MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belagavi)

Autonomous Programme

Bachelor of Engineering

Department of

Electrical and Electronics Engineering

SCHEME AND SYLLABUS

(2024 Admitted Batch)

Academic Year 2025-26

VISION OF THE INSTITUTE

To be an institute of excellence in engineering education and research, producing socially responsible professionals.

MISSION OF THE INSTITUTE

1. Create conducive environment for learning and research
2. Establish industry and academia collaborations
3. Ensure professional and ethical values in all institutional endeavors

VISION OF THE DEPARTMENT

To become a department of excellence in the domain of Electrical and Electronics Engineering producing competent engineers with research acumen having moral and social values.

MISSION OF THE DEPARTMENT

1. Enhance industry and alumni interaction.
2. Promote continuous quality up gradation of faculty and technical staff.
3. Time to time modernization of departmental infrastructure to provide state of the art laboratories.
4. Create research-oriented culture to invoke the desire and ability of lifelong learning among the students for pursuing successful career.
5. Create and sustain environment of learning in which students acquire knowledge and learn to apply it professionally with due consideration of social and ethical values.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the program will be able to

PEO 1: Pursue a diverse range of career as engineers and researchers.

PEO 2: Design and develop innovative systems to provide best solutions to electrical engineering problems.

PEO 3: Learn and adapt in a world of constantly evolving technology.

PROGRAM OUTCOMES (POS)

PO 1: **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.

PO 2: **Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO 3: **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)

PO 4: **Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO 5: **Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO 6: **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, and WK7).

PO 7: **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO 8: **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO 9: **Communication:** Communicate effectively and inclusively within the engineering 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

PO 10: **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.

PO 11: **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)

KNOWLEDGE AND ATTITUDE PROFILE (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Acquire core competency in analyzing, designing and controlling electrical and electronic systems to meet industrial and societal needs.

PSO 2: Adopt technology by leveraging state-of-the-art and AI tools to develop innovative solutions in emerging areas like renewable energy, electric vehicles and embedded systems.

Scheme of Evaluation (Theory Courses)

Assessment	Marks
CIE 1	**10**
CIE 2	**10**
CIE 3	**10**
Activities as decided by course faculty	**20**
SEE	**50**
Total	**100**

Scheme of Evaluation (Laboratory Courses)

Assessment	Marks
Continuous Evaluation in every lab session by the Course Coordinator	**10**
Record Writing	**20**
Laboratory CIE conducted by the Course Coordinator	**20**
SEE	**50**
Total	**100**

Examination	Maximum Marks	Minimum marks to qualify
CIE	50	20
SEE	50	20

COURSE TYPES

Basic Science Course	BSC
Engineering Science Course	ESC
Emerging Technology Course	ETC
Programming Language Course	PLC
Professional Core Course	PCC
Integrated Professional Core Course	IPCC
Professional Core Course Laboratory	PCCL
Professional Elective Course	PEC
Open Elective Course	OEC
Project/Mini Project/Internship	PI
Humanities and Social Sciences, Management Course	HSMC
Ability Enhancement Course	AEC
Skill Enhancement Course	SEC
Universal Human Value Course	UHV
Non-credit Mandatory Course	MC

Semester-wise Credit Distribution

Curricular Component / Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course (BSC)	8	8	3	1	-	-	-	-	**20**
Engineering Science Course (ESC)/ Emerging Technology Course (ETC)/Programming Language Course	9	9	3	3	-	-	-	-	**24**
Professional Core Course (PCC)	-	-	12	15	14	14	8	-	**63**
Professional Elective Course (PEC)	-	-	-	-	3	3	3	3	**12**
Open Elective Course (OEC)	-	-	-	-		3	3	3	**09**
Project/Mini Project/Internship (PI)	-	-	-	-	-	2	4	10	**16**
Humanities and Social Sciences, Management Course (HSMC)	1	2	1	-	2	-	-	-	**06**
Ability Enhancement Course (AEC)/ Skill Enhancement Course (SEC)	2	1	1	1	3	1	-	-	**09**
Universal Human Value Course (UHV)	-	-	-	1	-	-	-	-	**01**
Total Credits	**20**	**20**	**20**	**21**	**22**	**23**	**18**	**16**	**160**

THIRD SEMESTER												
Sl. No	Course Category	Course Code	Course Title	Teaching Hours per Semester					Exam Marks			Credits
				L	T	P	TW + SL	Total	CIE	SEE	Total	
1	BSC	24MA301	Mathematics -III for Electrical and Electronics Engineering	42	14	-	34	90	50	50	100	3
2	PCC	24EE302	Electrical Network Analysis	56	14	-	50	120	50	50	100	4
3	PCC	24EE303	Analog Electronic Circuits	42	-	-	48	90	50	50	100	3
4	PCC	24EE304	Transformers and Induction Machines	42	-	-	48	90	50	50	100	3
5	PCCL	24EE305	Analog Electronics Laboratory	-	-	28	02	30	50	50	100	1
6	PCCL	24EE306	Transformers and Induction MachinesLaboratory	-	-	28	02	30	50	50	100	1
7	ESC	24ESEE3X	Engineering Science Course – II	42	-	-	48	90	50	50	100	3
8	HSMC	24SCR	Social Connect and Responsibility	-	-	28	02	30	100	-	100	1
9	AEC	24AEEE3X	Ability Enhancement Course - III	-	-	28	02	30	50	50	100	1
10	MC	24NYP1	NSS,YOGA,PE	-	-	28	02	30	100	-	-	Audit
11	BSC	24BCM301	Bridge Mathematics-I (Mandate Audit Course for Diploma entry students)	42	-	-	48	90	100	-	100	Audit
Total								**720**				**20**

Note:

This scheme is as per the new National Credit Framework, which accounts for 30 hours of learning as equivalent to 1 credit

L: Lecture; T: Tutorial; P: Practical/Drawing; TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.);

SL: Self Learning, MOOCs, spoken tutorials, online educational resources etc.

ENGINEERING SCIENCE COURSES – II			
24ESEE31	Electrical and Electronics Measurements	24ESEE33	Sensors and IoT
24ESEE32	Introduction to PLC	24ESEE34	Programming in C++
ABILITY ENHANCEMENT COURSE – III			
24AEEE31	Electric Circuits and Measurements Laboratory	24AEEE33	Effective Communication and Report Writing Skills
24AEEE32	Scilab/ MATLAB for Electrical Engineering	24AEEE34	Web Technology Laboratory

FOURTH SEMESTER												
Sl. No	Course Category	Course Code	Course Title	Teaching Hours per Semester					Exam Marks			Credits
				L	T	P	TW + SL	Total	CIE	SEE	Total	
1	PCC	24EE401	Digital Electronic Circuits	42	-	-	48	90	50	50	100	3
2	PCC	24EE402	Electric Power Generation and Transmission	56	-	-	64	120	50	50	100	4
3	PCC	24EE403	Synchronous and Special Electrical Machines	42	-	-	48	90	50	50	100	3
4	PCC	24EE404	Microcontrollers	42	-	-	48	90	50	50	100	3
5	PCCL	24EE405	Digital Electronic Circuits Laboratory	-	-	28	02	30	50	50	100	1
6	PCCL	24EE406	Microcontrollers Laboratory	-	-	28	02	30	50	50	100	1
7	ETC	24ETC42X	Emerging Technology Course - II	42	-	-	48	90	50	50	100	3
8	UHV	24UHV	Universal Human Values	-	28	-	02	30	50	50	100	1
9	AEC	24AEEE4X	Ability Enhancement Course - IV	-	-	28	02	30	50	50	100	1
10	MC	24NYP2	NSS,YOGA,PE	-	-	28	02	30	100	-	100	Audit
11	BSC	24BE41	Biology for Engineers	-	28	-	02	30	50	50	100	1
Total								**660**				**21**

Note:

This scheme is as per the new National Credit Framework, which accounts for 30 hours of learning as equivalent to 1 credit

L: Lecture; T: Tutorial; P: Practical/Drawing; TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.);

SL: Self Learning, MOOCs, spoken tutorials, online educational resources etc.

EMERGING TECHNOLOGY COURSES – II			
24ETEE41	Signals and Systems	24ETEE43	Renewable Energy Systems
24ETEE42	Fundamentals of Electric Vehicles	24ETEE44	Python for Electrical Engineers
ABILITY ENHANCEMENT COURSE – IV			
24AEEE41	AutoCAD for Electrical Engineering	24AEEE43	Renewable Energy Laboratory
24AEEE42	PCB Design Laboratory	24AEEE44	IoT Laboratory

FIFTH SEMESTER											
Sl. No	Course Category	Course Code	Course Title	Teaching Hours per Semester					Exam Marks			Credits
				L	T	P	TW + SL	Total	CIE	SEE	Total	
1	PCC	24EE501	Linear Control Systems	42	14	-	34	90	50	50	100	3
2	PCC	24EE502	Power Electronics	42	-	-	48	90	50	50	100	3
3	PCC	24EE503	Switchgear and Protection	42	-	-	48	90	50	50	100	3
4	PCC	24EE504	Electromagnetic Fields	42	-	-	48	90	50	50	100	3
5	PCCL	24EE505	Power Electronics Laboratory	-	-	28	02	30	50	50	100	1
6	PCCL	24EE506	Synchronous Machines Laboratory	-	-	28	02	30	50	50	100	1
7	HSMC	24EE507	Industrial Management	-	28	-	02	30	50	50	100	1
8	HSMC	24EVS	Environmental Studies	-	28	-	02	30	50	50	100	1
9	PEC	24EE51X	Professional Elective Course - I	42	-	-	48	90	50	50	100	3
10	MC	24NYP3	NSS,YOGA,PE	-	-	28	02	30	100	-	100	Audit
11	AEC	24RIP	Research Methodology and IPR	42	-	-	48	90	50	50	100	3
Total								**690**				**22**

Note:

This scheme is as per the new National Credit Framework, which accounts for 30 hours of learning as equivalent to 1 credit

L: Lecture; T: Tutorial; P: Practical/Drawing; TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.);

SL: Self Learning, MOOCs, spoken tutorials, online educational resources etc.

PROFESSIONAL ELECTIVE COURSE - I			
24EE511	Digital Signal Processing	24EE513	AI in Electrical Engineering
24EE512	Operational Amplifiers and Linear ICs	24EE514	Automation in Industry 4.0

SIXTH SEMESTER											
Sl. No	Course Category	Course Code	Course Title	Teaching Hours per Semester					Exam Marks			Credits
				L	T	P	TW + SL	Total	CIE	SEE	Total	
1	PCC	24EE601	Electrical Machine Design	42	-	-	48	90	50	50	100	3
2	PCC	24EE602	Modern Control Theory	42	-	-	48	90	50	50	100	3
3	PCC	24EE603	Power System Analysis and Stability	42	-	-	48	90	50	50	100	3
4	PCC	24EE604	High Voltage Engineering	42	-	-	48	90	50	50	100	3
5	PCCL	24EE605	Linear Control Systems Laboratory	-	-	24	06	30	50	50	100	1
6	PCCL	24EE606	Relay and High Voltage Laboratory	-	-	24	06	30	50	50	100	1
7	PI	24PROJ1	Project Phase - I	-	-	42	18	60	50	50	100	2
8	PEC	24EE62X	Professional Elective Course - II	42	-	-	48	90	50	50	100	3
9	OEC	24OEX6X	Open Elective Course - I	42	-	-	48	90	50	50	100	3
10	MC	24NYP4	NSS,YOGA,PE	-	-	24	06	30	100	-	100	Audit
11	AEC	24ASK	Analytical Ability and Soft Skills	-	-	28	02	30	50	50	100	1
Total								**720**				**23**

Note:

This scheme is as per the new National Credit Framework, which accounts for 30 hours of learning as equivalent to 1 credit

L: Lecture; T: Tutorial; P: Practical/Drawing; TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.);

SL: Self Learning, MOOCs, spoken tutorials, online educational resources etc.

PROFESSIONAL ELECTIVE COURSE - II			
24EE621	Flexible AC Transmission Systems	24EE623	Testing and Commissioning of Electrical Equipment
24EE622	Embedded Systems	24EE624	Electrical Power Quality
OPEN ELECTIVE COURSE - I			
24OEEE61	Introduction to Electric Vehicle	24OEEE62	Alternate Energy Sources

SEVENTH SEMESTER												
Sl. No	Course Category	Course Code	Course Title	Teaching Hours per Semester					Exam Marks			Credits
				L	T	P	TW + SL	Total	CIE	SEE	Total	
1	PCC	24EE701	Computer Methods in Power Systems	56	-	-	64	120	50	50	100	4
2	PCC	24EE702	Industrial Drives and Applications	42	-	-	48	90	50	50	100	3
3	PCCL	24EE703	Power System Simulation Laboratory			28	02	30	50	50	100	1
4	PI	24PROJ1	Project Phase - II			84	36	120	50	50	100	4
5	PEC	24EE73X	Professional Elective Course - III	42	-	-	48	90	50	50	100	3
6	OEC	24OEX7X	Open Elective Course – II	42	-	-	48	90	50	50	100	3
Total								**540**				**18**

Note:

This scheme is as per the new National Credit Framework, which accounts for 30 hours of learning as equivalent to 1 credit

L: Lecture; T: Tutorial; P: Practical/Drawing; TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.);

SL: Self Learning, MOOCs, spoken tutorials, online educational resources etc.

PROFESSIONAL ELECTIVE COURSE - III			
24EE731	Energy Auditing and Demand-Side Management	24EE733	Solar Power Conversion Systems
24EE732	Smart Grid Technologies	24EE734	VLSI Design
OPEN ELECTIVE COURSE - I			
24OEEE71	Battery Energy Storage Systems	24OEEE72	Utilization of Electric Power

EIGHTH SEMESTER												
Sl. No	Course Category	Course Code	Course Title	Teaching Hours per Semester					Exam Marks			Credits
				L	T	P	TW + SL	Total	CIE	SEE	Total	
1	PEC	24SW01	Professional Elective (Online Course)	-	-	-	-	-	50	50	100	3
2	OEC	24SW02	Open Elective (Online course)	-	-	-	-	-	50	50	100	3
3	PI	24INT	Internship (Research/Industry) (15-20 weeks)	-	-	210	90	300	100	100	100	10
Total								**300**				**16**

III SEMESTER

Course Title	MATHEMATICS -III FOR ELECTRICAL AND ELECTRONICS ENGINEERING		
Course Code	24MA301	(L-T-P) C	(3-1-0) 3
CIE	50	Hours/Week	4
SEE	50	Total Hours	42L + 14T + 34ABL = 90

Course Objective: To introduce linear algebra and transform calculus which may be employed as tools in solving engineering application problems.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Analyze the engineering problems using concepts of linear algebra.	PO1	-
2	Apply the Fourier Transform to interpret continuous and discrete-time signals to solve engineering problems.	1, 2	-
3	Represent the function/experimental data in terms of a Fourier series and to solve the problems.	1	-
4	Solve Z - transforms of the given function and gain the capability to find solutions of difference equations.	1, 2	-

MODULE - 1 — 10 Hrs.

Linear Algebra: Importance of Matrices in engineering. Rank of a matrix. Consistency of non-homogeneous and homogeneous system of equations, Solution of the system of linear equations by Gauss elimination method and Gauss – Seidel iterative method.

Eigen values and Eigenvectors, properties, Illustrative examples. Stability analysis of differential equations which governs the dynamical systems using the concept of Eigen value &eigenvectors.

Applications of solution of system of equations: circuit flow problem.

SLC: linear transformation.

MODULE - 2 — 10 Hrs

Fourier Transform: Introduction, Fourier Integral, Infinite Fourier transform, Properties of Fourier transform (Linearity, Change of Scale, Shifting), Evaluation of Complex Fourier transform, Fourier sine & Fourier cosine transforms.

Inverse Fourier Transforms Inverse complex Fourier transform, Inverse sine & Cosine transforms, Properties.

Application: Applications of Fourier transforms in Electrical & Electronics engineering.

SLC: Fast Fourier transforms.

MODULE - 3 — 10 Hrs.

Fourier Series: Introduction, Periodic function, Periodic functions and their graphical representation, Trigonometric series, Fourier series of Odd & Even functions, to find Fourier series by change of interval method, to represent the experimental data as a Fourier series using the method - Practical harmonic analysis.

Application of Fourier series in engineering-To represent the signal (wave form) in terms of Fourier series, Fourier series representation for the excitation described by the wave form, graphs of Fourier series approximating the given function.

SLC: Half range series method.

MODULE - 4 — 12 Hrs

Z-Transforms: Introduction to Z-transforms,Definition and property , Z-transforms of some standard functions, Standard forms, properties, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem. – Problems.

Application -Application to deflection of a loaded string.

SLC: Inverse Z transforms, Solution of Difference equations using Z Transforms.

NOTE:

Note– Theorems and properties without proof. Applicable to all the modules. Self-study is not included in SEE.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Higher Engineering Mathematics	Dr. B. S. Grewal	44th	Khanna	2016
2	Linear algebra	David c lay	3rd	Pearson education	2002
3	Linear Algebra and its Applications	Gilbert Strang	4th	Cenage publications	2014

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Advanced Engineering mathematics	R K Jain and S R K Iyengar	2nd	Narosa	2005
2	Calculus	Thomas Finney	9th	Pearson education	2002
3	Advanced Engineering Mathematics	Erwin Kreyszig	8th	Wiley India Pvt. Ltd (Wiley student edition)	2004

EBooks and online course materials:

1. https://www.geneseo.edu/~aguilar/public/assets/courses/233/main_notes.pdf
2. https://theengineeringmaths.com/wp-content/uploads/2017/08/ftransforms.pdf
3. https://see.stanford.edu/materials/lsoftaee261/book-fall-07.pdf

Online Courses and Video Lectures:

1. https://www.coursera.org/learn/introduction-to-linear-algebra
2. https://archive.nptel.ac.in/courses/111/106/111106135/

Teaching -Learning– Evaluation Scheme:

Sl.No	Teaching and Learning Method	No.of Hours/ Week	No.of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Tutorial & Student Study Hours – Self Learning	1	14	14
3	Activity Based Learning (ABL1 & ABL2)	-	-	27
4	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Writing Assignment with Problems on concerned to real world applications	10
	Activity 2: Problem Solving Assignment	10
Total		**50**

Activity Based Learning (27 Hours)

ABL1 (14Hours) : Activity1details		**Hours**
Writing Assignment with Problems on concerned to real world applications.	Submission of the final assignment report and evaluation.(Questions of Blooms level L3 and Higher)	14
ABL1: Total		**14**
ABL2(13Hours): Activity 2 details		
Problem Solving Assignment	Understand the input data requirements	1
	Formulate the methodology	4
	Design the solution	4
	Solving the problem and submission	4
ABL2: Total		**13**
ABL1 + ABL2: Total		**27**

Course Articulation Matrix

Course Outcomes	**Program Outcomes**												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3												
CO2	3	2											
CO3	3												
CO4	3	2											

Course Title	ELECTRICAL NETWORK ANALYSIS		
Course Code	24EE302	(L-T-P) C	(4-1-0) 4
CIE	50	Hours/Week	5
SEE	50	Total Hours	56L + 14T + 50ABL = 120

Course Objective: To analyze electrical networks using various techniques.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Model DC and AC network using basic laws and theorems	1, 2	1
2	Analyze three-phase circuits and resonant circuits under steady state condition.	1, 2, 3	1
3	Solve network to assess initial and final conditions in networks	1, 2	1
4	Analyze electrical networks using Laplace Transforms and two port network.	1, 2, 3	1

MODULE-1 **13 Hrs**

Circuit Analysis: Active and Passive elements , Linear and Non-linear elements, Ideal and Practical Sources, Controlled Sources, Source transformation techniques, Mesh, Loop and Node analysis with linearly dependent and independent sources for dc and ac networks.

Network Theorems: Superposition and Reciprocity for dc and ac circuits.

SLC: Dual circuits

MODULE-2 **13 Hrs**

Network Theorems: Thevenin's, Norton's theorem, Maximum power transfer, Millman's theorems for dc and ac circuits.

Resonant circuits: Series resonance, quality factor, frequency response, half power frequencies, bandwidth, selectivity, frequency at which VC and VL is maximum (No derivation), parallel resonance, R-L -C, RL-C and RL-RC circuits.

Three-phase circuits: Types of three phases, voltage, currents and power in star and delta connections. Analysis of balanced and unbalanced star with both 3 – wire as well as 4 – wire and delta connected loads.

SLC: Measurement of active and reactive power.

MODULE-3 **13 Hrs**

Initial conditions: Integro-differential equations for networks, behaviour of R, L, and C at the instant of switching and at final conditions, initial and final conditions in networks.

Laplace Transforms for waveform synthesis: Waveform synthesis of periodic and aperiodic signals gate function.

SLC: Synthesis of wave using gate function

MODULE-4 **13 Hrs**

Laplace Transforms for network analysis: Transient response and Steady state response, Solution using classical method for RLC network, Network elements in frequency domain , Concept of transformed impedance, analysis of circuits by using transformed network, initial and final value theorems and their applications to networks, transfer functions, convolution theorem.

Two Port Networks: Z-parameters, Y-parameters, ABCD-parameters, h-parameters, relationship among parameter sets. Calculation of these parameters for resistive networks.

SLC: Concept of poles and zeros.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Electric Circuits	Charles K. Alexander and Mathew N.O. Sadiku	4th	McGraw-Hill	2009
2	Network Analysis	Van Valkenburg	6th	Pearson education	2006

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Engineering Circuit Analysis	Hayt, Kemmerly and Durbin	8th	McGraw-Hill	2007
2	Networks and Systems	Roy Choudhury	2nd	New age Publication	2005
3	Network Theory: Analysis and Synthesis	Smarajit Ghosh	9th	PHI	2005

E Books and online course materials:

1. https://courses.minia.edu.eg/Attach/9850Fundamentals%20of%20Electric%20Circuits%20(Alexander%20and%20Sadiku),%204th%20Edition.pdf
2. https://ia600805.us.archive.org/8/items/M.E.VanValkenburgNetworkAnalysis.6PrenticeHallInc1959/M.E.%20Van%20Valkenburg%20-%20Network%20Analysis.%206- Prentice%20Hall%2C%20Inc%20%281959%29.pdf
3. https://uodiyala.edu.iq/uploads/PDF%20ELIBRARY%20UODIYALA/EL96/Hayt%20Engineering%20Circuit%20Analysis%208th%20txtbk.pdf

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/
2. https://www.udemy.com/course/full-course-circuit-analysis/?srsltid=AfmBOorUsGpqXV3s1CAAPDC9u5fznH-uFizDdtvyp4yqv5vFdTyjXvGo&couponCode=CP130525

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	4	14	56
2	Tutorial	1	14	14
3	Student Study Hours – Self Learning	1	14	14
4	Evaluation of Learning Process	-	-	07
5	Activity Based Learning **(ABL)**	-	-	15+14=29
Total Learning Hours / Semester				**120**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Simulation of electrical circuits	10
	Activity 2: Mini Project: RLC circuit behaviour and resonance for radio tuning	10
Total		**50**

Activity Based Learning (29 Hours)

ABL 1 : Simulation of electrical circuits (15 Hrs)		
Simulation-Based Learning	Verification of Superposition theorem	2
	Verification of Thevenin's theorem	2
	Verification of Maximum power transfer theorem	2
	Simulation of Unbalanced Star-Connected Loads in 3-Phase system	2
	Simulation of Unbalanced Delta-Connected Loads in 3-Phase system	2
	Generation of waveforms using standard signals.	1
	Finding the response of given network	2
	Submission of the report	2
ABL1: Total		**15**
ABL 2 : Mini Project: RLC circuit behaviour and resonance for radio tuning (14 Hrs)		
Project Based Learning	Research on radio tuning circuits (basic LC filter concept)	1
	Circuit design with RLC components	2
	Simulation of resonance curve (frequency vs current)	2
	Quality factor and bandwidth calculation	1
	Study transient behavior during switching	2
	Changing component values to tune frequency (e.g., FM 100 MHz)	2
	Filter performance for desired frequency range	2
	Submission of the report	2
ABL2: Total		**14**
ABL1 + ABL2: Total		**29**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Activity 1 and 2	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	-

Course Title	ANALOG ELECTRONIC CIRCUITS		
Course Code	24EE303	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: To analyze analog electronic circuits for different applications.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Explain the basic concepts of analog electronic devices as an amplifier and switch.	1	1
2	Analyze the performance of analog electronic devices.	1, 2	1
3	Apply the knowledge of analog electronic devices to realize oscillator circuits.	1, 2	1
4	Build analog electronic circuits based on operational amplifiers.	1, 2	1

MODULE - 1 **11 Hrs.**

Semiconductor Diodes: Introduction to diodes, Bridge rectifier, Clippers-Parallel clippers; Clampers- positive clamping and negative clamping without bias; Zener Diode-working and characteristics of Zener diode.

Bipolar Junction Transistors: Introduction to BJT, Biasing of transistor and limitations of biasing, biasing transistor as an amplifier; Self bias circuit, voltage divider bias circuit, small signal analysis of self and Voltage divider bias circuit for CE configuration (Exact analysis only) using hybrid model, RC coupled amplifier and its frequency response.

SLC: Zener diode as a voltage regulator (regulation at supply side and regulation at load side), Emitter follower bias circuit and its small signal analysis using hybrid model.

MODULE - 2 **11 Hrs.**

JFET: Construction, Operation and Characteristics of JFETs, biasing of FET using Self-bias and Voltage divider bias circuits for CS configuration, FET small signal model, Small signal analysis of voltage divider bias circuits for CS configurations, JFET working as a switch.

MOSFET: Types of MOSFET, Construction, Operation and Characteristics of Enhancement type MOSFET. Biasing of Enhancement type MOSFET using voltage divider bias circuit, Small signal model for enhancement type MOSFET, MOSFET working as a switch.

SLC: Biasing JFET in CD configuration, operation of Depletion type MOSFET

MODULE - 3 **10 Hrs.**

Feedback Amplifiers: Feedback concept and feedback connection types.

Oscillators: Principles of Oscillators, Bark Hausen's criterion, Phase shift oscillator- conditions for sustained oscillations, frequency of oscillation; Wien-bridge oscillator, Principles of tuned oscillator circuits- Colpitts Oscillator and Hartley Oscillator.

SLC: Multistage amplifiers, Different feedback circuits working principle, Darlington amplifier.

MODULE - 4 **10 Hrs**

Operational Amplifiers: Introduction, Inverting Amplifier, Non-inverting Amplifier, Voltage follower, Summing Amplifier, Difference Amplifier, Integrator and Differentiator, zero crossing detector,.

SLC: Precision rectifiers using OPAMPs, Schmitt trigger circuits.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Electronic Devices and Circuit Theory	Robert L. Boylestad and Louis Nashelsky	11th	Pearson	2013
2	Electronic Devices and Circuits	David A Bell	5th	Oxford University Press	2008

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Principles of Electronics	V. K. Mehta and Rohit Mehta	11th	S. Chand & Co	2020
2	Integrated Electronics: Analog and Digital Circuits and Systems	Jacob Millman and Christos C. Halkias	2nd	TMH	1972
3	Electronic Circuits	Sudhaker Samuel, U. B. Mahadevaswamy & V.Nattarasu	2th	Sanguine Technical Publishers	2006

E Books and online course materials:

1. https://onlinecourses.nptel.ac.in/noc20_ee45/preview?utm_source=chatgpt.com
2. https://www.iitg.ac.in/apvajpeyi/ph218/Lec-1.pdf?utm_source=chatgpt.com
3. https://content.kopykitab.com/ebooks/2016/06/7572/sample/sample_7572.pdf?utm_source=chatgpt.com

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/108/105/108105158/
2. https://nptel.ac.in/courses/108106188

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	13+14=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Simulation of Diode Clippers, Clampers, BJT and JFET	10
	Activity 2: Mini Project: Design of a Biomedical Signal Amplifier (ECG Pre-Amp)	10
Total		**50**

Activity Based Learning (27 Hours)

ABL 1 : Simulation of Diode Clippers, Clampers, BJT and JFET (13 Hrs)		
Simulation-Based Learning	Simulate half and full-wave rectifiers with filters	02
	Design and simulate **parallel clippers** with DC bias	03
	Simulate **positive/negative clampers** with/without bias	02
	Simulation of BJT CE amplifier with voltage divider bias	02
	Simulate JFET as an analog switch in ON/OFF states	02
	Submission of the report	02
ABL1: Total		**13**
ABL 2 : Mini Project: Design of a Biomedical Signal Amplifier (ECG Pre-Amp) (14 Hrs)		
Project Based Learning	Study ECG signal specs (amplitude, frequency range ~0.1–150 Hz)	02
	Design inverting amplifier with gain of 100–1000	02
	Add bandpass filter using RC circuits	01
	Add voltage follower for isolation	01
	Simulate ECG signal (or use waveform generator input)	02
	Add comparator to detect threshold condition (heartbeat level)	02
	Final testing + waveform capture	02
	Submission of the report	02
ABL2: Total		**14**
ABL1 + ABL2: Total		**27**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Activity 1 and 2	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3											2	
CO2	3	3										2	
CO3	3	3										2	
CO4	3	2										2	

Course Title	TRANSFORMERSAND INDUCTION MACHINES		
Course Code	24EE304	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: To analyze the performance of Transformers and Induction Motors.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Explain the principle operation of transformers and Induction motors.	1	1
2	Develop equivalent circuits of transformers and Induction motors.	1,2	1
3	Test the transformer to know their performance.	1,2,	1
4	Apply the knowledge of Induction motor to find their performance.	1,2	1

MODULE - 1	11 Hrs.

Transformers: Construction and Practical considerations of 1phase and 3 phase core and shell type transformers, Principle of transformer action for voltage transformation, Ideal and practical transformers, EMF equation, Transformation ratio, Transformer operation under no load and load condition, Vector diagrams, Exact and approximate equivalent circuit, voltage regulation, losses, power efficiency and All-day efficiency.
SLC: Auto-transformer: Construction, saving of copper, Advantages/disadvantages, Methods of cooling

MODULE - 2	10 Hrs.

OC-SC tests - Predetermination of efficiency and regulation, Polarity test, Sumpner's test, Parallel operation– need, conditions to be satisfied and load sharing. Choice of connection, all types of 3 phase transformer connection including open delta.
SLC: Special transformers and their applications.

MODULE - 3	11 Hrs.

Induction motors: Basic concepts, Construction, Concept of rotating magnetic field, Operating principle, Classification – 3-phase, Squirrel cage, Slip ring. Phasor diagram of Induction motor under no load and load, equivalent circuit, losses and efficiency, performance evaluation (HP, Torque, efficiency, current and power factor).
SLC: Construction and working principle of various types of single-phase induction motors.

MODULE - 4	10 Hrs

Torque-slip characteristics of motoring, Generating & Braking, Induction generator, No load and blocked rotor tests, Circle diagram and performance evaluation, Necessity of starters, DOL, Star -Delta starter, Auto-transformer starting, Rotor resistance starting, Speed control: voltage, frequency and rotor resistance variation.
SLC: Applications of three phase and single-phase induction motors

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Electrical Machinery	P. S. Bimbhra	1st	Khanna	2021
2	Electrical Machines	Nagarath and Kothari	5th	Tata McGraw Hill	1985

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Electrical Machines	V. K.Mehta and Rohit Mehta	2nd	S. Chand & Co	2002
2	Electrical Machines	Ashfaq Husain	2nd	Dhanapathrai& Co	2000
3	Electric Machinery	A. E. Fitzgerald	4th	McGraw-Hill Higher Education	2003
4	Theory of Alternating Current Machines	S. Langsdorf	2nd	Tata McGraw Hill	1993

E Books and online course materials:

1. https://www.scribd.com/doc/245014778/transformers-and-Induction-Machines

Online Courses and Video Lectures:

1. https://www.youtube.com/watch?v=EI0GJo00_oY
2. https://lectures.pi2.in/course/transformer-induction-motors-kiit/?v=dea99b4facad

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	14+13=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Industrial Visit	10
	Activity 2: Seminar	10
Total		**50**

Activity Based Learning (27 Hours)

ABL 1 : Industrial Visit (14 Hrs)		
Industrial visit / substation visit	Identify different types transformers and Induction motors	02
	Understanding the Features of above machines	04
	Writing the layout diagram	02
	Understand the working principle of the transformer / Induction machine	04
	Submission of the report	02
ABL 1: Total		**14**
ABL 2 : Seminar (13 Hrs)		
Seminar on different parts of transformers and Induction machines (Using you-tube videos)	Literature review	04
	Report writing	04
	Presentation, demonstration, viva-voce	05
ABL 2: Total		**13**
ABL1 + ABL2: Total		**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Quiz (1 and 2) (optional)	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3											3	
CO2	3	2										3	
CO3	2	3										2	
CO4	1	3										1	

Course Title	ANALOG ELECTRONICS LABORATORY		
Course Code	24EE305	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 30

Course Objective: To provide practical knowledge for the analysis of diode, transistor and Op-amp based circuits.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Apply the concepts of analog electronics to test the operation of diode and transistor-based circuits.	1,2	1
2	Analyze the performance and characteristics of amplifier and oscillator circuits through practical implementation.	1,2	1
3	Evaluate the frequency response of operational amplifier circuits.	1,2	1

List of Experiments

1. Testing of Bridge rectifier with and without filter.
2. Testing of Diode parallel Clipping circuits.
3. Testing of Diode clamping circuits.
4. Testing of zener diode as voltage regulator.
5. Testing of a single stage BJT based RC coupled amplifier and determination of frequency response, input and output characteristics.
6. Testing of RC phase shift oscillator and determination of frequency of oscillation.
7. Testing of FET/MOSFET as a switch to on/off the lamp load.
8. Frequency response of Inverting Amplifier using Op-Amp
9. Frequency response of Non-inverting Amplifier and Voltage follower using op-amp 741-IC.
10. Testing of inverting and non-inverting Zero-crossing detector.

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3										2	
CO2	3	3										2	
CO3	3	3										2	

Course Title	TRANSFORMERS AND INDUCTION MACHINES LABORATORY		
Course Code	24EE306	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 30

Course Objective: To test and operate the transformers and induction machines.

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

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Test transformer and Induction motor to know the performance	1,2	1
2	Develop skills to operate and control transformer and Induction motor	1,2	1
3	Illustrate record writing skills, communication skills with upholding electrical ethical values in electrical engineering	1,2,9,10,11	1

List of Experiments

1. SC & OC test 1-phase transformer & predetermination of efficiency & regulation for different loads & PFs; verification by direct loading for UPF.
2. Sumpner's test.
3. Polarity test on 1-phase transformer.
4. Parallel operation of two dissimilar 1-phase transformers.
5. Connection of three 1-phase transformers in star-delta and determination of efficiency & regulations for balanced direct loading (UPF).
6. Load test on 3-phase Induction motor – performance evaluation (Torque-speed, BHP-efficiency, BHP-PF, slip-BHP).
7. No load and Blocked rotor test on three-phase slip ring IM: Circle Diagram of 3 phase Induction Motor-performance evaluation.
8. Determination of equivalent circuit parameters of 1- phase induction motor-performance evaluation.
9. Speed control of 3-phase Induction motor by Stator voltage control.
10. Load test on 1-phase Induction motor.

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2										2	
CO2	2	3										2	
CO3	2	2							1	1	1	1	

ENGINEERING SCIENCE COURSE – II

Course Title	ELECTRICAL AND ELECTRONICS MEASUREMENTS		
Course Code	24ESEE31	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: To analyse the basic concepts about the construction, working principles and applications of various measuring Instruments.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Explore the various techniques to measure different parameters of measuring instruments.	1, 2	1
2	Apply the concept of electrical parameters for various types of AC and DC bridges and measuring instruments	1, 2	1
3	Explain the basic principle of analog and digital meters.	1, 2	1
4	Describe the basic medical essentials of measuring instruments and their uses.	1, 2, 6	1

MODULE - 1 — 11 Hrs.

Measurement of Resistance, Inductance and Capacitance: DC bridges: Wheatstone's bridge- sensitivity, limitations. Kelvin's double bridge, Illustrative Examples. Earth resistance measurement by fall of potential method, Megger and measurement of earth resistance.

AC Bridges: Sources and Detectors, Anderson's bridge, Schering bridge. Illustrative Examples. Extension of instrument ranges using Shunts and multipliers.

Instrument transformers: Use of CTs and PTs for current, voltage and Power measurements, Ratios and Burden of instrument transformer, Problems on CT and PT.

SLC: Comparison between CT and PT.

MODULE - 2 — 10 Hrs.

Measurement of Power, Energy, Power Factor and Frequency: Electrodynamometer type wattmeter: construction, theory and operation of UPF and LPF watt meters. Method of measurement of three phase real and reactive power using two wattmeter method and illustrative examples.

Single phase induction type energy meter: construction and working principle, errors, adjustments, and illustrative examples.

Single phase Electrodynamometer power factor meter - construction and working principle. **Weston frequency meters-** construction and working principle. Phase sequence indicator.

SLC: Digital energy meter

MODULE - 3 — 11 Hrs.

Electronic and Digital Instruments: Introduction. Essentials of electronic instruments, Advantages of electronic instruments. Analog to digital converter, resolution, quantization error, True rms reading voltmeter.

Digital voltmeters (DVM): Ramp type DVM, Integrating type DVM and Successive approximation DVM. Digital energy meter. Digital Maximum demand indicator, Digital multimeter.

Digital Meters for Medical Applications and its advantages: Glucometers, Blood pressure monitors, respiration rate meters.

SLC: Pulse oximeters and Heart rate monitors

MODULE - 4 — 10 Hrs

Transducers and Oscilloscopes: Transducers: Introduction, Electric transducers, Types of Electric Transducer, Classification of transducers**,** and Measurement of pressure using primary transducer.

Oscilloscopes -Block diagram of a general-purpose oscilloscope, method of measuring amplitude, phase, frequency, period, use of Lissajous patterns, Digital Storage Oscilloscope-working principle, Signal Generators and Function Generators. **Sensors:** Temperature sensor and strain gauge.

SLC: Position and Proximity Sensor

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Electrical and Electronic Measurements and Instrumentation	A. K. Sawhney	4th	Dhanpatrai and Sons	1985
2	Modern Electronic Instrumentation and Measuring Techniques	Cooper D. and A.D. Heifrick	-	PHI	1958

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Electrical Measurements and Measuring Instruments	Golding and Widdies	-	Pitman	1949
2	Electronic Instrumentation and Measurement	David A. Bell	2nd	PHI	2006

Books and online course materials:

1. http://182.160.117.219:8080/xmlui/handle/123456789/145
2. https://archive.org/details/in.ernet.dli.2015.19585

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	14+13=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Substation visit and detailed report of that visit	10
	Activity 2: Presentation of Self learning concepts	10
Total		**50**

Activity Based Learning (27 Hours)

ABL 1 : Substation visit and detailed report of that visit		
Substation visit and detailed report of that visit	Introduction	02
	Company Profile	02
	Objectives of the Visit	02
	Visit Details	03
	Observation and Learning's	05
ABL 1: Total		**14**
ABL 2 : Presentation of Self learning concepts		
Presentation of Self learning concepts	Preparation of a report	03
	Preparation of slides	05
	Presentation	05
ABL 2: Total		**13**
ABL 1 + ABL 2: Total		**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Quiz (1 and 2) (optional)	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2										1	
CO2	3	2										1	
CO3	3	1										1	
CO4	3	2				3						1	

Course Title	INTRODUCTION TO PLC		
Course Code	24ESEE32	(L-T-P) C	3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: To develop ladder programming skills to control plc based system.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Describe architecture and hardware of PLC.	1	2
2	Discuss input, output devices used with PLCs.	1,2	2
3	Apply ladder programming using basic and advanced ladder logic to solve control problems.	1,2	2
4	Apply PLC knowledge to recommend appropriate automation strategies for specific tasks.	1,2,5	2

MODULE - 1	11 Hrs

Introduction to PLC: Programmable logic controller hardware and internal architecture, CPU, buses, memory, input/output unit, sourcing and sinking, PLC programming.

Input devices: Common terms to define performance of sensors, mechanical switches, proximity sensors, photoelectric sensors and switches, encoders, temperature sensors.

SLC: IEC 61131 Standard for PLCs.

MODULE - 2	10 Hrs

Interfacing of Input Devices to PLC: Position/displacement sensors, strain gauge, pressure sensors, liquid level sensor, fluid flow sensor, smart sensor.

Interfacing of Output devices to PLC: Relay, solenoids and directional valves, single and double acting cylinders, dc motor control.

SLC: Stepper motors and its drivers.

MODULE - 3	11 Hrs

PLC Ladder programming: Ladder diagrams, PLC ladder programming, logic functions, multiple outputs, latching, interlocking, entering programs, ladder programs for simple applications.

Advanced Ladder Logic: Jump, jumps within jumps, subroutines, master control. Ladder logic Programming with Basic gates, Sequencing, latching and Interlocking and Basic real-world problems using basic gates.

SLC: Function blocks.

MODULE - 4	10 Hrs

Advanced Ladder Logic: Types of timers, on-delay timer, off-delay timer, pulse timer, retentive timer, forms of counters, up-counter, and down-counter. Ladder logic Programming with Timers and counters, Basic real-world problems involving timers and counters and Interfacing sensors and actuators with PLCs.

SLC: Timers with counters.

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Programmable Logic Controllers	W. Bolton,	-	Elsevier Publication, Oxford UK.	-

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Programmable Controllers-An Engineers Guide	E.A Paar	-	Newness publication	-
2	Process Control Instrumentation Technology	Johnson Curties	8th	Prentice Hall of India.	-
3.	Programmable logic controller: principle and application",	John W Webb, Ronald Reis,	-	Pearson publication	-

E Books and online course materials:

1. tf.ues.rs.ba/~slubura/Procesni%20racunari/Programmable%20Logic%20Controllers%204th%20Edition%20(W%20Bolton).pdf

Online Courses and Video Lectures:

1. https://www.udemy.com/course/an-introduction-to-plc-programming/

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	14+13=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Simulation based Activity	10
	Activity 2: Laboratory activity	10
Total		**50**

Activity Based Learning (27 Hours)

ABL 1 : Simulation based Activity (14 Hrs)		
Programming exercises	Staircase lighting programs DC Motor direction control Valve operation programs Pump applications Lamp task	08
	Report writing	04
	Submission	02
ABL 1: Total		**14**
ABL 2 : Laboratory activity (13 Hrs)		
Hands on laboratory experiments	Basic gates Interlocking Traffic lights Star Delta starter Real time clock	05
	Experimental set up and demonstration	05
	Submission of report	03
ABL 2: Total		**13**
ABL 1 + ABL 2: Total		**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Activity (1 and 2)	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3												2
CO2	3	2											2
CO3	3	2											2
CO4	3	2			3								2

Course Title	SENSORS AND IOT		
Course Code	24ESEE33	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: To develop skills to learn sensor based IoT systems.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Discuss the operating principle of various sensors.	1	2
2	Apply the knowledge of sensors and transducers for different applications.	1,2	2
3	Explain fundamental protocols necessary for working of IoT.	1	2
4	Develop the knowledge of programming IoT and interfacing peripherals and sensors.	1,2	2

MODULE – 1	10 Hrs.

Introduction to sensors: Introduction, Classification of sensors, selection of sensors, mechanical devices as primary detectors, mechanical quantities and their modes of operation, introduction to transducers, electric transducers (types) its advantages, process control block diagram, strain gauges, proximity sensors, pneumatic sensors, light sensors.

SLC: Pressure transmitter

MODULE - 2	11 Hrs.

Types of transducers, Data acquisition and telemetry: Resistance transducer, capacitive transducer, thermoelectric transducer, photoelectric transducer, Block diagram of generalized data acquisition system, objective and configuration of DAS, introduction to telemetry, block diagram of general telemetering system

SLC: Frequency modulation Telemetry system

MODULE - 3	11 Hrs.

Fundamentals of IOT: Introduction –definition and characteristics of IOT, physical design, IOT protocols– Logical design-IOT communication models, IOT communication API's, Wireless sensor networks, domain specific IOT's, IOT architectural view.

SLC: History of IOT

MODULE - 4	10 Hrs.

Elements of IOT and protocols: IOT and M2M and its difference, software defined networks-network function virtualization, IOT systems management-needs NETCONF-YANG, IOT design methodology, and communication modules-ZigBee-LoRa-ARDUINO.

Interfacing: LED interfacing, Relay interfacing, Pushbutton interfacing, LCD display interfacing, temperature sensor interfacing.

SLC: Fire base cloud and AWS cloud

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Electronic Measurements and instrumentation	R.K Rajput	3rd Edition	S. Chand	2013
2	Instrumentation measurement and analysis	B.C Nakra, K. K Chaudary	2nd reprint 2003	Tata McGraw Hill publishing company Limited	2003
3	Internet of Things (A hands on approach)	Vijay Madisetti and Arshdeep Bahga	1st	VPT	2016
4	Internet of Things and its Applications	Jain, Prof. Satish, Singh, Shashi	1st	BPB	2020

Reference Books:

Sl.No	Book Title	Authors	Editi on	Publisher	Year
1	Transducers and instrumentation	Murty, D. V. S.	-	PHI Learning Pvt. Ltd	2010
2	Internet of things_ do-it-yourself projects with Arduino, Raspberry Pi, and Beagle Bone Black	Donald Norris.	1st	McGraw-Hill	2015
3	Building Arduino Projects for the Internet: Experiments with Real-World Applications	Adeal Javed Lake Zurich, Illinois	1st	USA, A press	2016
4	A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawheny		Dhanpat Rai	2015

E Books and online course materials:

1. Sensors and transducers, third edition, Ian Sinclair, Newnes publication.
2. https://shorturl.at/WBj1R
3. https://shorturl.at/EWk7C

Online Courses and Video Lectures:

1. https://www.courseera.org/
2. https://nptel.ac.in/courses/

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	14+13=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Lab based learning	10
	Activity 2: Development of models using Arduino Board	10
Total		**50**

Activity Based Learning (27 Hours)

ABL 1: Lab based learning (14 Hrs.)		
Arduino IDE software	Introduction to Arduino IDE software	02
	Software installation of Arduino IDE	04
	Introduction to sensors concept and different types of sensors.	02
	Explanation and writing of program structure in Arduino IDE Software and execution of programs in Arduino IDE	04
	Introduction to Simulation software TINKERCAD	01
	Basic model making using sensors and concept of IOT.	01
ABL 1: Total		**14**
ABL 2: Development of models using Arduino Board (13 Hrs.)		
Project Based Learning	Literature review	02
	Report writing	04
	Presentation, demonstration, viva-voce	07
ABL 2: Total		
ABL1 + ABL2: Total		**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Activity (1 and 2)	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	3												1
CO2	3	1											1
CO3	3												1
CO4	3		2		2								1

Course Title	PROGRAMMING IN C++		
Course Code	24ESEE34	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: To develop program writing skills using C++.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Apply the basic concepts of C++ programming to the problems.	1, 2, 5	2
2	Develop programming skills in C++ using control structure.	1, 2, 5	2
3	Solve the given problem using functions.	1, 2, 5	2
4	Build the concept of object oriented programming.	1, 2, 5	2

MODULE - 1	12 Hrs.

Introduction: Comparison between PoP and OoP, Basic features and concept of OoP. The C++ Program, input operator, output operator, Pre-processor directives; The C++ Basic Data Types, operators in C++, character and literals, variables, tokens, literals, initializing variables, output operator, input operator, simple programs.

MODULE - 2	10 Hrs.

Selection: if statement, if –else statement, comparison operators, switch statement, programs on selection statements.

Iteration: THE while STATEMENT, TERMINATING A LOOP, THE do..while STATEMENT, THE for STATEMENT, THE break STATEMENT, THE continue STATEMENT, THE goto STATEMENT, Programs on iteration statement.

MODULE - 3	10 Hrs.

Derived data types: Arrays, pointers, reference, functions.

Functions: Function prototype, declaration of a function, calling a function, void functions, returning a value, passing by value, passing by reference, default arguments, programs on functions.

MODULE - 4	10 Hrs

Functions: inline functions, recursive functions, overloaded functions, Generic functions (function template), a generic swap.

Classes and object: Concept of PoP and OOP, Class prototype, access specifier, define member function inside the class, define member outside the class, creation of objects, programs.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Object-Oriented Programming with C++	E. Balaguruswamy	8th	McGrawhill (India)	2021
2	Programming with C++	John R Hubbard	2nd	McGraw Hill	2000

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	C++, The complete reference	Herbert Schmidt	3rd	TMH	1998
2	Object-Oriented Programming in C++	Robert Lafore	3rd	The Waite Group, Galgotia Publications	1999
3	The C++ Programming Language	Bjarne Stroustrup	4th	Addison-Wesley	2003

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/106/105/106105151/
2. https://archive.nptel.ac.in/courses/106/105/106105151/
3. https://www.w3schools.com/cpp/cpp_oop.asp

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	-	-	-
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	26+15=41
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Basic Programs	10
	Activity 2: OOPs Programming	10
Total		**50**

Activity Based Learning (41 Hours)

ABL 1 : Basic Programs		
Programming using branching , looping, functions	Programming using to class based on percentage	02
	Programming the simple calculator	02
	Programming using looping find total marks of all semester then declare CGPA	04
	Program to generate even/prime/odd series	04
	Program to find factorial of a number	04
	Submission of the report	06
	Quiz	04
ABL1: Total		**26**
ABL 2 : OOPs Programming		
Programming using OOPs	Create class called library	05
	Program to monitor the books drawn, date of return and calculate the fine to be paid	10
ABL2: Total		**15**
ABL1 + ABL2: Total		**41**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Activity (1 and 2)	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	3	-		2								2
CO2	2	3	-		2								2
CO3	1	3	2		2								2
CO4	2	3	-		2								2

Course Title	SOCIAL CONNECT AND RESPONSIBILITY		
Course Code	24SCR	(L-T-P) C	(0-0-2) 1
CIE	100	Hours/Week	2
SIE	-	Total Hours	28 + 02 = 30

Course Objective: Provide a formal platform for students to communicate and connect with their surroundings and create a responsible connection with society

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Describe societal challenges and build solutions to alleviate these complex social problems through immersion, design & technology.	3,5,6	-
2	Communicate and connect with their surroundings.	7, 12	-

Course Articulation Matrix

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			3		2	3								
CO2							3					3		

MODULE-1	7 Hrs

Plantation and adoption of a tree: Plantation of a tree that will be adopted by a group of students. They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

MODULE-2	7 Hrs

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms.

MODULE-3	7 Hrs

Organic farming and waste management: Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.

MODULE-4	7 Hrs

Water Conservation: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices. **Food Walk City's** culinary practices, food lore, and indigenous materials of the region used in cooking.

Course Conduction

A total of 15-20 hours engagement per semester is required for the course. Students will be divided into teams and each team will be handled by two faculty mentors. Faculty mentors will design the activities for evaluation.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE)

After completion of, the social connect, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed.

- Dairy recording the details of activity conducted
- Planning and scheduling the social connect
- Information/Data collected during the social connect
- Analysis of the information/data and report writing

Considering all above points allotting the marks as mentioned below

Excellent	80 to 100
Good	60 to 79
Satisfactory	40 to 59
Unsatisfactory and fail	<=39

Web Link:

1. https://onlinecourses.nptel.ac.in/noc24_hs167/preview

ABILITY ENHANCEMENT COURSE – III

Course Title	ELECTRIC CIRCUITS AND MEASUREMENTS LABORATORY		
Course Code	24AEEE31	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 28

Course Objective: To practice and analyze design of electric circuits using network theorems.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Demonstrate the experimental skills to measure resistance, inductance, capacitance and power	1,2,5,9	1
2	Apply basic laws and network theorems to analyse given circuit.	1,2,5,9	1
3	Analyze the measurement error and reliability of electrical measuring equipment.	1,2,6,7	1

LIST OF EXPERIMENTS

1. Resonance characteristics of series circuits.
2. Resonance characteristics of parallel circuits.
3. Verification of KCL & KVL for multi-loop electrical circuits, with independent DC sources.
4. Verification of Thevenin's Theorem.
5. Verification of Norton's theorem.
6. Measurement of single phase power and power factor for fluorescent lamp
7. Measurement of three phase power using two wattmeter method in star and delta connected system
8. Determination of errors in single phase energy meter.
9. Measurement of low resistance using kelvin's double bridge.
10. Measurement of inductance and determination of Q-factor.
11. Measurement of capacitance and determination of dissipation factor using Schering bridge

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3			1				2				2
CO2	2	3							2				2
CO3	1	2				1	2		1				1

Course Title	SCILAB/MATLAB FOR ELECTRICAL ENGINEERING		
Course Code	24AEEE32	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 28

Course Objective: To develop practical skills for simulating and modeling of Electrical and Electronics circuits.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Demonstrate proficiency in using simulation tools to model electrical and electronic systems.	1,2,5	1
2	Apply fundamental circuit laws and theorems to verify the behavior of DC and AC electrical circuits.	1,2,5	1
3	Assess the performance of various analog electronic circuits.	1,2,5	1

LIST OF EXPERIMENTS

1. Introduction to MATLAB and Simulink
2. Generation of various signals and sequences (Periodic and Aperiodic), such as unit Impulse, Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp.
3. Simulation of DC circuits using Mesh Analysis
4. Verification of Thevenin's theorem.
5. Verification of Maximum Power Transfer theorem.
6. Simulation of Half and Full wave rectifier
7. Simulation of RC coupled amplifier
8. Simulation of low pass and high pass filter
9. Simulation of inverting and non-inverting using operational amplifiers
10. Transient Analysis of RC Networks

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3			3							3	
CO2	2	3			3							3	
CO3	3	2			3							3	

Course Title	EFFECTIVE COMMUNICATION AND REPORT WRITING SKILLS		
Course Code	24AEEE33	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 28

Course Objective: To demonstrate effective written and oral communication skills by composing professional reports and delivering structured presentations.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Apply principles of effective communication to compose clear, concise, and structured professional documents.	9,10,11	-
2	Demonstrate proficiency in oral communication through presentations, group discussions, and interpersonal interactions.	9,10,11	-
3	Analyze and evaluate written reports for coherence, grammatical accuracy, and organizational structure.	1,2, 9,10,11	-

LIST OF EXPERIMENTS

1. Barriers to Communication – Role Play and Analysis
2. Active Listening and Feedback Skills
3. Verbal and Non-Verbal Communication Practice
4. Public Speaking and Oral Presentation
5. Group Discussion (GD) Simulation
6. Resume and Cover Letter Drafting
7. Email and Business Correspondence Writing
8. Technical Report Writing
9. Minutes of Meeting and Agenda Writing
10. Editing and Proofreading Practice

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1									2	2	2		
CO2									2	2	2		
CO3	3	2							2	2	2		

Course Title	WEB TECHNOLOGY LABORATORY		
Course Code	24AEEE34	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 28

Course Objective: To demonstrate effective written and oral communication skills by composing professional reports and delivering structured presentations.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Develop web pages using HTML, DHTML and Cascading Styles sheets.	1,3,5,11	-
2	Build and consume web services.	1,5	-
3	Develop a Program using XML.	1,3,5,11	-

LIST OF EXPERIMENTS

1. Introduction to web technology
2. Create a HTML page, which has properly aligned paragraphs with image along with it
3. Write a program to display list of items in different styles.
4. Create both client side and server side image maps.
5. Create your own style sheets and use them in your web page.
6. Create a form with various fields and appropriate front and validations using any one of the scripting languages.
7. Write a program to store the form fields in a database, use any appropriate Server Slide Scripting.
8. Create a web page using XML.
9. Write a program to connect a XML web page to any database engine.

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2		3		2						2		
CO2	2				3								
CO3	1		2		2						2		

FOURTH SEMESTER

Course Title	DIGITAL ELECTRONIC CIRCUITS		
Course Code	24EE401	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: To apply logic design methods for the analysis of digital logic circuits.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
CO1	Apply laws based on Boolean algebra for the realization of logic networks using basic and universal gates.	1,2,5	1
CO2	Formulate Combinational Logic Networks involving MSI and LSI components.	1,2,3,5	1
CO3	Develop logic networks for flip-flops using gates.	1,2,5	1
CO4	Design Sequential circuits using memory elements and Mealy-Moore models.	1,2,3	1

MODULE-1	12 Hrs

Principles of Combinational Logic: Introduction to fundamentals of Boolean algebra, basic gates and combinational networks, definition of combinational logic, canonical forms, generation of Boolean expressions from truth tables, universal gates, Realization of a logical function using only NAND and NOR gates. Karnaugh maps-3,4,5 variables, Implicants, Prime Implicants and Essential Prime Implicants, Incompletely specified functions (Don‘t care terms), SimplifyingMax term equations, Quine-McCluskey minimization technique, Map-Entered Variables.

SLC*:* Quine-McCluskey using don’t care terms

MODULE-2	10 Hrs

Logic Design with MSI Components: Binary adders and subtractors. Look ahead adder. Decimal adders. Comparators. Decoders. Logic design using decoders. Encoders. Multiplexers. Logic design with multiplexers. Programmable Logic Devices-Programmable Logic Devices (PLD). PLD notation; programmable read-only memories (PROMS). Programmable Logic Arrays (PLAS). Programmable Array Logic (PAL) devices.

SLC: Field Programmable Gate Array (FPGA).

MODULE-3	10 Hrs

Flip-flops and applications: S-R latch and Gated S-R latch. Gated D latch. Pulse triggered master-slave S-R flip flop. The master-slave J-K flip-flop. Edge-triggered flip-flop; Positive edge-triggered D flip-flop; Negative edge-triggered D flip-flops. Characteristic equations of flip-flops. Registers. Binary ripple counters. Synchronous binary counters. Counters based on shift registers.

SLC: Ring and Johnson Counters

MODULE-4	10 Hrs

Sequential Circuit Design: Design of synchronous counters using clocked J-K flip-flops. Design of synchronous counter using clocked D, T or S-R flip-flops. Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, counter design.

SLC: Applications of Mealy and Moore models

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Digital Principles and Design	Donald D. Givone	1st	Tata Mc-Graw Hill	2002
2	Digital Logic Applications and Design	John M Yarbrough	1st	Thomson Learning	2001

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Logi Design – A Simplified Approach	R. D. Sudhakar Samuel	1st	Sanguine Technical Publishers	2005

Online Courses and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc25_ee20/preview
2. https://onlinecourses.nptel.ac.in/noc25_ee24/preview
3. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	20+07=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Lab based learning	10
	Activity 2: Lab based learning	10
Total		**50**

Activity Based Learning (27 Hours)

ABL 1: Lab based learning (20 Hrs)		**Hours**
Simulation of Combinational Circuits	Realization of combinational circuit for given minterms using basic gates.	02
	Design and simulation of combinational circuit for given maxterms.	02
	Simulation of adders, subtractors	02
	Simulation of decoders	02
	Simulation of encoders	02
	Simulation of multiplexers	02
	Simulation of minterms using PROMs/PLAs	02
	Report Writing	03
	Presentation	03
ABL1: Total		**20**
ABL 2: Lab based learning (07 Hrs)		
Implementation of digital circuit	Digital circuit implementation on breadboard	02
	Report Writing	03
	Demonstration	02
ABL2: Total		**07**
ABL1 + ABL2: Total		**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Activity (1 and 2)	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-		2							2	
CO2	2	3	2		2							2	
CO3	3	3	-		2							2	
CO4	2	3	3		-							2	

Course Title	ELECTRICAL POWER GENERATION AND TRANSMISSION		
Course Code	24EE402	(L-T-P) C	(4-0-0) 4
CIE	50	Hours/Week	4
SEE	50	Total Hours	56L + 64ABL = 120

Course Objective: To analyze Electric power Generation plants and transmission lines.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Explain the fundamental concepts of power generation plants.	1	1
2	Analyze the performance of electrical Power plants.	1,2	1
3	Apply the knowledge of electrical laws to know transmission line parameters.	1,2	1
4	Assess the performance of transmission line using different network model.	1,2	1

MODULE - 1	14 Hrs.

Electrical Power Generation: Advantages, disadvantages and site selection for hydro power generation, Thermal power plant, Nuclear power station, wind power plant and solar power plants.

Hydro Power Generation: Classification of hydroelectric plants, General arrangement and operation, Power station structure and control.

Thermal: Main portions, working, plant layout. **Nuclear Power Station:** Component of reactors, working, safety of nuclear power reactor. **Diesel Electric Station:** Diesel electric plants and component, choice and characteristics, plant layout and maintenance.

Introduction to tidal power plants and geo thermal plants.

SLC: Description of Hydro Electrical Power Stations in Karnataka

MODULE - 2	14 Hrs.

Performance analysis: Introduction, terms used in system operation: diversity factor, load factor, plant capacity factor, plant use factor, plant utilization factor, loss factor, load duration curve, energy load curve. **Power factor improvement:** causes, disadvantages and methods to improve. **Tariffs:** objectives and requirements of tariff, characteristics of tariff and types of tariffs. Interconnection of power station, Numerical Examples

SLC: Power Import/port between India and other countries.

MODULE - 3	14 Hrs.

Typical transmission, Standard voltages for Transmission, Advantages of high voltage transmission.

Overhead transmission line: Introduction to transmission tower structures and its classification. Definition of sag, sag calculation in conductors- **(a)** Suspended on level supports **(b)** Supports at different levels. Effect of wind and ice.

Line parameter - Inductance: Calculation of inductance of single phase, three phase lines with Equilateral and unsymmetrical spacing.

Line parameter - Capacitance: Capacitance-calculation for two wires and three phase Lines, capacitance calculation for two wires 3-phase lines with equilateral and Unsymmetrical spacing. Numerical Examples.

SLC: Stringing Chart

MODULE - 4	14 Hrs

Power transmission lines: Short and medium lines, Introduction, Classification of overhead transmission lines, Representation of transmission lines, Terms related to performance of transmission lines, Performance analysis of short transmission lines, Medium transmission lines. Generalized circuit constants of nominal T network lines. Long Transmission Lines, Condenser method, nominal T and π representation of medium transmission lines, Representation of long transmission lines.

SLC: Generalized circuit constants of nominal π network lines.

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Power System Engineering	Chakrabarti A., M.L. Soni, P.V. Gupta and .S..Bhatnagar	-	Dhanpat Rai & Co. (Pvt.) Ltd	2003

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Electric Power Generation Transmission and Distribution	S. M. Singh	2nd	Prentice Hall of India	2008
2					

E Books and online course materials:

1. https://**Electric Power Generation, Transmission and Distribution.** *Author:* S. N. Singh
2. https://www.phindia.com/Books/ShoweBooks/MTMwNw/Electrical-Power-Systems

Online Courses and Video Lectures:

1. https://www.coursera.org/specializations/power-system-generation-transmission-and-protection
2. https://onlinecourses.nptel.ac.in/noc22_ee17/preview

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	4	14	56
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	22+21=43
Total Learning Hours / Semester				**120**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Simulation based Activity	10
	Activity 2: Field Visit activity	10
Total		**50**

Activity Based Learning (43 Hours)

ABL 1 : Simulation based Activity (22 Hrs)		
Simulation based Assignments	Simulation of short transmission lines Simulation of Medium Transmission lines i) T method ii) π method Simulation of transmission line parameters	3*5=15
	Demonstration	01
	Report writing and submission	06
ABL1: Total		**22**
ABL 2 : Field Visit activity (21 Hrs)		
Generation Power plant / Substation visit	Pre Visit Procedure	02
	Visit	10
	Report preparation	05
	Presentation	02
	Quiz	02
ABL2: Total		21
ABL1 + ABL2: Total		**43**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Quiz (1 and 2) (optional)	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3											3	
CO2	2	3										2	
CO3	2	3										3	
CO4	2	3										2	

Course Title	SYNCHRONOUS AND SPECIAL ELECTRICAL MACHINES		
Course Code	24EE403	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: To analyze different types of synchronous machines and special electrical machines.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Interpret the concepts of synchronous machines.	1	1
2	Explain the principle operation of special electrical machines.	1	1
3	Analyze the performance of Synchronous machines and special electrical machines.	1,2	1
4	Solve various types of numerical problems, with respect to synchronous machines	1,2	1

MODULE - 1 **10 Hrs.**

Synchronous Machines: Basic principles of operation, construction of salient and non-salient pole synchronous machines, Generated EMF considering the effect of distribution and short chording of winding, causes of harmonics and its elimination, slot harmonics, methods of reducing slot harmonics. Numerical Problems.

SLC: Different types of windings.

MODULE - 2 **10 Hrs.**

Voltage Regulation: Armature reaction, reasons for voltage drops in synchronous machines, EMF, MMF & ZPF methods of determining voltage regulations, comparative studies. Numerical Problems

SLC: ASA method of Voltage regulation.

MODULE - 3 **12 Hrs.**

Salient pole Synchronous Machines: Salient pole synchronous machines, Two reaction theory, concept of Xd and Xq, phasor diagram, Power output, Power angle diagram, Reluctance power, Slip test. Synchronization of Alternator with infinite bus bar, Parallel operation of alternators, synchronising current, synchronising power, Effect of change of excitation and input power, Load sharing, Numerical Problems.

SLC: Hunting in synchronous machines, Damper winding's.

MODULE - 4 **10 Hrs**

Special Machines: Introduction, Variable Reluctance Stepper Motor, Permanent Magnet Stepper Motor, Hybrid Stepper Motor, Windings in Stepper Motors, working principle, Torque Equation, Applications of Stepper Motor Classifications of permanent magnet motors, Construction and working principle of Permanent Magnet DC (PMDC) motor, Brushless Permanent Magnet DC (BLDC) Motors.

SLC: Applications of permanent magnet motors.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Electric Machinery	P. S. Bhimbra	-	Khanna Publishers	-
2	Electric machines	I. J. Nagrath & D. P. Kothari	3rd	TMH	-
3	Special Electrical Machines	K Venkataratnam	-	Universities Press	2024

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Theory of Alternating Current Machines	A. S. Langsdorf	2nd	Tata McGraw Hill	1993
2	Electrical Machines	V. K. Mehta and Rohit Mehta	2nd	S. Chand & Co	
3	Problems in Electrical Engineering	N. N parker Smith		CBS publishers	

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	14+13=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (50 marks):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Substation visit and detailed report of that visit	10
	Activity 2: Presentation of Self learning concepts	10
Total		**50**

Activity Based Learning (27 Hours)

ABL 1 : Substation visit and detailed report of that visit		
Substation visit and detailed report of that visit	Introduction	02
	Company Profile	03
	Objectives of the Visit	03
	Visit Details	03
	Observation and Learning's	03
ABL1: Total		**14**
ABL 2 : Presentation of Self learning concepts		
Presentation of Self learning concepts	Preparation of a report	03
	Preparation of slides	03
	Presentation	04
ABL2: Total		**13**
ABL1 + ABL2: Total		**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Quiz (1 and 2) (optional)	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2											2
CO2	3	2											2
CO3	3	2											2
CO4	2	3											2

Course Title	MICROCONTROLLERS		
Course Code	24EE404	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: To develop programming skills on 8051 and ARM microcontroller and interfacing techniques.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Explain the fundamentals of 8051 and ARM microcontrollers.	1	2
2	Develop Assembly Level Programming for the given problem using 8051 microcontroller	1, 2	2
3	Describe the functions of ARM Cortex Microcontroller.	1, 2	2
4	Build embedded C Program to interface peripheral to ARM Cortex M3 Microcontroller	1, 2, 3	2

MODULE-1 — 11 Hrs

Introduction: Introduction to Microprocessors, Microcontroller and Microcomputer, Architecture of 8051 , Pin details of 8051 and their functions, Internal Memory Organization of 8051

Instructions and Programming using 8051 Microcontroller: Instruction Set of 8051- format of an instruction and execution of the instructions, Different addressing modes of 8051. Data transfer instructions and programming using data transfer instructions. Logical instructions- Byte level logical Operations, rotate and Swap Operations, programming using Logical instructions, Bit Manipulation Instructions- Bit addressable area in internal RAM, Bit addressable SFRs, programming using Bit Manipulation Instructions.

SLC : Different types of Memory, Stack, Crystal Oscillator and Reset circuit

MODULE-2 — 11 Hrs

8051 Instructions and Programming using 8051 Microcontroller: Arithmetic Instructions - Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Adjust, programming using Arithmetic Instructions.

Branching instructions - **c**lassification of Jump and Call instructions, Difference between Jump and Call instructions, , programming using Branching instructions, Subroutines

SLC : Program Status Word, Classification of instructions

MODULE-3 — 10 Hrs

ARM Cortex M3 Microcontroller: ARM Technology overview and design philosophy, ARM Processor Modes, ARM Processor Embedded Hardware and Software, ARM Memory Mapping, Processor Modes, Register Set, Data Flow Model, Data Processing Instruction, Data Transfer Instructions, Control Flow and Conditional Execution.

Peripherals and Programming: GPIOs Configuration, Timers, Sys Tick Timers, NVIC Controllers, DAC, Embedded C Example Programs.

SLC: Watch Dog Timer, Pulse Width Modulation

MODULE - 4 — 10 Hrs

ARM Microcontroller and Communication Protocols and Programming: UARTs, I2C, SPI, Embedded C Example Programs

ARM Microcontroller Interfacing: Interfacing of Switches, Buzzer, Seven Segment Display, LCD (8 bit mode), Keypad (4*4), DC Motor, Stepper Motor, Relay, Ultrasonic sensor, PIR Sensor, Embedded C Example Programs.

SLC: CAN protocol, Interfacing Temperature Sensor

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	The 8051 Microcontroller	Kenneth Ayala	3rd	Thomson Learning	2007
2	The 8051 Microcontroller and Embedded Systems Using Assembly and C	M A Mazidi, J G Mazidi and R D Mckinlay	2nd	Prentice Hall India	2007
3.	The Definitive Guide to ARM Cortex M3	Joseph Yiu	2nd	Newnes	2010
4.	ARM System Developer's Guide	Andrew N Sloss, Dominic Symes, Claris Wright	2nd	-	-

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Programming & Customizing 8051 the Microcontroller	Myke Predko	-	Tata MGH.	-
2.	ARM System On-Chip Architecture	Steve Furber	2nd	Pearson Education	

E Books and online course materials:

1. https://wiki.ifsc.edu.br/mediawiki/images/2/29/MIPM3TUG.pdf

Online Courses and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc22_cs93/preview
2. https://www.udemy.com/course/stm32-introduction-to-stm32-stm-electronics/?srsltid=AfmBOormJMIbjhQ7n0udXGFfYw-2neNmIOt4jI7dMNq9fi8p0ca9_5mk&couponCode=CP130525

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning (ABL)	-	-	14+13=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Components Survey	10
	Activity 2: Mini Project	10
Total		**50**

Activity based learning (27 Hours)

ABL 1 : Components Survey (14 Hrs)		
Prerequisite of the project	List out the different types of microcontrollers	02
	Understanding the Features of above listed Microcontrollers	04
	List out the types of LEDs, Object Sensors	02
	Understand the working principle of the above peripherals	04
	Submission of the report	02
ABL1: Total		**14**
ABL 2 : Mini Project (13 Hrs)		
Project Based Learning	Interface LEDs/Object sensor to the µC	2
	Programming using embedded 'C'	4
	Project Presentation	4
	Submission of the report	3
ABL2: Total		**13**
ABL1 + ABL2: Total		**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	**Hours**
CIE (1, 2 and 3)	03
Activity 1 and 2	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	**Program Outcomes**												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3												3
CO2	3	3	3										3
CO3		3	3										3
CO4	3	3	3										3

Course Title	DIGITAL ELECTRONIC CIRCUITS LABORATORY		
Course Code	24EE405	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 30

Course Objective: To implement combinational and sequential digital circuits using gates.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Realize combinational circuits using principles of boolean algebra.	1,2	1
2	Construct sequential circuits using different flip flops.	1,2	1
3	Demonstrate effective communication and teamwork skills through collaborative execution of laboratory experiments.	8,9,10,11	1

LIST OF EXPERIMENTS

1. Simplification, realization of Boolean expressions using logic gates/Universal gates.
2. Realization of half adder and full adder circuits.
3. Realization of Parallel adders and subtractors circuits.
4. Realization of Binary to Excess code conversion
5. Realization of Binary to Gray code conversion and vice versa.
6. Testing of Ring counter and Johnson counter.
7. Design of Sequence generator using D-flip flops.
8. Truth table verification of flip-flops: (i) J K Master slave (ii) T type and (iii) D type.
9. Realization of SISO, SIPO, PISO, PIPO shift registers.
10. Truth table verification of 1-bit and 2-bit comparator.

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3										2	
CO2	3	3										2	
CO3								2	2	2	2	3	

Course Title	MICROCONTROLLERS LABORATORY		
Course Code	24EE406	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02ABL = 30

Course Objective: To develop 8051 ALP and ARM Cortex M3 embedded C programming for a given tasks

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Develop Assembly Level Programming for the given problem using 8051 microcontroller	1,2,3,5	2
2	Make use of embedded C Program to interface peripheral to ARM Cortex M3 Microcontroller	1,2,3,5,11	2
3	Demonstrate effective communication and teamwork skills through collaborative execution of laboratory experiments.	8,9,10,11	1

LIST OF EXPERIMENTS

Part A: Assembly Level Programming using 8051 microcontrollers

1. Simple programs using mainly data transfer instructions: Block move, Exchange, Finding largest and smallest element in an array.
2. Programs involving arithmetic operations like addition, subtraction, multiplication and division, square, cube of 8 bit data bytes.
3. Programs involving arithmetic operations like addition and subtraction of 16 bit data bytes.
4. Programs involving looping, indexing and counting.
5. Program requiring logical operations like logical OR, AND, XOR, shift and rotate.

Part B: Interfacing using ARM Cortex M3

1. Interfacing a simple switch and display its status Relay, LED, Buzzer
2. Interfacing bidirectional DC motors with and without PWM
3. Interfacing stepper motor.
4. Generate non- sinusoidal waveforms with variable amplitude and frequency using internal DAC
5. Display the output for given analog input (any sensor) using internal ADC

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	2	-	-	-	-	-	-	-	2
CO2	3	3	3	-	3	-	-	-	-	-	3	-	3
CO3								2	2	2	2	2	

EMERGING TECHNOLOGY COURSE – II

Course Title	SIGNALS AND SYSTEMS		
Course Code	24ETEE41	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: The students will classify signals and transform them to frequency domain. They will analyse basic properties of systems in both time and frequency domains.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Analyze signals mathematically and perform mathematical operations on CT/DT signals and classify the systems based on their properties.	1,2,5	2
2	Represent signals in the time domain, perform convolution operations and analyze the characteristics of LTI systems.	1,2,5	2
3	Analyze the time-domain response of linear time-invariant (LTI) systems using differential equations for continuous-time systems and difference equations for discrete-time systems.	1,2,5	2
4	Apply Z-transform techniques to convert discrete-time signals from the time domain to the frequency domain.	1,2,5	2

MODULE - 1	10 Hrs.
Introduction: Definition of a signal and a system, Classification of signals, Basic operations on signals, Elementary signals and Properties of systems.	
MODULE - 2	**10 Hrs.**
Time-domain Representations for LTI Systems: Properties of Impulse Response Representation for LTI Systems - Memory less Systems, Causality and Stability. Impulse response representations for LTI systems, Concepts of Convolution, Computation of Convolution Sum and Convolution integral. Step Response of an LTI system.	
MODULE - 3	**10 Hrs.**
Differential and Difference equation representations of LTI Systems, Solution of Differential equations. Block diagram representations of LTI systems in Direct form-I & Direct form-II.	
MODULE - 4	**10 Hrs**
Z-Transforms: Introduction, Definition of the z-transform and its inverse, Region of convergence, Properties of ROC, Properties of z-transforms. Inverse z-transforms by partial fraction expansion method.	

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Signals and Systems	Simon Haykin Barry Van Veen	2nd	Wiley	2007

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Signals and Systems: Analysis of signals through Linear Systems	Michel J Roberts	2nd	McGraw-Hill	2003
2	Signals and Systems	D. Ganesh Rao & Satish Tunga	4th	Pearson	2010

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/108/104/108104100/

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning (ABL)	-	-	20+07=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Simulation based Activity	10
	Activity 2: Lab based Activity for 10 Marks	10
Total		**50**

Activity based learning (27 Hours)

ABL 1 : Simulation based Activity (20 Hrs)		
Simulation based Assignments	Classification of Signals	03
	Basic operations on Signals	02
	Classification of Systems	02
	Convolution of two signals	03
	Impulse Response of an LTI system	02
	Step Response of an LTI system	02
	Report Writing	03
	Presentation	03
ABL1: Total		**20**
ABL 2 : Lab based learning (07 Hrs)		
Hardware Implementation	Generation of various signals	02
	Project Presentation	03
	Submission of the report	02
ABL2: Total		**07**
ABL1 + ABL2: Total		**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Activity 1 and 2	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	2	3	1		2								2
CO2	2	3	1		2								2
CO3	2	3	1		2								2
CO4	2	3	1		2								2

Course Title	FUNDAMENTALS OF ELECTRIC VEHICLES		
Course Code	24ETEE42	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: To analyze various aspects of Electric Vehicles and Hybrid Electric Vehicles and various options of energy storage systems.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Explain the basic concepts of various types of electric vehicles.	1	1
2	Analyze EV and EHV configurations and their electric propulsion systems.	1, 2	1
3	Apply various type of battery sources that can be used in EV and EHV.	1, 2	1
4	Outline the electric power supply, Operating principles of fuel cells.	1, 2	1

MODULE - 1 — 11 Hrs.

Introduction to Electric Vehicles: History of Electric Vehicles (EV), Hybrid Electric Vehicles (EHV) andFuel Cell Vehicles. Social and environmental importance of electric and hybrid electric vehicles – air pollution, global warming, impact of modern drive trains on energy supplies.

Types of Electric Vehicles: Battery Electric Vehicles, IC Engine/Electric Hybrid Vehicle, Fuelled EVs, EVs using Supply Lines, EVs which use Flywheels or Super capacitors, Solar-Powered Vehicles, Vehiclesusing Linear Motors, EVs for the Future.

SLC: AC and DC motor drives.

MODULE - 2 — 11 Hrs.

Configuration of EV's and EHV's: Configurations of EVs, Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains - Series Hybrid Electric Drive Trains, Parallel Hybrid Electric Drive Trains and series-parallel Hybrid Electric Drive Trains.

SLC: BLDC motor drives.

MODULE - 3 — 10 Hrs.

Sources: Batteries, Battery Parameters, Lead Acid Batteries, Nickel-Based Batteries, Sodium-Based Batteries, Lithium Batteries, Battery Charging, Battery Management System.

SLC: Recent Trends in Battery technology (Reference of IEEE paper)

MODULE - 4 — 10 Hrs

Fuel Cells: Operating principles of fuel cells, Fuel cell technologies, fuel supply, and non-Hydrogen Fuel cells.

Electric Supply: Normal Existing Domestic and Industrial Electricity Supply, Infrastructure needed for charging Electric Vehicles, Electricity supply Rails, Battery swapping, Battery Management System.

SLC: Hybrid Energy sources.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Electric Vehicle Technology	James Larminie, John Lowry	2nd	John Wiley & Sons Ltd	2012
2	Modern Electric, Hybrid Electric andFuel Cell Vehicles: Fundamentals, Theory and Design,	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi	3rd	CRC Press Taylor & Francis Group	2004

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid	John G. Hayes, G. Abas Goodarzi	3rd	Wiley	2005
2	Handbook of Automotive Power Electronics and Motor Drives	Ali Emadi	3rd	Taylor & Francis Group	2008

E Books and online course materials:

1. https://www.nielit.gov.in/content/online-course-ev-technology-public-charging-station
2. https://www.classcentral.com/subject/electric-vehicles
3. https://course.cutm.ac.in/wp-content/uploads/2020/06/Notes-on-Electric-Vehicles.pdf

Online Courses and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview
2. https://www.dqindia.com/iit-madras-offers-free-online-course-electric-vehicles-can-completed-12-weeks/

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning (ABL)	-	-	14+13=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: EV manufacturing plant visi	10
	Activity 2: Seminar on recent trends in Electric vehicle technologies (IEEE JOURNAL PAPER)	10
Total		**50**

Activity based learning (27 Hours)

ABL 1: EV manufacturing plant visit **(14 Hrs.)**	
ABL1: Total	**14**
ABL 2: Seminar on recent trends in Electric vehicle technologies (IEEE JOURNAL PAPER) **(13 Hrs.)**	
ABL2: Total	**13**
ABL1 + ABL2: Total	**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Activity 1 and 2	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2										2	
CO2	3	2										2	
CO3	2	2										2	
CO4	3	2										2	

Course Title	RENEWABLE ENERGY SYSTEMS		
Course Code	24ETEE43	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objectives: To analyze the renewable energy technologies for real time application.

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

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Understand the various technologies of solar photovoltaic and thermal systems.	1, 6, 7	1
2	Solve various problems on solar photovoltaic and thermal systems.	2,6,7	1
3	Design different components of solar thermal and photovoltaic systems	3,6,7	1
4	Apply modern tools for prediction and modeling of renewable energy systems.	5	1

MODULE-1 — 11 Hrs

Basics of Solar PV Cells: Review on Renewable Energy Sources , Structure of solar cell, types of solar cell, I-V and P-V characteristics solar cell, Effects of temperature, irradiance, series, and shunt resistance on characteristics of solar cell. Series & parallel connected solar cells

Solar Photovoltaic Technologies: Basic of solar photovoltaic technology – Amount of power generated, generating more power using solar PV. Solar PV system and their components. Solar PV lantern- Design and costing of Solar PV lantern. Solar Standalone PV system-Home lighting and other usage-case study. Solar PV water pumping systems- design of solar PV Pumping system- Case study.

SLC: Study on different types of solar cell

MODULE-2 — 10 Hrs

Solar Thermal systems and Applications: Review of Flat Plate Collectors- Efficiency of flat plate collectors, numerical problems.

Applications: Solar Water Heater- Components and specification of Solar water heater, Design and Costing solar heating, Installation and Maintenance.

Solar Energy storage: Introduction, Solar energy storage systems-Solar Pond Electric power generation.

SLC: Central tower based solar power generation

MODULE-3 — 11 Hrs

Applications: Solar cooking systems: Principle of cooking, cooking by boiling, and speed of cooking, energy required for cooking (numerical problems). Types of solar cooker- Box.

Solar Distillation: Water categories, distillation process for water purification, operation of solar distillation. Design of solar still and costing. Parameters affecting solar still performance, Economics of solar still.

SLC: Dish Heat transfer type solar cooker

MODULE-4 — 10 Hrs

Mathematical Modelling of Renewable energy systems: Solar, wind, Biomass/ biogas and battery systems. Integrated renewable energy system for on/off grid Applications.

Software Tools - (HOMER and MATLAB software). Simulation of Solar energy system, Case study for a typical residential/ commercial application- Load assessment and resources assessment.

SLC: Simulation of wind energy system

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Non-conventional sources of energy	Rai, G D	4th	Khanna publishers	2007

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Solar energy: fundamentals and applications	Garg, H. P.	-	Tata McGraw-Hill Education	2000
2	Solar energy: principles of thermal collection and storage	Sukhatme, S. P., & Sukhatme	-	Tata McGraw-Hill	1996

E Books and online course materials:

1. https://www.scribd.com/document/491553447/Non-conventional-Energy-Sources-by-G-D-Rai

Online Courses and Video Lectures:

1. https://ocw.tudelft.nl
2. https://open.umn.edu/opentextbooks
3. https://www.edx.org/learn/renewable-energy

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning (ABL)	-	-	14+13=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Field visit	10
	Activity 2: Model development of solar and wind hybrid system using HOMER	10
Total		**50**

Activity based learning (27 Hours)

ABL 1 : Field visit		
Field visit and preparation of technical report	Plant visit	07
	Technical report preparation	07
ABL1: Total		**14**
ABL 2 : Model development of solar and wind hybrid system using HOMER		
Model development	Data collection	03
	Resource/Load assessment	03
	Validation/Execution	04
ABL2: Total		**13**
ABL1 + ABL2: Total		**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Quiz (1 and 2) (optional)	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3					2	2					2	
CO2		3				2	2					2	
CO3			3			2	2					2	
CO4					1							2	

Course Title	PYTHON PROGRAMMING FOR ELECTRICAL ENGINEERING		
Course Code	24ETEE44	(L-T-P) C	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	42L + 48ABL = 90

Course Objective: Develop problem-solving skills using Python.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Analyze complex electrical circuits using Python programming	1, 2	2
2	Create Python programs to model and simulate electrical systems	3, 5	2
3	Evaluate and assess various electrical parameters and control systems using machine learning and Python.	4, 6	2
4	Apply Python programming skills to address real-world challenges in electrical engineering.	3, 4, 5	2

MODULE - 1	10 Hrs.

Introduction to Python Programming: Python Basics: Introduction to Python, installation, basic syntax, variables, data types. Control Structures: If-else statements, loops (for, while). Functions: Defining and calling functions, scope of variables. Basic Libraries: Introduction to essential Python libraries (NumPy, SciPy). Applications in Electrical Engineering: Ohm's Law: Simple Python programs to solve Ohm's Law problems, Kirchhoff's Voltage Law (KVL) Kirchhoff's Current Law (KCL), Analyzing simple resistor networks.

SLC: Practice basic syntax, control structures, and functions to reinforce understanding.

MODULE - 2	11 Hrs.

Python for Advanced Circuit Analysis: Advanced Data Structures: Lists, tuples, dictionaries, sets. **File Handling**: Reading from and writing to files, **Plotting with Matplotlib**: Visualizing data and circuit behavior. **Complex Circuit Analysis**: Using Python to analyze RLC circuits, Solving circuits with multiple power sources, Analyzing AC circuits using Python. **Use Cases and Applications**: Designing Python programs to solve complex RLC circuit problems, Real-time plotting of circuit parameters.

SLC: Develop problems based on advanced circuit analysis techniques like mesh analysis and nodal analysis

MODULE - 3	11 Hrs.

Electrical Machine Characteristics and Control Systems: Advanced Libraries and Tools: Introduction to Pandas, SymPy, and other relevant libraries. Numerical Methods in Python: Solving differential equations, numerical integration. Characteristics of Electrical Machines: Analysis of DC machines: Characteristics and performance. Analysis of AC machines: Induction motors and synchronous machines. Efficiency and losses in electrical machines. Control Systems: Modeling control systems using Python. P, PI and PID controller design and tuning. Time and frequency domain analysis of control systems.

SLC: Fundamentals of electrical machines, including DC machines, induction motors, and synchronous machines.

MODULE - 4	10 Hrs

Advanced Applications: Signal Processing: Digital signal processing using Python. Fourier analysis and filtering. Machine Learning for Electrical Engineers: Basics of machine learning. Applying machine learning to electrical engineering problems including fault detection, load forecasting.

SLC: Explore advanced Python libraries, such as TensorFlow for machine learning or SciPy for scientific computing.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Python for Electrical Engineering: A Complete Guide	Austin O'Connor	-	-	-
2	Python Crash Course	Eric Matthes	-	-	-

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Python for Data Analysis	Wes McKinney	-	-	-

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning (ABL)	-	-	14+13=27
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Activity 1: Real-Life Electrical Problems – Python-based Analysis	10
	Activity 2: Data driven insights in Electrical Systems using Python	10
Total		**50**

Activity based learning (27 Hours)

ABL 1 : Real-Life Electrical Problems – Python-based Analysis		
Real-Life Electrical Problems – Python-Based Analysis	Task Description Hours Identify common household / industrial electrical issues (voltage drop, overload, energy loss)	02
	Frame the problem as an analyzable Python task (create equations for a resistor network or motor behavior)	03
	Write basic Python scripts to analyze the chosen electrical problem (use Ohm's Law, KVL, etc.)	04
	Plot results using Matplotlib (power vs time, voltage vs current)	03
	Submit and present findings in a report with code explanation	02
ABL1: Total		**14**
ABL 2 : Data driven insights in Electrical Systems using Python		
Data-Driven Insights in Electrical Systems Using Python	Collect/simulate data from electrical systems (voltage, current, power factor, etc.)	02
	Use Pandas to organize and analyze the data	03
	Apply NumPy/SciPy to compute trends (average load, peak usage)	03
	Visualize data using Matplotlib/Seaborn	03
	Prepare report and presentation on insights from data	02
ABL2: Total		**13**
ABL1 + ABL2: Total		**27**

Evaluation of Learning Process (07 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	03
Quiz (1 and 2) (optional)	01
Semester End Exam	03
Total	**07**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO11**	**PSO1**	**PSO2**
CO1	2	3											2
CO2			3		3								2
CO3				3		1							2
CO4			3	2	3								2

Course Title	UNIVERSAL HUMAN VALUES		
Course Code	24UHV	(L-T-P) C	(0-2-0) 1
CIE	50	Hours/Week	1
SEE	50	Total Hours	28 + 02 = 30

Course Objective: To facilitate the development of a holistic perspective by understanding the harmony at all levels of existence, thereby enabling them to live with clarity, confidence, and commitment in personal, professional, and social life.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Start exploring themselves, get comfortable with each other and with the teacher and they start appreciating the need and relevance for the course. Also they are able to note that the natural acceptance (intention) is always for living in harmony.	6, 7, 8, 9,11	-
2	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them and need to take appropriate steps to ensure right participation (in terms of nurturing, protection and right utilization) in the nature.	6, 7, 8, 9, 11	-
3	Present sustainable solutions to the problems in society and nature.	6, 7, 8, 9, 11	-
4	Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.	6, 7, 8, 9, 11	-

MODULE - 1	7 Hrs.

Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations

MODULE - 2	7 Hrs.

Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Lecture, Understanding Harmony in the Self Tutorial, Harmony of the Self with the Body to ensure self-regulation and Health.

MODULE - 3	7 Hrs.

Harmony in the Family, Nature and Existence: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order. Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

MODULE - 4	7 Hrs

Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models, Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Self-Learning Activities:

1. Sharing about Oneself and Exploring Natural Acceptance
2. Exploring Harmony of Self with the Body
3. Exploring the Feeling of Respect
4. Exploring the Four Orders of Nature Lecture and Exploring Co-existence in Existence
5. Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order

Evaluation :

Continuous Internal Evaluation (CIE)

Two CIEs will be conducted for 20 marks each.

For the activity component students should form a team of 3 to 4 members each. A group activity should be assigned to each team based on the modules covered in the course. Students should show the progress in this activity as a preliminary phase for SEE.

CIE	Schedule	Assessment Method	Marks	Duration (Min.)
CIE I	At the end of 8 weeks	Objective Questions	20	60
CIE II	At the end of 11 weeks	Objective Questions	20	60
Activity	After CIE 2	Presentation/Role Play/Prototype development	10	-

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	2nd	Excel Books, New Delhi	2019
2	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	2nd	Excel Books, New Delhi	2019

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Human Values	A.N. Tripathi	-	New Age Intl. Publishers, New Delhi	2014
2	Hind Swaraj or Indian Home Rule	Mohandas K. Gandhi	-	-	-

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1						2	1	3	2		1		
CO2						2	1	3	2		1		
CO3						2	1	3	2		1		
CO4						2	1	3	2		1		

ABILITY ENHANCEMENT COURSE – IV

Course Title	AUTOCAD FOR ELECTRICAL ENGINEERING		
Course Code	24AEEE41	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 30

Course Objective: To analyze and design the assembly of electrical circuits and machines.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the concept of single line diagram and Electrical machines	1, 2, 5, 6, 9, 10, 11	1
2	Apply winding concept and assembly of DC and AC machines.	1, 2, 3, 4, 5, 9, 10	1
3	Analyze and design the assembly of AC and DC machines.	3, 5, 6, 9, 11	1

LIST OF EXPERIMENTS

1. Power plants layout diagram and single line diagram of substations.
2. Developed winding diagrams of D.C. machines and A.C. machines
3. Transformers - sectional views of single and three phase core and shell type transformers.
4. D.C. machine - sectional views of yoke, field system, armature and commutator dealt separately.
5. Induction motor – sectional views of stator and rotor dealt separately
6. synchronous generator – sectional views of stator and rotor dealt separately

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3		3	1			1	1	2	2	
CO2	2	2	3	3	2				1	2	2	2	
CO3			3		1	2			2		2	2	

Course Title	PCB DESIGN LABORATORY		
Course Code	24AEEE42	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 30

Course Objective: To provide hands-on experience in PCB design using EDA tool.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Use EDA tools to create schematics and PCB layouts.	1,3,5	2
2	Design basic analog and digital circuits.	1,2,3,5	2
3	Develop application-based PCBs for sensing and control projects.	1,2,3,4,5,9,10	2

LIST OF EXPERIMENTS

1. Introduction to PCB DESIGN and EDA Tool KiCad
2. Parameter setting for PCB Design.
3. Design of an IR Proximity Sensor – Touchless Door Bell using Zero PCB
4. Design PCB schematic and Layout for 5V dc Power Supply.
5. Design and simulation of a Half and Full Wave Rectifier
6. Design of a PCB layout of simple transistor tester circuit.
7. Design of a PCB layout of Low pass and High Pass filter
8. Design PCB schematic and Layout the layout for a simple BJT amplifier circuit.
9. Design of a Water Level Indicator circuit
10. Design a single layer an obstacle detection PCB for robotics and security applications.

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3		2		2								2
CO2	3	2	2		2								2
CO3	2	2	2	2	2				2	2			2

Course Title	RENEWABLE ENERGY LABORATORY		
Course Code	24AEEE43	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 30

Course Objective: To implement renewable energy systems to assess their performance.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Develop a solar PV system under various conditions to find their characteristics.	1, 2, 6, 7, 9	1
2	Build renewable energy systems and converters to study their performance.	1, 2, 5, 6, 7, 9	1
3	Analyze energy estimation in renewable systems using software tools.	1, 2, 3, 4, 5, 6, 7, 9	1

LIST OF EXPERIMENTS

1. I-V & P-V Characteristics of solar PV cell/modules.
2. Voltage & current enhancement through Series /Parallel connected solar PV cell/module.
3. Performance of PV cell/ module under partial shading conditions.
4. Experimental analysis of solar cooker and solar water heating system
5. MPPT Technique
6. Simulation of solar PV Fed induction motor/BLDC motor
7. Simulation of partial shading effects on solar PV array
8. Simulation of Buck, Boost converters, resonant converters systems
9. Integrated renewable energy system for on/off grid applications using software tools
10. Energy audit and demand side management using software tools

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3				2	3		2			3	
CO2	3	3			3	3	3		2			2	
CO3	3	3	3	2	3	3	3		2			3	

Course Title	IOT LABORATORY		
Course Code	24AEEE44	(L-T-P) C	(0-0-2) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28P + 02 = 30

Course Objective: Build embedded IoT systems for real-time automation.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Interface sensors with embedded processors for communication with each other's.	2, 5, 6, 9, 10	2
2	Develop IoT systems for data acquisition and cloud integration using advanced microcontrollers.	3, 5, 6, 9, 10	2
3	Design automation systems for real-time applications.	3, 5, 6, 9, 10	2

LIST OF EXPERIMENTS

1. Traffic light control system using Arduino UNO.
2. Interfacing ultrasonic sensor with Arduino UNO for Obstacle detection and Distance measurement
3. Interfacing IR sensor with Arduino UNO for DC motor control
4. Interfacing soil moisture sensor with Arduino Uno for detect moisture in the soil
5. Interfacing LDR sensor with Arduino UNO to switch on/off 230V bulb using 5V Relay
6. Greetings message through webpage with ESP as server.
7. Temperature and humidity monitoring in cloud platform
8. Servo motor control with webpage
9. WIFI weather station tool and analysis
10. Temperature and humidity monitoring with Raspberry Pi

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1		3			3	2			2	2			3
CO2			3		3	3			2	2			3
CO3			3		3	3			2	2			3

Course Title	BIOLOGY FOR ENGINEERS		
Course Code	24BE41	(L-T-P) C	(0-2-0) 1
CIE	50	Hours/Week	2
SEE	50	Total Hours	28 + 02 = 30

Course Objective: To analyze the basic biological concepts and their engineering applications.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	To familiarize engineering students with basic biological concepts in an engineering perspective.	6,7,8,9,10,11	-
2	To involve students in an interdisciplinary vision of biology and engineering	6,7,8,9,10,11	-
3	To gain the realization of translation of natural engineering in biological systems into novel devices in man-made engineering domain.	6,7,8,9,10,11	-
4	To gain the realization of translation of natural engineering in biological systems into novel devices in man-made engineering domain.	6,7,8,9,10,11	-

MODULE - 1	8 Hrs.

Introduction to Human Anatomy: Overview of human anatomy, Structural organization of the human body - cardiovascular system, endocrine system, digestive system, respiratory system, excretory system, lymphatic system, nervous system, muscular system and skeletal system.

MODULE - 2	6 Hrs.

Receptors (Sensors) and Effectors (Actuators): Comparative study of biological principles with Electrical principles, Sense Organs; External and Internal sense organs, Effectors; Muscles and glands, brief introduction to Sensory and motory nerves, Comparative Study of Sensors and Actuators (Engineering system) based on the concepts of Receptors and Effectors in Human body

MODULE - 3	6 Hrs.

Communication system in Human Body: Nervous system; Neurons, Organ of human body, Nerves; Cranial nerves, Spinal nerves and visceral nerves, Functioning of various nerves as Sensory nerves, Motory nerves and Relay nerves, Comparison of natural communication system with the design of engineering system

MODULE - 4	8 Hrs

Controls involved in Human Body: Controls involved in Human Body: Introduction to Open loop and Closed loop system, Role of Endocrine system in control process of many parameters, study of natural Control in various biological systems, Extending the concept of Biological Open loop and closed loop systems to the field of automation, Case studies.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Biology for Engineers	Johnson A T	-	CRC Press	2018

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Handbook of General Anatomy	B D Chaurasia's	4th	-	-

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

Course Articulation Matrix

Course Outcomes	**Program Outcomes**												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1						3	1	3	1	3	2		
CO2						3	1	3	1	3	2		
CO3						2	3	2	3	2	2		
CO4						2	3	2	3	2	2		