering Materials", Laxmi Publications
2.	G.K. Mithal, "Electrical Engineering Materials", Khanna Publication 2nd Edition.
Reference Text Books	
1.	A.J. Dekker, "Electrical engineering Materials", Prentice Hall of India Reprinty 2005
2.	C.S. Indulkar and S.Thiruvengadam “An Introduction to electrical engineering materials" , S.Chand & Co
3.	"Electrical engineering Materials" by T.T.T.I, Madras & S.P.Seth, “A course in electrical engineering materials" Dhanapatrai & Sons, New Delhi

Web links and Video lectures (e-Resources)
1. http://nptel.ac.in/courses.php NPETL resources
2. http://jntuk-coeerd.in/

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	1	1	-	-	-	-	1	-
CO2	3	1	1	2	2	-	-	-	-	1	-
CO3	3	1	1	2	2	-	-	-	-	-	-
CO4	3	1	1	2	2	-	-	-	-	-	-
CO5	3	1	1	2	2	-	-	-	-	-	-

Level 1-High, Level 2-Moderate, level 3-Low

SEMESTER-IV					
LINEAR INTEGRATED CIRCUITS & APPLICATIONS **Category: ESC/ETC/PLC-IV**					
Course Code	:	B24EE462	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To introduce the characteristics and limitations of ideal and practical operational amplifiers
2.	To develop the ability to design and implement active filters and signal generator circuits using linear ICs
3.	To impart knowledge of linear IC applications such as comparators, precision rectifiers, and related circuits
4.	To enable students to analyze and design voltage regulation circuits using op-amps and dedicated IC regulators
5.	To provide a foundation on the principles, operation, and applications of Phase-Locked Loops (PLL) and Timers

Module – 1: Operational Amplifiers	**No.of Hours**
Operational Amplifiers: Introduction, Block diagram representation of a typical Op-amp, schematic symbol, characteristics of an Op-amp, ideal op-amp, equivalent circuit, ideal voltage transfer curve, open loop configuration, differential amplifier, inverting & non –inverting amplifier, Op-amp with negative feedback(excluding derivations). **General Linear Applications:** A.C. amplifier, summing, scaling & averaging amplifier, inverting and non-inverting configuration, Instrumentation amplifier.	9
Module – 2: Active Filters and DC Voltage Regulations	**No.of Hours**
Active Filters: First & Second order high pass & low pass Butterworth filters. Band pass filters, all pass filters. **DC Voltage Regulators:** voltage regulator basics, voltage follower regulator, adjustable output regulator, LM317 & LM337 Integrated circuits regulators	9
Module – 3: Signal generators and Converters	**No.of Hours**
Signal generators: Triangular / rectangular wave generator, phase shift oscillator, Wien bridge oscillator, oscillator amplitude stabilization, signal generator output controls. Comparators & **Converters**: Basic comparator, zero crossing detector, inverting & non-inverting Schmitt trigger circuit, voltage to current converter with grounded load, current to voltage converter and basics of voltage to frequency and frequency to voltage converters	9
Module – 4: Signal processing circuits	**No.of Hours**
Signal processing circuits: Precision half wave & full wave rectifiers limiting circuits, clamping circuits, peak detectors, sample & hold circuits. A/D & D/A Converters: Basics, R–2R D/A Converter, Integrated circuit 8-bit D/A, successive approximation ADC, linear ramp ADC, dual slope ADC, digital ramp ADC	9
Module – 5: PLL and Timer	**No.of Hours**
Phase Locked Loop (PLL): Basic PLL, components, performance factors. **Timer:**Internal architecture of 555 timer, Mono stable multivibrators and applications	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe the characteristics of ideal and practical operational amplifier.
CO2	Design filters and signal generators using linear ICs.
CO3	Demonstrate the application of Linear ICs as comparators and rectifiers.
CO4	Analyze voltage regulators for given specification using op-amp and IC voltage regulators.
CO5	Summarize the basics of PLL and Timer.

Text Books	
1.	Op-Amps and Linear Integrated Circuits Ramakant A Gayakwad Pearson 4thEdition
2.	Operational Amplifiers and Linear ICs David A. Bell Oxford 3rd Edition

Reference Text Books	
1.	Operational Amplifiers and Linear Integrated Circuits K. Lal Kishore Pearson 1 st Edition
2.	Linear Integrated Circuits Muhammad H Rashid Cengage Learning 1 st Edition

3.	Op-Amps and Linear Integrated Circuits, Concept and Application James M Fiore Cengage

Web links and Video lectures (e-Resources)
1. https://onlinecourses.nptel.ac.in/noc24_ee73/preview
2 https://onlinecourses.nptel.ac.in/noc24_ee73/preview
3. https://onlinecourses.nptel.ac.in/noc24_ee73/preview

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
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3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	2	-	1	1	1	-	2
CO2	3	3	3	-	2	-	1	1	1	-	2
CO3	3	3	2	-	3	-	1	1	1	-	2
CO4	3	2	3	-	3	-	1	1	1	-	2
CO5	3	2	2	-	2	-	1	1	1	-	2

Level-3 -High, Level-2- Moderate, Level-1 - Low

SEMESTER-IV					
IoT APPLICATIONS FOR ELECTRICAL ENGINEERING **Category: ESC/ETC/PLC-IV**					
Course Code	:	B24EE463	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand the fundamentals, types, and applications of various sensors
2.	To explore occupancy, motion detection, and measurement techniques for physical parameters
3.	To learn MEMS design concepts and their role in modern sensors and actuators
4.	To examine the role of IoT in smart grids, including monitoring and interoperability
5.	To study the concept, architecture, and vision of the Internet of Energy (IoE)

Module – 1: Sensors	**No.of Hours**
Sensors: Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric.	9
Module – 2: Occupancy and Motion Detectors	**No.of Hours**
Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors -Resistive microphones, Piezoelectric, Photo resistors.	9
Module – 3: MEMS	**No.of Hours**
Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors	9
Module – 4: IoT for Smart Grid	**No.of Hours**
Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home	9
Module – 5: Internet of Energy (IoE)	**No.of Hours**
Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Classify and explain the working principles of temperature, pressure, and force sensors
CO2	Analyze and apply occupancy, motion, and displacement sensors for various applications
CO3	Demonstrate knowledge of MEMS fabrication, electrostatic actuation, and related sensors
CO4	Evaluate IoT applications across power generation, transmission, and distribution in smart grids
CO5	Describe the concept, architecture, and future vision of IoE and its integration with smart grids

Text Books	
1.	Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004
2.	Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1st Edition, Mc Grawhill Education, 2017
3.	Ersan Kabalci and Yasin Kabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019

Reference Text Books	
1.	Raj Kumar Buyya and Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016
2.	Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1st Edition, CRC Press, 2019
3.	RMD Sundaram Shriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
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3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
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6. Students should answer five full questions, selecting one full question from each module.
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PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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CO2	3	3	2	1	2	1	-	-	1	-	2
CO3	3	3	3	2	3	-	-	-	1	1	2
CO4	3	3	3	2	3	2	2	-	2	2	2
CO5	3	2	2	-	2	3	2	1	2	2	3

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-IV					
JAVA PROGRAMMING **Category: ESC/ETC/PLC-IV** **(Common to ECE, EEE, RA)**					
Course Code	:	B24EC464	CIE	:	50 Marks
Teaching Hours L:T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To learn primitive constructs JAVA programming language.
2.	To understand Object Oriented Programming Features of JAVA.
3.	To gain knowledge on packages, multithreaded programming and exceptions.

Module–1: An Overview of Java	**No. of Hours**
Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles), Using Blocks of Code, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, The Java Keywords). **Data Types, Variables, and Arrays:** The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables. **Operators:** Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The Operator, Operator Precedence, Using Parentheses. **ControlStatements:**Java'sSelectionStatements(if,TheTraditionalswitch),Iteration Statements (while, do-while, for, The For-Each Version of the for Loop, Local Variable Type Inference in a for Loop, Nested Loops), Jump Statements (Using break, Using continue, return).	9
Module–2: Introducing Classes	**No. of Hours**
Class Fundamentals**,** Declaring Objects**,** Assigning Object Reference Variables**,** Introducing Methods, Constructors**,** The this Keyword**,** Garbage Collection. **Methods and Classes:** Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes.	9
Module–3: Inheritance and Interfaces	**No. of Hours**
Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class. **Interfaces:** Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods.	9
Module–4: Packages and Exceptions	**No. of Hours**
Packages: Packages, Packages and Member Access, Importing Packages. **Exceptions:**Exception-HandlingFundamentals**,**ExceptionTypes**,**UncaughtExceptions**,**Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built- in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions.	9
Module–5: Multithreaded Programming	**No. of Hours**
Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using is Alive() and join(), Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State. **Enumerations, Type Wrappers and Autoboxing:** Enumerations (Enumeration Fundamentals**,** The values() and value Of() Methods), Type Wrappers (Character, Boolean, The Numeric Type Wrappers),Autoboxing(AutoboxingandMethods,Autoboxing/UnboxingOccursinExpressions, Autoboxing /Unboxing Boolean and Character Values).	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate proficiency in writing simple programs involving branching and looping structures.
CO2	Design a class involving data members and methods for the given scenario.

CO3	Apply the concepts of inheritance and inter faces in solving real world problems.
CO4	Use the concept of packages and exception handling in solving complex problem.
CO5	Apply concepts of multi threading, autoboxing and enumerations in program development

Text Books	
1.	Herbert Schildt, Java The Complete Reference,7th Edition,TataMcGrawHill, 2007.

Reference Text Books	
1.	MaheshBhaveandSunilPatekar,"ProgrammingwithJava",1st Edition,PearsonEducation,2008, ISBN:9788131720806
2.	RajkumarBuyya,SThamarasiselvi,xingchenchu,ObjectorientedProgrammingwithjava,TataMcGraw Hill education private limited
3.	EBalagurusamy,ProgrammingwithJavaAprimer,TataMcGrawHill companies
4.	AnitaSethandBLJuneja,JAVAOnestepAhead,OxfordUniversityPress,2017

Web links and Video lectures (e-Resources)	
1.	JavaTutorial:https://www.geeksforgeeks.org/java/
2.	Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu):https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
3.	JavaTutorial:https://www.w3schools.com/java/
4.	JavaTutorial:https://www.javatpoint.com/java-tutorial

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	1	2	2	1	1	-	1	2	1
CO2	1	-	1	2	2	-	-	-	1	1	1
CO3	2	-	1	2	3	-	-	-	1	1	1
CO4	2	-	1	1	1	1	1	-	1	2	1
CO5	1	-	1	2	2	1	1	-	2	1	1

Level3 -High, Level2- Moderate, Level1- Low

SEMESTER-IV					
PROJECT ON RENEWABLE ENERGY SOURCES **Category: AEC/SEC-IV**					
Course Code	:	B24EE481	CIE	:	50 Marks
Teaching Hours L : T : P	:	0:0:2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	To provide opportunity to perform the experiments/programmes at their own time, at their own pace, at any place as per their convenience and repeat any number of times to understand the concept.
2.	To Provide unhindered access to perform whenever the students wish.
3.	To study the behavior of the circuit without the risk of damaging equipment/ deviceor injuring themselves.

Students can select appropriate projects with the approval of the guide. The projects be applicationoriented and can be considering any of the following or any other.

1. Automatic solar tracking system.
2. Solar based small traffic control system.
3. Solar mobile charger.
4. Vertical axis wind turbine system.
5. Solar powered Smart irrigation system.
6. Renewable energy based home automation system.
7. Domestic illumination using solar.
8. Solar grass cutter. Solar UPS.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate the ability to perform experiments and simulations independently at their own pace, location, and time, enhancing self-directed learning and conceptual understanding
CO2	Utilize flexible and on-demand access to virtual laboratories or simulation tools to reinforce learning through repeated experimentation
CO3	Analyze and interpret circuit behavior by varying parameters safely in a virtual environment, without the risk of damaging equipment or causing harm

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	**Scale down to**	**Total Marks**
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	2	3	1	–	1	–	2	–
CO2	2	1	1	2	3	1	–	1	–	2	–
CO3	2	2	2	2	3	1	–	1	–	2	–

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-IV					
PCB DESIGN LABORATORY **Category: AEC/SEC-IV**					
Course Code	:	B24EE482	CIE	:	50 Marks
Teaching Hours L : T : P	:	0 : 0 : 2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	To introduce the fundamentals of PCB technology, types, materials, and electronic component packaging relevant to modern electronic systems
2.	To provide hands-on experience in using Electronic Design Automation (EDA) tools such as Proteus or OrCAD for schematic design, layout, and PCB design
3.	To train students in post-design processes like fabrication, soldering, testing, and generation of Gerber files for practical PCB realization

Sl. No	**Experiments**
1.	Introduction Need for PCB, Types of PCBs : Single and Multilayer, Technology: Plated Through Hole, Surface Mount, PCB Material, Electronic Component packaging, PCB Designing, Fabrication, Electronic Design Automation Tools: proteus, Orcad or any other tool.
2.	Introduction to proteus, Orcad or any other tool., Schematic entry / drawing, netlisting, layering, component foot print library selection & designing, design rules, component placing: Manual & automatic, track routing: automatic & manual, rules: track length, angle, joint & size, Autorouter setup. Design Rules.
3.	PCB Designing Practice : PCB Designing of Basic and Analog Electronic Circuits, PCB Designing of Power Supplies.
4.	Post Designing & PCB Fabrication Process: Printing the Design, Etching, Drilling, Interconnecting and Packaging electronic Circuits, Gerber Generation, Soldering and Desoldering, Component Mounting, PCB and Hardware Testi

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand PCB structures, materials, and fabrication technologies including through-hole and surface mount
CO2	Design PCB layouts for basic electronic circuits using tools like Proteus or OrCAD, applying design rules and layout constraints
CO3	Execute post-design procedures such as Gerber generation, etching, drilling, soldering, and testing of fabricated PCBs

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	**Scale down to**	**Total Marks**
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	2	2	–	–	1	–	1	–
CO2	3	1	1	3	3	–	–	1	–	1	–
CO3	2	1	1	3	–	–	–	1	–	2	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-IV					
MATLAB FOR TRANSFORMERS & GENERATORS **Category: AEC/SEC-IV**					
Course Code	:	B24EE483	CIE	:	50 Marks
Teaching Hours L : T : P	:	0 : 0 : 2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand and perform various tests on single-phase and three-phase transformers such as open circuit, short circuit, Sumpner's test, and load sharing under parallel operation, and to predetermine efficiency, voltage regulation, and equivalent circuit parameters
2.	To analyze the voltage regulation characteristics of alternators using EMF, MMF, and ZPF methods, and to study the power angle characteristics and performance of synchronous machines including operation with an infinite bus and salient pole machines using slip test
3.	To apply simulation tools like MATLAB/Simulink and Simscape to model transformers with AVR and to visualize and analyze the power angle curve of synchronous generators for performance evaluation under varying conditions

Sl. No	**List of Experiments**
1.	Open Circuit and Short circuit tests on single phase step up or step down transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.
2.	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.
3.	Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load sharing and analytical verification given the Short circuit test data.
4.	Separation of hysteresis and eddy current losses in single phase transformer.
5.	Voltage regulation of an alternator by EMF and MMF methods.
6.	Voltage regulation of an alternator by ZPF method.
7.	Power angle curve of synchronous generator.
8.	Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines.
9.	Power angle curve of synchronous generator or Direct load test on three phase synchronous generator to determine efficiency and regulation.
10.	Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.
11.	Model transformer in Simscape for Automatic Voltage Regulation.
12.	Simulate power angle curve of generator in MATLAB.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Perform and analyze standard tests on single-phase and three-phase transformers (OC, SC, Sumpner's, and parallel operation) to predetermine efficiency, voltage regulation, and derive equivalent circuit parameters.
CO2	Evaluate the voltage regulation of alternators using EMF, MMF, and ZPF methods, and analyze the power-angle characteristics and operational behavior of synchronous generators, including salient pole machines through slip test.
CO3	Model and simulate transformers and synchronous generators using MATLAB/Simulink and Simscape to analyze power angle curves and implement automatic voltage regulation.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	–	–	–	–	1	–
CO2	3	3	2	2	2	–	–	–	–	1	–
CO3	2	2	2	2	3	1	1	1	2	2	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-IV					
ARDUINO AND RASPBERRY Pi LAB **Category: AEC/SEC-IV** **(Common to ECE, EEE, RA)**					
Course Code	:	B24EE484	CIE	:	50 Marks
Teaching Hours L : T : P	:	0 : 0 : 2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand interfacing of basic I/O devices (LEDs, buzzers, buttons) with Arduino/Raspberry Pi
2.	To understand sensor interfacing (temperature, humidity, current, distance, analog sensors) and data acquisition
3.	To understand actuator control using relays, motors, and real-time clock integration
4.	To apply the cocept of wireless communication and IoT connectivity using Bluetooth and cloud platforms
5.	To comprehend skills for measuring, monitoring, and transmitting energy-related parameters for smart applications

Sl. No	**List of Experiments**
1.	i) To interface LED/Buzzer with Arduino and write a program to 'turn ON' LED for 1 sec after every 2 seconds. ii) ii) To interface Push button/Digital sensor (IR/LDR) with Arduino and write a program to 'turn ON' LED when push button is pressed or at sensor detection.
2.	i) To interface DHT11 sensor with Arduino and write a program to print temperature and humidity readings. ii) ii) To interface OLED with Arduino and write a program to print temperature and humidity readings on it.
3.	To interface motor using relay with Arduino and write a program to 'turn ON' motor when push button is pressed.
4.	To interface Bluetooth with Arduino and write a program to send sensor data to Smartphone using Bluetooth.
5.	To interface Bluetooth with Arduino and write a program to turn LED ON/OFF when '1'/'0' is received from Smartphone using Bluetooth.
6.	Write a program to interface an analog sensor (e.g., potentiometer or temperature sensor) with Arduino and display the analog values on the Serial Monitor.
7.	To interface a Real-Time Clock (DS3231/DS1307) module with Arduino and write a program to display the current date and time on the Serial Monitor.
8.	Write a program to measure an analog voltage (0–5V) using Arduino and display the measured voltage on the Serial Monitor.
9.	Interface a current sensor (e.g., ACS712) with Arduino and write a program to measure and display the current flowing through a load on the Serial Monitor.
10.	To interface a DC motor through a relay module with Arduino/ Raspberry Pi and write a Python program to turn ON the motor when a push button is pressed.
11.	Interface an ultrasonic sensor (HC-SR04) with Arduino/ Raspberry Pi and write a program to measure and display the distance in centimeters on the Serial Monitor.

12.	Write a python program on Raspberry Pi to upload temperature and humidity data to thing speak cloud.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the interfacing and control of digital devices such as LEDs and buzzers using Arduino.
CO2	Understand sensor interface to acquire and display data from temperature, humidity, distance, voltage, and current sensors.
CO3	Design motor and relay-based actuation systems using sensor input for automation and control.
CO4	Analyze communication techniques for exchanging data with smartphones and cloud servers using Bluetooth and IoT.
CO5	Understand and evaluate methods for measuring and transmitting sensor parameters using Raspberry Pi.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

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CO2	3	2	-	2	3	-	-	-	-	-	2
CO3	3	3	3	2	3	-	-	-	1	1	2
CO4	3	3	2	2	3	1	-	-	2	2	2
CO5	3	3	2	2	3	2	2	1	2	2	3

Level 3 - High, Level 2 - Moderate, Level 1 - Low