MANAKULA VINAYAGAR
INSTITUTE OF TECHNOLOGY
An Autonomous Institution
Affiliated to Pondicherry University, Approved by AICTE, New Delhi,
Accredited by NAAC with 'A' Grade
Kalitheerthalkuppam, Puducherry- 605 107.

UG Degree Course
in
B.Tech
ELECTRICAL AND ELECTRONICS ENGINEERING

(Approved Curriculum & Syllabus For 1st,2nd,3rd & 4th sem – Autonomous)

REGULATIONS 2025
(For the students admitted in the academic year 2025-26)

Manakula Vinayagar Institute of Technology
Department of EEE

Dr. C. SHANMUGASUNDARAM, B.E.,M.Tech.,Ph.D.
PROFESSOR AND HEAD
Dept. of Electrical and Electronics Engineering
Manakula Vinayagar Institute of Technology
Kalitheerthalkuppam, Puducherry-605 107.

INSTITUTE VISION	DEPARTMENT VISION
To be a globally reputed Technical Institution creating Competent leaders and Skillful innovators in Science, Technology and Management.	To create comprehensive electrical engineers to meet up the growing technological demands of the society.
INSTITUTE MISSION	**DEPARTMENT MISSION**
M1: Providing a dynamic and creative learning environment for its students to acquire exemplary technical, analytical, professional skills.	**DM1: Higher Order Thinking**-To impart high quality education to help the students hone their professional skills.
M2: Imbibing a spirit of innovation and research among its students and faculty for solving critical problems.	**DM2: Competency -** To improve the competencies of students and faculties on contemporary technologies through continuous improvement programs.
M3: Promoting Innovation, Employability and entrepreneurship skills through industry academia collaboration.	**DM3: Continuous Learning -** To undertake research on frontier areas of electrical and electronics engineering.
M4: Serving the society through technical intervention and creating socially responsible Professionals.	**DM4: Entrepreneurship -** To imbibe the spirit of innovation and entrepreneurship among the students.

PROGRAM OUTCOMES:

POs	DESCRIPTION
PO1	**Engineering knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems
PO2	**Problem analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	**Design/development of solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	**Conduct investigations of complex problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions. (WK8)
PO5	**Engineering tool usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7)
PO7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO10	**Project management and finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	**Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PSOs	EEE Dept. - Program Specific Outcome (PSO) After the successful completion of the program, the graduates will be able to:
PSO 1	**Products Development:** An ability to design, analysis and to implement power electronics converters in renewable energy applications.
PSO 2	**Design Thinking:** A capability to design and examine the power system and to solve the unit commitment with various constraints.

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: In the light of the fact that a typical Model AICTE Four-year Under Graduate degree program in Engineering has about163 credits, the total number of credits proposed for the four-year B. Tech in Electrical and Electronics Engineering as172.

C. Structure of UG Program in Electrical and Electronics Engineering (EEE): The structure of UG program in Electrical and Electronics Engineering (EEE)shall have essentially the following categories of courses with the breakup of credits as given:

S.No.	Category	AICTE	PU R-2023	MIT Proposed IT -R-2025
1	Humanities and Social Sciences including Management courses (HS)	16	16	**12**
2	Basic Science courses (BS)	**23**	**25**	**16**
3	Engineering Science courses including workshop, drawing, basics of electronics /electrical /mechanical/ computer etc. (ES)	**29**	**24**	**24**
4	Professional core courses (PC)	**59**	**66**	**70**
5	Professional Elective courses relevant to chosen specialization/branch (PE)	12	12	12
6	Open subjects – Electives from other technical and /or emerging subjects (OE)	**09**	**09**	**12**
7	Core Enrichment Course (Project work, seminar, mini project and internship / in-plant training in industry or elsewhere) (CEC)	**15**	**17**	**16**
8	Employability Enhancement Courses (EEC)	**-**	**-**	**0**
9	Mandatory Courses (MCC) [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]	non-credit	non-credit	non-credit
	Total	**163**	**169**	**162**

MVIT- B.Tech. EEE- Curriculum- R 2025
Academic Year 2025-2026

SUMMARY OF ALL COURSES

S. No	Course Category	I	II	III	IV	V	VI	VII	VIII	Total Credits
1	**HS**	**3**	**2**	**-**	**-**	**-**	**3**	**3+1**		**12**
2	**BS**	**4+3+1**	**4**	**4**						**16**
3	**ES**	**3+3+1+1**	**3+3+1+1**	**4**	**4**					**24**
4	**PC**		**3+4+1**	**3+3+3+3 1+1+1**	**3+3+3+3 +3+1+1**	**3+3+3+4 +1+1**	**3+3+1**	**3+4+1**		**70**
5	**PE**					**3**	**3**	**3**	**3**	**12**
6	**OE**					**3**	**3**	**3**	**3**	**12**
7	**CEC**				**1**		**2+1**	**4**	**8**	**16**
8	**EEC**	**0**	**0**	**0**	**0**	**0**	**0**			**0**
9	**MCC**									
Total		**19**	**22**	**23**	**22**	**21**	**19**	**22**	**14**	**162**

HS - Humanities and Social Sciences including Management Course; BS – Basic Science Course; ES – Engineering Science Course; PC – Professional Core Course; CEC – Core Enrichment Course (Project work, seminar, mini project and internship / in-plant training in industry or elsewhere) ; PE – Professional Elective Course; OE- Open Elective Courses; EEC –Employability Enhancement Courses; MCC – Mandatory Course;

SEMESTER I								MARKS		
S. No	Course Code	Course Title	category	L	T	P	Credits	CAM	ESM	TM
Induction Program - Universal Human values-I										
THEORY										
1.	25UMAT11	Matrices &Calculus	BS	3	1	0	4	40	60	100
2.	25UPHT12	Physical science for Electrical and Electronics Engineers	BS	3	0	0	3	40	60	100
3.	25UEET13	Energy Engineering	ES	3	0	0	3	40	60	100
4.	25UEET14	Fundamentals of Electrical Engineering	ES	3	0	0	3	40	60	100
INTEGRATED COURSES										
5.	25UHSI16	Professional Communication for Engineers	HS	1	0	4	3	50	50	100
PRACTICAL										
6.	25UPHP11	Physical science Lab	BS	0	0	2	1	60	40	100
7.	25UEEP17	Basic Electrical Engineering Lab	ES	0	0	2	1	60	40	100
8.	25UGEP19	Engineering Graphics and Auto CAD	ES	0	0	2	1	60	40	100
EMPLOYABILITYENHANCEMENTCOURSES										
9.	25UPCE11	Career Development Skills	EEC	0	0	2	0	-	-	-
MANDATORYCOURSE										
10.	25UMCC11	IKS–Concepts and applications in Engineering and Science	MCC	1	0	1	0	-	-	-
11.	25UMCC12	Environmental Science &Sustainability	MCC	2	0	0	0	-	-	-
		Total					**19**	**330**	**410**	**800**

SEMESTER II								MARKS		
S. No	Course Code	Course Title	category	L	T	P	Credits	CAM	ESM	TM
THEORY										
1.	25UMAT21	Differential Equations and Transforms	BS	3	1	0	4	40	60	100
2	25UHST22	Universal Human Values-II	HS	2	0	0	2	40	60	100
3.	25UEET23	Electronic Devices	ES	3	0	0	3	40	60	100
4.	25UEET24	Electric Circuit Theory	PC	3	0	0	3	40	60	100
INTEGRATED COURSES										
5.	25UCSI26	Programming in C	ES	2	0	2	3	50	50	100
6.	25UEEI26	Digital Electronics	PC	3	0	2	4	50	50	100
PRACTICAL										
7.	25UEEP27	Electronic Devices Lab	ES	0	0	2	1	60	40	100
8.	25UEEP28	Electric Circuit Theory Lab	PC	0	0	2	1	60	40	100
9.	25UGEP29	Design Thinking & Idea Lab	ES	0	0	2	1	60	40	100
EMPLOYABILITY ENHANCEMENT COURSES										
10.	25UPCE21	Communication skills	EEC	0	0	2	0	-	-	-
11.	25UCCC21	Certification Course I	CCC	0	0	2	0	-	-	-
MANDATORY COURSE										
12.	25UMCC21	IKS in Humanities and Social Science	MCC	1	0	1	0	-	-	-
13.	25UMCC22	Holistic Wellness	MCC	0	0	1	0	-	-	-
		Total					**22**	**440**	**460**	**900**

SEMESTER III								MARKS		
SL. No	**Course Code**	**Course Title**	**category**	**L**	**T**	**P**	**Credits**	**CAM**	**ESM**	**TM**
THEORY										
1.	25UMAT34	Fourier series & Numerical Techniques	BS	3	1	0	4	40	60	100
2.	25UEET31	DC Machines and Transformers	PC	3	0	0	3	40	60	100
3.	25UEET32	Electronic Circuits	PC	3	0	0	3	40	60	100
4.	25UEET33	Engineering Electro Magnetics	PC	3	0	0	3	40	60	100
5.	25UEET34	Measurement and Instrumentation	PC	3	0	0	3	40	60	100
INTEGRATED COURSES										
6.	25UCSI31	Problem solving using Python	ES	3	0	2	4	50	50	100
PRACTICAL										
7.	25UEEP35	DC Machines and Transformers Lab	PC	0	0	2	1	60	40	100
8.	25UEEP36	Electronic Circuits Lab	PC	0	0	2	1	60	40	100
9.	25UEEP37	Measurement and Instrumentation Lab	PC	0	0	2	1	60	40	100
EMPLOYABILITY ENHANCEMENT COURSES										
9.	25UPCE31	Personality development Skills	EEC	0	0	2	0	-	-	-
10.	25UCCCXX	Certification Course-II	CCC	0	0	0	0	-	-	-
MANDATORY COURSE										
11.	25UMCC31	Indian Constitution and Human Rights	MCC	2	0	0	0	-	-	-
Total							**23**	**430**	**470**	**900**

SEMESTER IV								MARKS		
SL. No	**Course Code**	**Course Title**	**category**	**L**	**T**	**P**	**Credits**	**CAM**	**ESM**	**TM**
THEORY										
1.	25UEET41	AC Machines	PC	3	0	0	3	40	60	100
2.	25UEET42	Transmission and Distribution	PC	3	0	0	3	40	60	100
3.	25UEET43	Control Systems	PC	3	0	0	3	40	60	100
4.	25UEET44	Linear Integrated Circuits	PC	3	0	0	3	40	60	100
5.	25UEET45	Utilization of Electrical Energy	PC	3	0	0	3	40	60	100
INTEGRATED COURSES										
6.	25UCSI46	Data Structures and Algorithms	ES	3	0	2	4	50	50	100
PRACTICAL										
7.	25UEEP47	AC Machines Lab	PC	0	0	2	1	60	40	100
8.	25UEEP48	Linear Integrated Circuits Lab	PC	0	0	2	1	60	40	100
CORE ENRICHMENT COURSE										
9.	25UEEW41	Mini Project-I	CEC	0	0	2	1	100	-	100
EMPLOYABILITY ENHANCEMENT COURSES										
10.	25UPCE41	Professionalism and Basic Aptitude	EEC	0	0	2	0	-	-	-
11.	25UCCCXX	Certification Course-III	CCC	0	0	0	0	-	-	-
MANDATORY COURSE										
12.	25UMCC41	Entrepreneurial skills and concepts	MCC	2	0	0	0	-	-	-
Total							**22**	**470**	**430**	**900**

SEMESTER V								MARKS		
S.No	Course Code	Course Title	category	L	T	P	Credits	CAM	ESM	TM
THEORY										
1.	25UEET51	Microprocessor And Micro Controller	PC	3	0	0	3	40	60	100
2.	25UEET52	Signal System	PC	3	1	0	3	40	60	100
3.	25UEET53	Power Electronics	PC	3	0	0	3	40	60	100
4.	25UEELXX	Professional Elective - I	PE	3	0	0	3	40	60	100
5.	25UEEOXX	Open Elective - I	OE	3	0	0	3	40	60	100
INTEGRATED COURSES										
6.	25UEEI54	Computer Aided Power System Analysis	PC	3	0	2	4	50	50	100
PRACTICAL										
7.	25UEEP55	Microprocessor And Micro Controller Lab	PC	0	0	2	1	60	40	100
8.	25UEEP56	Power Electronics Lab	PC	0	0	2	1	60	40	100
Employability Enhancement Courses										
9.	25UPCE51	Quantitative & Verbal Aptitude	EEC	0	0	2	0	-	-	-
MANDATORY COURSE								**-**	**-**	**-**
10.	25UMCC51	English for Career Pursuits	MCC	2	0	0	0	-	-	-
Total							**21**	**370**	**430**	**800**

SEMESTER VI								MARKS		
S.No	Course Code	Course Title	category	L	T	P	Credits	CAM	ESM	TM
THEORY										
1.	25UEET61	Protection and Switch Gear	PC	3	0	0	3	40	60	100
2.	25UEET62	Industrial Drives and Control	PC	3	1	0	3	40	60	100
3.	25UHST63	Principles of Management	HS	3	0	0	3	40	60	100
4.	25UEELXX	Professional Elective - II	PE	3	0	0	3	40	60	100
5.	25UEEOXX	Open Elective -II	OE	3	0	0	3	40	60	100
PRACTICAL										
6.	25UEEP64	Capstone course- II	PC	0	0	2	1	100	-	100
7.	25UEEW65	Seminar	CEC	0	0	2	1	100	-	100
8.	25UEEW66	Mini Project-II	CEC	0	0	4	2	100	-	100
EMPLOYABILITY ENHANCEMENT COURSES										
9.	25UPCE61	Analytical & Reasoning skills	EEC	0	0	2	0	-	-	-
10.	25UCCC62	Certification Course-3	CCC	0	0	0	0	-	-	-
MANDATORY COURSE										
11.	25UMCC61	Foreign Language	MCC	2	0	0	0	-	-	-
Total							**19**	**500**	**300**	**800**

SEMESTER VII								MARKS		
S.No	**Course Code**	**Course Title**	**category**	**L**	**T**	**P**	**Credits**	**CAM**	**ESM**	**TM**
THEORY										
1.	25UHST71	Organizational Behavior	HS	3	0	0	3	40	60	100
2.	25UEET72	Power System Operation and Control	PC	3	1	0	3	40	60	100
3.	25UEET73	Electric and Hybrid Vehicles	PC	3	1	0	4	40	60	100
4.	25UEELXX	Professional Elective - III	PE	3	0	0	3	40	60	100
5.	25UEEOXX	Open Elective -III	OE	3	0	0	3	40	60	100
PRACTICAL										
6.	25UEEP74	E-MOBILITY LAB	PC	0	0	2	1	100	-	100
7.	25UHSP81	Professional Ethics	HS	1	0	0	1	100	-	100
8.	25UEEW76	Project Phase -I	CEC	0	0	8	4	100	-	100
Total							**23**	**500**	**300**	**800**

SEMESTER VIII								MARKS		
S.No	**Course Code**	**Course Title**	**category**	**L**	**T**	**P**	**Credits**	**CAM**	**ESM**	**TM**
THEORY										
1	25UEELXX	Professional Elective - IV	PE	3	0	0	3	40	60	100
2	25UEEOXX	Open Elective -IV	OE	3	0	0	3	40	60	100
PRACTICAL										
3	25UEEW82	Internship/In-plant Training	CEC	0	0	0	0	100	-	100
4	25UEEW83	Project Phase -II	CEC	0	0	16	8	100	-	100
Total							**14**	**280**	**120**	**400**

LIST OF PROFESSIONAL ELECTIVE COURSES (PE)

PROFESSIONAL ELECTIVE COURSES-I (OFFERED IN SEMESTER V)			Periods			
S.No	**Course Code**	**Course Title**	L	T	P	Credits
1	25UEEL51	INTERNET OF THINGS FOR ELECTRICAL ENGINEERING	3	0	0	3
2	25UEEL52	ELECTRICAL MACHINE DESIGN	3	0	0	3
3	25UEEL53	GREEN TECHNOLOGY	3	0	0	3
4	25UEEL54	POWER QUALITY	3	0	0	3
PROFESSIONAL ELECTIVE COURSES-II (OFFERED IN SEMESTER VI)						
1	25UEEL61	EMBEDDED SYSTEMS	3	0	0	3
2	25UEEL62	HVDC TRANSMISSION SYSTEM	3	0	0	3
3	25UEEL63	ELECTRICAL SAFETY	3	0	0	3
4	25UEEL64	INDUSTRIAL AUTOMATION	3	0	0	3
PROFESSIONAL ELECTIVE COURSES-III (OFFERED IN SEMESTER VII)						
1	25UEEL71	ENERGY MANAGEMENT AND AUDITING	3	0	0	3
2	25UEEL72	RESTRUCTURED POWER SYSTEMS	3	0	0	3
3	25UEEL73	SMART GRID TECHNOLOGIES	3	0	0	3
4	25UEEL74	AI TECHNIQUES IN ELECTRICAL SYSTEM	3	0	0	3
PROFESSIONAL ELECTIVE COURSES-IV (OFFERED IN SEMESTER VIII)						
1	25UEEL81	OPTIMIZATION TECHNIQUES	3	0	0	3
2	25UEEL82	AI IN SMART GRID	3	0	0	3
3	25UEEL83	ENERGY STORAGE AND BATTERY MANAGEMENT SYSTEM	3	0	0	3
4	25UEEL84	SOFT COMPUTING TECHNIQUES	3	0	0	3

LIST OF OPEN ELECTIVES(OE)

Sl. No.	Course Code	Course Title
1	25UEEO01	ANALOG AND DIGITAL ELECTRONICS
2	25UEEO02	BASICS OF ELECTRICAL CIRCUITS
3	25UEEO03	CONTROL SYSTEM ENGINEERING
4	25UEEO04	ELECTRIC POWER UTILIZATION
5	25UEEO05	ELECTRICAL MACHINES
6	25UEEO06	POWER ELECTRONICS IN POWER SYSTEMS
7	25UEEO07	INTRODUCTION TO ROBOTICS AND AUTOMATION
8	25UEEO08	POWER SYSTEM ENGINEERING
9	25UEEO09	ENERGY ENGINEERING
10	25UEEO10	SENSORS AND TRANSDUCER
11	25UEEO11	POWER PLANT ENGINEERING
12	25UEEO12	ELECTRIC VEHICLE TECHNOLOGY

ADVANCED LEVEL COURSES FOR B.Tech.

HONOR

Students who have registered for B.Tech. (**Honor - Renewable Energy**) in Electrical and Electronics Engineering can opt to study Minimum 5 out of the courses listed below. Students of own Department (B.Tech. EEE) are applicable the Honors Programme.

HONOR -RENEWABLE ENERGY

Sl.No	Course Code	List of Minor Course	Hrs/Week			Credits
			L	T	P	
1.	25UEEH01	Renewable Energy Systems	4	0	0	4
2.	25UEEH02	Energy Storage Systems	4	0	0	4
3.	25UEEH03	Solar Energy Engineering and Photovoltaic Systems	4	0	0	4
4.	25UEEH04	Wind Energy Conversion Systems	4	0	0	4
5.	25UEEH05	Bioenergy and Biomass Power Systems	4	0	0	4
6.	25UEEH06	Hydro Power Systems	4	0	0	4

MINOR

Students who have registered for B.Tech. (**Minor - Electric Vehicle Technology)** in Electrical and Electronics Engineering from any other branches can opt to study Minimum 5 out of the courses listed below. Students of own Department (B.Tech. EEE) are not applicable for Minor Programme.

MINOR - ELECTRIC VEHICLE TECHNOLOGY

Sl.No	Course Code	List of Minor Course	Hrs/Week			Credits
			L	T	P	
1.	25UEEM01	Introduction to Electric Vehicle	4	0	0	4
2.	25UEEM02	Electric and Hybrid Vehicle Systems	4	0	0	4
3.	25UEEM03	Electric Machines for EV Applications	4	0	0	4
4.	25UEEM04	Power Electronics for Electric Vehicles	4	0	0	4
5.	25UEEM05	Battery Technology and Battery Management Systems (BMS)	4	0	0	4
6.	25UEEM06	Electric Vehicle Drives and Control	4	0	0	4

SEMESTER–I

25UMAT11	MATRICES & CALCULUS	Category	L	T	P	Credit
		BS	3	1	0	4

Course Prerequisite:

- Higher Secondary Level Mathematics

Course Objective:

- To understand and gain the knowledge of matrix algebra, partial differentiation, double integration, triple integration and their application, curl, divergence. To familiar with vector differential operators, integral theorems (Green's, Stoke's, Gauss divergence).

Course Outcome		
On the successful completion of the course, students will be able to		
CO1	Find eigenvalues and eigenvectors, verify the Cayley-Hamilton theorem, and perform orthogonal diagonalization.	Apply (K3)
CO2	Compute partial derivatives, determine total derivatives, Jacobians, employ Taylor's series, and find extremes of functions of two variables.	Apply (K3)
CO3	Demonstrate proficiency in evaluating double integration and triple integration and using them to compute area and volume.	Apply (K3)
CO4	Compute gradients, divergence, curl, directional derivatives, and apply vector identities to solve vector field problems.	Apply (K3)
CO5	Apply Green's theorem, Stoke's theorem and Gauss divergence theorem.	Apply (K3)

SYLLABUS

UNIT I MATRICES 12 Hours

Eigenvalues and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigen values and Eigenvectors- Cayley-Hamilton Theorem, Diagonalization of matrices. Reduction of a quadratic form to canonical form by orthogonal transformation -Nature of quadratic forms.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12 Hours

Partial derivatives-Total derivative- Differentiation of implicit functions, Change of variables- Jacobians and their properties-Taylor's series for functions of two variables- Maxima and minima, Lagrange"s method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS 12 Hours

Multiple Integral – Change of order of integration (Cartesian form). Applications: Areas as a double integral (Cartesian form) – Volume as a triple integral (Cartesian form).

UNIT IV VECTOR DIFFERENTIATION 12 Hours

Scalar and vector valued functions-gradient, tangent plane – directional derivative-divergence and curl- scalar and vector potentials. Statement of vector identities-simple problems.

UNIT V VECTOR INTEGRATION 12 Hours

Line, surface and volume integrals- statements of Green's, Stoke's and Gauss Divergence theorems – verification and evaluation of vector integrals using them.

TOTAL PERIODS: 60

TEXT BOOKS:

1. Veerarajan T., "Engineering Mathematics – I and II", Tata McGraw-Hill, New Delhi, 2014 and 2015.
2. Dr. M.K. Venkataraman, "Engineering Mathematics – Volume I and Volume II", The National Publishing Company, Chennai 2008.

REFERENCE BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.
3. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
4. Erwin Kreyszig, Advanced Engineering Mathematics (9th Edition), John Wiley & Sons, New Delhi, 2011.

Online Courses/NPTEL/SWAYAM:

https://nptel.ac.in/courses/111106100

https://nptel.ac.in/courses/111104125

https://nptel.ac.in/courses/111105121

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

CO-PO -PSO Mapping (New)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	1	-	-	-
CO2	3	2	2	2	-	-	-	-	-	1	-	-	-
CO3	3	2	2	2	-	-	-	-	-	1	-	-	-
CO4	3	2	2	2	-	-	-	-	-	1	-	-	-
CO5	3	2	2	2	-	-	-	-	-	1	-	-	-

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
Problem based Assignment	Moodle / Google form	5
Simulation (Python/Matlab/Scilab) Based Project assignment	Demo and viva	5
Attendance		5
Total		**40**

25UPHT12	PHYSICAL SCIENCE FOR ELECTRICAL AND ELECTRONICS ENGINEERS	Category	L	T	P	Credit
		BS	3	0	0	3

Course Prerequisite:

- 12th standard knowledge of Wave motion, light properties, Crystal structure, Energy bands.
- Knowledge of functional groups, polymerization basics, and reaction mechanisms.

Course Objectives:

- To understand basics of oscillations, optics and lasers.
- To understand the concept of dielectrics and its applications.
- To instill knowledge on physics of semiconductors, determination of charge carriers and device applications
- To understand the basic electrochemical properties such as electrodes, cell potentials, lead storage batteries.
- To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.

Course Outcome		
On the successful completion of the course, students will be able to		
CO1	Understand the basics of oscillations, interference phenomenon, apply it to understand optical based devices and classify the different laser systems used for various application	Understand
CO2	Understand properties and applications of dielectrics	Understand
CO3	Understand the principles of physics behind semiconductors, Hall effect and apply the same to identify type of any semiconductor sample, evaluate no. of charge carriers	Understand
CO4	Analyze the galvanic cells, electrode potentials, and the electrochemical series, including EMF measurement and the Nernst equation using hydrogen and calomel reference electrodes. Study different batteries and H_2-O_2 fuel cells, focusing on their types and applications.	Analyze
CO5	Understand the importance of nanotechnology and nanodevices.	Understand

Syllabus

Unit1- OSCILLATIONS, OPTICS AND LASERS **9 Hours**

Simple harmonic motion – Electrical and mechanical oscillation - waves on a string - standing waves - traveling waves - Interference - Anti-reflection coating - Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet-Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: Nd: YAG laser CO_2 laser and semiconductor laser - Applications : Laser in medicine and materials Processing.

Unit 2- DIELECTRIC PROPERTIES **9 Hours**

Dielectric Polarization and Mechanism –Temperature dependence of polarization, Internal or local Field - Clausius-Mossotti relation. Basic ideas of Dielectric loss -frequency dependence of dielectric constant – Measurement of Dielectric constant and loss using Scherring bridge – Elementary ideas of Piezo electrics, Ferroelectrics and Pyroelectric materials and Applications

Unit-3 PHYSICS OF SEMICONDUCTORS **9 Hours**

Elemental and compound semiconductors –Direct and Indirect band gap semiconductors- Drift and diffusion current – Intrinsic semiconductors: Intrinsic carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors (Qualitative ideas}— Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

Unit – 4 ELECTRO CHEMICAL CELLS AND STORAGE DEVICES **9Hours**

Galvanic cells, single electrode potential, standard electrode potential, electrochemical series. EMF of a cell and its measurement. Nernst equation. Reference electrodes-hydrogen and calomel. Batteries and fuel cells: Types of batteries- alkaline battery-lead storage battery- nickel-cadmium and Lithium-ion battery - fuel cell H_2 -O_2 fuel cell-applications.

Unit – 5 NANODEVICES: **9Hours**

Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties (optical, electrical, mechanical, magnetic and catalytic). Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, chemical vapour deposition, electrochemical deposition and electro spinning. Characterization - Scanning Electron Microscope and Transmission Electron Microscope - Principle and instrumentation (block diagram). Applications of nanomaterials - medicine, Agriculture, electronics and catalysis.

Total No. Of Hours: 45

Text Book

1. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.
2. P K. Palanisamy, Engineering Physics Vol I and II Scitech Publications (India) Pvt Ltd, 2018.
3 Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpa
4. William D Callister Jr., Material Science and Engineering, 6th Edition, John Wiley and sons, 2009.
5. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley & sons, Singapore, 2007.
6. V Raghavan, Materials Science and Engineering- A First Course, 5th Edition, Prentice Hall of India, 2008.
7. P.C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai and Sons, New Delhi 2004.

Reference Book & Web Resources

1. Laszlo Solymar, Walsh, Donald, Syms and Richard R.A., Electrical Properties of Materials, Oxford Univ. Press (Indian Edition) 2015.
2. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw- Hill Education (Indian Edition), 2019.
3. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
4. Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.
5. Tipler P.A. and Mosca, G.P., Physics for Scientists and Engineers with Modern Physics, W.H. Freeman, 2007.
6. Markert J.T., Ohanian. H. and Ohanian, M., Physics for Engineers and Scientists, W.W. Norton & Co., 2007.
7 Palanisamy P.K., —Semiconductor physics and optoelectronics‖ Scitech Publications, 2003.

Online Courses/NPTEL/SWAYAM:

https://archive.nptel.ac.in/courses/115/102/115102124/
https://archive.nptel.ac.in/courses/122/106/122106034/
https://archive.nptel.ac.in/courses/115/101/115101107/

CO-PO -PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	1	-	-	-	-	-	1	1	-
CO2	3	2	1	1	1	-	-	-	-	-	1	1	-
CO3	3	2	1	1	1	-	-	-	-	-	1	1	-
CO4	3	1	1	1	2	2	2	2	1	1	2	-	-
CO5	3	3	3	3	3	1	2	1	2	2	2	-	1
CO6	3	3	3	3	3	1	2	1	2	2	2	-	-

Assessment Methodology	Assessment Tools	Marks
Test		25
MCQ unit wise 10 questions	Moodle / Google form	5
Virtual lab based assignment	Demo and viva	5
Attendance		5
Total		**40**

25UEET13	ENERGY ENGINEERING	Category	L	T	P	Credit
		ES	3	0	0	3

Course Prerequisite: HSS Physics

Course Objectives:

The objective of the course is to introduce various energy resources right from the conventional energy systems to upcoming renewable energy systems. The course offers details on hydro electric technology, wind, solar and biomass energy technologies. Besides, It enables the students to understand the necessity of energy conservation and management

Course Outcome

On the successful completion of the course, students will be able to

CO1	Explain the current world and Indian energy scenario and the various resources	K2
CO2	Describe the working of different types of principles of different conventional energy sources	K2
CO3	Explain the potential and concept of the hydro and ocean energy technologies	K2
CO4	Illustrate the applications of different types of wind, solar energy and DG technologies.	K2
CO5	Discuss about the energy conservation and management	K2

Syllabus

UNIT I: Energy Resources **9Hours**

World Energy Status, Indian scenario, Energy reserves – conventional and non-conventional, Forms of Energy - Fossil Fuel, Fuel cell, Hydrogen energy, Small hydro resources - Renewable Energy Sources - Energy Intensity - Gross Domestic product – Need for energy storage, Energy storage methods - Environmental aspects of energy.

UNIT II: Conventional Energy Sources **9Hours**

Coal fired steam thermal power plant– layout, working principle- Gas turbine power plant–various options, layout, working principle- Nuclear power plants: fuels, nuclear fuel cycle, reactors, nuclear power plant, and nuclear waste management.

UNIT III: Hydro and Ocean Energy Electric Technologies **9Hours**

Hydro Electric plants – Types, energy conversion schemes, power equation, environmental aspects– Hydro- Thermal coordination-Ocean Energy Technology- Power plant-limitations.

UNIT IV: Wind, Solar Energy and DG Technologies **9Hours**

Wind turbine types and construction– wind energy conversion systems- grid connection environmental aspects. Solar energy basics- Solar PV plant- Distributed Generation- Impacts-Benefits.

UNIT V: Energy Conservation and Management **9 Hours**

Principle of energy conservation- waste heat recovery –Heat Exchanger– Economics of energy Conservation-co generation- Definition and Objectives of Energy Management, Energy Management System, Top management support, Energy policy purpose, Roles and responsibilities of energy manager**.**

Total No. Of Hours: 45

Text Books:

1. S. Rao and Dr.B. Parulekar, Energy Technology, Khanna pub., 3rd Edition, 1999.
2. B.H. Khan, Non-conventional Energy Resources, TMH, 2006.
3. Amalan Chakrabarti, Energy Engineering and Management, PHI Learning Pvt. Ltd., 2018.
4. D.P. Kothari, K.C. Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, PHI, 2011.

Reference Book & Web Resources

1. Tyler Gregory Hicks, Handbook of Energy Engineering Calculations, McGraw Hill, 2011.
2. G.D. Rai, Non-Conventional Energy Sources, Khanna pub. Fourth Edition, 2002.
3. Abbasik, Renewable Energy Sources and their Environment, PHI, 2008.

CO-PO -PSO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	2	1								1	1
CO2	3	3	2	1								1	1
CO3	3	3	2	1								1	1
CO4	3	3	2	1								1	1
CO5	3	3	2	1								1	1

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
MCQ unit wise 10 questions	Moodle / Google form	5
Virtual lab-based assignment	Demo and viva	5
Attendance		5
Total		**40**

25UEET14	FUNDAMENTALS OF ELECTRICAL ENGINEERING	Category	L	T	P	Credit
		ES	3	0	0	3

Course Prerequisite: Physics

Course Objective:

- Understand basic electrical concepts, laws, and circuit analysis techniques in DC and AC systems.
- Gain knowledge of electrical wiring methods, safety practices, illumination, and energy-saving measures.
- Learn the fundamental principles and operations of DC machines, transformers, and single-phase induction motors.
- Explore the structure and components of power generation, transmission, and distribution systems.
- Identify essential protective devices like fuses and circuit breakers used in electrical systems.

Course Outcome

On the successful completion of the course, students will be able to

CO1	Apply basic electrical laws and analysis techniques to solve DC circuits.	K3
CO2	Analyze single-phase AC circuits and explain power measurement methods.	K3
CO3	Identify wiring systems, safety measures, and understand energy conservation practices.	K3
CO4	Explain the working principles of basic electrical machines.	K2
CO5	Describe the structure of power systems and the fundamentals of power generation and protection.	K3

SYLLABUS

UNIT – I - DC CIRCUITS **9Hours**

Definition of Voltage, Current, Power & Energy, circuit parameters, Ohm's law, Kirchhoff's law & its applications – Simple Problems - Division of current in Series& parallel circuits - star/delta conversion - Node and Mesh methods of analysis of DC circuits.

UNIT – II - AC CIRCUITS **9Hours**

Concepts of AC circuits – rms value, average value, form and peak factors – Simple RLC series circuits – Concept of real and reactive power – Power factor - Introduction to three phase system-star/Delta connection balanced and unbalanced load, Power measurement by two wattmeter method.

UNIT III – WIRING, SAFETY, AND ILLUMINATION **9Hours**

Types of wiring-staircase & corridor wiring, wiring accessories. Basic safety measures at home and industry-earthing. Electrical tariff, energy audit and importance of energy saving. The Laws of Illumination-Electric lamps.

UNIT – IV – ELECTRICAL MACHINES **9Hours**

Law of Electromagnetic induction, Fleming's Right- & Left-hand rule - Principle of DC rotating machine, Single phase transformer and single-phase induction motor (Qualitative approach only)

UNIT – V – POWER SYSTEMS **9Hours**

Simple layout of generation-various energy resources, transmission & distribution of power, Fundamentals of fuses and circuit breakers

Total No. Of Hours: 45

Text Books:

1. S. K. Sahdev, —Fundamentals of Electrical Engineering and Electronics‖, Dhanpat Rai & Co, 2017.
2. S.S. Dash, C. Subramani, K. Vijayakumar, —Basic Electrical Engineering‖, Vijay Nicole Imprints Pvt. Ltd, 1st Edition, 2013.
3. Leonard S Bobrow, —Foundations of Electrical Engineering‖, Oxford University Press, Asian Edition, 2013.

Reference Books:

1. S. K. Bhattacharya, S. Chatterji, —Projects in Electrical, Electronics, Instrumentation and Computer Engineering‖, S. Chand & Co, 2nd Edition, 2010.
2. David Herres, —The Homeowner's DIY Guide to Electrical Wiring‖, McGraw Hill Professional, 7th Edition, 2015.
3. Gaurav Verma and Matt Weber, —AutoCAD Electrical 2018 Black Book‖, Ingram short title, 4th Edition, 2018.

Web Resources:

1. https://www.electrical4u.com/
2. https:www.allaboutcicuits.com/
3. https: www.nptel.ac.in/couses/108105112/
4. https: demonstrations.wolfam.com/

Mapping with Programme Outcomes													
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	2	1	2						1	2	2
CO2	3	2	2	2	2						1	2	2
CO3	3	3	2	2	2						1	2	2
CO4	3	2	3	1	2						1	2	2
CO5	3	2	2	2	3						1	2	2

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
MCQ unit wise 10 questions	Moodle / Google form	5
Virtual lab based assignment	Demo and viva	5
Attendance		5
Total		**40**

25UHSI16	PROFESSIONAL COMMUNICATION FOR ENGINEERS	Category	L	T	P	Credit
		HS	1	0	4	3

Course Prerequisite: Higher Secondary General English.

Course Objectives:

1. To improve the communicative competence of learners
2. To learn to use basic grammatic structures in suitable contexts
3. To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
4. To help learners use language effectively in professional contexts
5. To develop learners‟ ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

SYLLABUS:

UNIT I: INTRODUCTION TO COMMUNICATION **9 Hours**

EFFECTIVE COMMUNICATION:

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C‟s of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

FUNDAMENTALS OF COMMUNICATION:

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

LAB ACTIVITY: Extempore (Oral), Conversation on asking directions, listening – Telephone conversation; Speaking Self-introduction; Telephone conversation – Video conferencing etiquette

UNIT II: NARRATION AND SUMMATION **9 Hours**

Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays – String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

LAB ACTIVITY: Listening – Travel podcast; Speaking – Narrating and sharing personal experiences through a podcast, Autobiography of a famous Personality

UNIT III: DESCRIPTION OF A PROCESS / PRODUCT **9 Hours**

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

LAB ACTIVITY: Listening – Railway / Airport Announcements, Travel Vlogs; Speaking – Describing a place or picture description.

UNIT IV: VISUALIZATION AND CLASSIFICATION **9 Hours**

Listening – TED talks Speaking – Interviewing a celebrity/Famous Personality Reading – Company profiles, Business Letters Vocabulary– Discourse Markers, Linking words and Phrases Collocation. Grammar – Pronouns, Conjunction, Preposition Writing – Interpretation of Charts and Graphs.

LAB ACTIVITY: Picture Description, about purchasing a product, summarizing a TED talk, Role play, Narrating an unforgettable event.

UNIT V: EXPRESSION COMMUNICATION **9 Hours**
Listening – Watching Movies / Listening to Dialogues and Conversations Speaking – Role play, Panel Discussion, Debate Reading – Blogs, Novels, Short Stories Vocabulary – Phrasal Verbs Grammar–Simple/Compound/Complex Sentences, Error Spotting, Punctuation. Writing – Descriptive Essay, Dialogue Writing **LAB ACTIVITY:** Listening /Reading Comprehension, Developing a story using given Vocabulary, Mini Presentation on General topic (ICT tools), Group Discussion.
Number of Practical Periods: 30 **Total Number of Periods: 75**

Assessment Methodology	**Assessment Tools**	**Marks**
Test		15
Listening and reading Comprehension	Online tool	5
Speaking assessment (Oral)	review	10
Online assessment test	Online tool	10
Content creation Competition	Peer review	5
Attendance		5
Total		**50**

25UPHP11	PHYSICAL SCIENCE LAB	Category	L	T	P	Credit
		BS	0	0	2	1

COURSE OBJECTIVES:

1. To provide an experimental foundation for the theoretical concepts introduced in the lectures
2. To teach how to make careful experimental observations and how to think about and draw conclusions from such data
3. To help students understand the role of direct observation in physics and to distinguish between inferences based on theory and the outcomes of experiments
4. To introduce the concepts and techniques which have a wide application in experimental science but have not been introduced in the standard courses
5. To teach how to write a technical report this communicates scientific information in a clear and concise manner

Course Outcomes:		
Upon completion of this course the students will be able to:		
CO1	Apply the concepts of elasticity and beam bending to experimentally determine Young's modulus using the non-uniform bending setup and interpret the results to understand material stiffness.	Apply
CO2	Apply the principles of fluid mechanics to experimentally determine the viscosity of a given liquid using Poiseuille's method	Apply
CO3	Apply the concept of steady-state heat conduction to experimentally determine the thermal conductivity of a bad conductor using Lee's Disc apparatus	Apply
CO4	Apply the principles of wave optics and interference to experimentally determine the thickness of a thin spacer using the Air Wedge method, and interpret the fringe pattern to calculate precise measurements.	Apply
CO5	Apply the principles of laser diffraction and wave optics to experimentally determine the wavelength of a laser beam and calculate the particle size of a fine powder	Apply

Sl.No	List of Experiments
1.	Determination of Young's modulus of given material by non-uniform bending method
2.	Determination of viscosity of the given liquid using Poiseuille's method.
3.	Determination of Thermal conductivity of a bad conductor –Lees 'Disc method
4.	Determination of the thickness of a given thin material– Air wedge method
5.	Determination of the wavelength of Laser and particle size of given powder
6.	Determination of the angle of divergence of a laser beam using semiconductor
7.	Determination of band gap of a semiconductor diode. **1.** Determination of radius of curvature of lens Newtons ring method. **2.** Determination of the wave spectrometer grating/ prism.

8.	Determination of the optical fibber's numerical aperture and Acceptance angles.
9.	Determination of radius of curvature of lens Newtons ring method
10.	Determination of the wavelength of mercury spectrum using spectrometer grating/ prism.
11.	Determination of the optical fibber's numerical aperture and Acceptance angles

Text Books:

1. Practical Physics – S.L. Gupta & V. Kumar
2. A Textbook of Practical Physics – M.N. Srinivasan
3. Engineering Physics Practical Manual – Dr. Arumugam M.
4. Engineering Physics Lab Manual – R.K. Shukla &Anchal Srivastava
5. Advanced Practical Physics for Students – B.L. Worsnop and H.T. Flint

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	0	3	0	1	1	1	1	0	2	1	0
CO2	2	2	2	0	0	0	1	1	1	0	2	1	0
CO3	2	2	2	2	0	0	1	1	1	0	2	1	0
CO4	2	1	1	1	0	0	1	1	1	0	1	0	0
CO5	2	2	1	1	1	0	1	1	1	0	1	0	0

Assessment Methodology	Assessment Tools	Marks
Laboratory Conduction	Observation	10
Record work		10

Assessment Methodology	Assessment Tools	Marks
Model exam		15
Viva		5
Virtual lab assignment	Review	5
STEM based model creation	Presentation	5
Attendance		10
Total		**60**

25UEEP17	BASIC ELECTRICAL ENGINEERING LAB	Category	L	T	P	C
		ES	0	0	2	1

Course Prerequisite: Physics

Course Objectives:

1. To equip students with knowledge and practical awareness of electrical safety measures.
2. To develop the ability to construct, test, and troubleshoot various residential and industrial wiring circuits.
3. To impart design and implementation skills for specific wiring layouts.
4. To train students in the effective use of electrical measuring instruments.
5. To reinforce fundamental electrical laws by performing hands-on verification of Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) in practical circuits.

Course Outcomes:		
On the successful completion of the course,		
CO1	Understand and apply electrical safety measures, tools, and accessories in practical scenarios.	K3
CO2	Demonstrate the ability to perform and test various residential and industrial wiring circuits.	K3
CO3	Develop skills in wiring design, including staircase, bedroom, doctor's room, and go-down layouts.	K3
CO4	Analyze and interpret measurements using CRO, meters, and fuse characteristics.	K3
CO5	Verify and apply fundamental electrical laws including Kirchhoff's Voltage and Current Laws.	K3

SYLLABUS – LIST OF EXPERIMENTS

1. Electrical Safety, Precautions, study of tools and accessories.
2. Practices of different joints.
3. Wiring and testing of series and parallel lamp circuits.
4. Staircase wiring.
5. Doctor's room wiring.
6. Bed room wiring.
7. Go down wiring.
8. Wiring and testing a ceiling fan and fluorescent lamp circuit.
9. Study of different types of fuses and A.C and D.C meters.
10. Study of CRO
    (a) Measurement of AC and DC voltages
    (b) Frequency and phase measurements (using Lissajou's figures)
11. Verification of Kirchhoff's Voltage and Current Laws

Mapping with Programme Outcomes													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	2	-	2	-	-	-	-	-	1	1	1
CO2	3	2	2	-	2	-	-	-	-	-	1	1	1
CO3	3	2	2	-	2	-	-	-	-	-	1	1	1
CO4	3	2	2	-	2	-	-	-	-	-	1	1	1
CO5	3	2	2	-	2	-	-	-	-	-	1	1	1

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	5
Circuit Construction Task	demo	5
Attendance		10
Total		**60**

25UGEP19	ENGINEERING GRAPHICS AND AUTOCAD	Category	L	T	P	C
		ES	0	0	2	1

Course Prerequisite.

- Students should have a fundamental understanding of engineering mathematics and basic geometric concepts, including lines, angles, shapes, and spatial visualization skills, typically covered in secondary school education.

Course Objectives:

- To develop knowledge of standard practices in engineering drawing, including lettering, line work, dimensioning, and projection techniques.
- To enable students to construct and interpret conic sections, spirals, involutes, helix curves, and projections of points, lines, planes, and solids.
- To understand the development and intersection of surfaces like cylinder-cylinder and cylinder-cone, essential for fabrication and design.
- To build skills in creating accurate isometric and orthographic projections for effective engineering communication.
- To introduce students to AutoCAD for creating 2D engineering drawings, enhancing their ability to use modern engineering tools.

Course Outcome		
On the successful completion of the course, students will be able to		
CO1	Understand and apply the principles of engineering drawing standards, including lettering, line types, dimensioning, and accurately construct conic sections, spirals, involutes, and helix curves.	K2
CO2	Interpret and generate projections of solid objects and their sectional views, aiding in better understanding of internal features in engineering components.	K3
CO3	Develop the lateral surfaces of solids essential for manufacturing and fabrication processes.	K3
CO4	Create and interpret isometric and orthographic projections of engineering objects to effectively communicate design intent.	K3
CO5	Utilize computer-aided drafting tools, particularly AutoCAD, to produce accurate 2D engineering drawings of simple geometries, enhancing proficiency in modern engineering software.	K3

Syllabus

UNIT-I

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning. Conic sections, Involutes, Spirals, Helix. Projection of Points, Lines and planes

UNIT-II

Projection of Solids and Sections of solids

UNIT-III

Development of surfaces

UNIT-IV

Isometric projections and Conversion of pictorial to Orthographic views

UNIT-V

Computer Aided Drafting: Introduction to Computer Graphics and Drafting, AutoCAD,2-D diagrams of simple geometries using Auto- CAD script.

Text Books:

1. K.R.Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics ,Inzinc Publishers, 2007.

Reference Books:

1. N.D.Bhatt, Engineering Drawing,49th edition,Chorotar Publishing House,2006.
2. K.Venugopal, Engineering DrawingandGraphics+AutoCAD,4th edition,NewAgeInternational Publication Ltd.,2004.
3. DavidIcook and Robert NMc Dougal, Engineering Graphics and Design with computer applications, Holt – Sounders Int. Edn.1985.
4. James D Bethuneandet.al., Modern Drafting,PrenticeHallInt.,1989.

Web Resources

1. **https://nptel.ac.in/courses/112/103/112103019/**
2. **https://archive.org/details/engineeringdrawingndbhatt**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2		2			1		2		
CO2	2	2	2	2		1			1		2		
CO3	2	2	2	2		2			1		2		
CO4	2	2	2	2		1			1		2		
CO5	2	2	2	2		2			2		2		

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Real Model Drawing	Review	5
CAD Simulation Test		5
Attendance		10
Total		**60**

25UPCC11	CAREER DEVELOPMENT SKILLS	Category	L	T	P	C
		EEC	0	0	2	0

Prerequisite: Basic communication skills and foundational knowledge of workplace behavior

Preamble/ Course Objective:
To empower students with the skills for self-discovery, goal achievement, effective time management, and personal effectiveness, alongside foundational knowledge in career planning, emotional intelligence, higher education, competitive exams, and entrepreneurship

Course Outcome
On the successful completion of the course, the students will be able to

CO1	Help students assess themselves, explore career options, and set actionable goals through structured planning.
CO2	Develop motivation, enhance personality effectiveness, and instill discipline for personal and professional growth.
CO3	Build awareness and practice of grooming, hygiene, positive attitudes, manners, and professional behaviour.
CO4	Strengthen self-awareness, time and stress management, and emotional intelligence for balanced personal development.
CO5	Introduce students to higher education paths, competitive exams, and the fundamentals of entrepreneurship and business planning

Syllabus

UNIT 1 **9 Hours**

Career Planning: Introduction to Career Planning - Self-Assessment for Career Planning - Exploring Career Options- Developing a Career Plan;
Goal Settings: Understanding Goal Setting - Setting Effective Goals - Action Plan Development - Practical Exercises

UNIT 2 **9 Hours**

Motivation – I: Definition and Importance of Motivation - Types of Motivation - Theories of Motivation - Factors Affecting Motivation
Personality Effectiveness: Components of Personality Effectiveness - Communication Skills - /Interpersonal Skills - Practical Exercises
Building Personality and Discipline: Introduction to Personality Development - Building Positive Habits - Discipline and Self-Control - Practical Application

UNIT 3 **9 Hours**

Grooming, hygiene and Cleanliness: Personal Hygiene Practices - Body Grooming Techniques - Environmental Cleanliness - Mental and Social Impact of Grooming and Hygiene.

Attitudes, Manners and Behaviour: Understanding Attitudes - Developing Positive Attitudes - Manners and Etiquette - Procedures and Protocols

UNIT 4 **9 Hours**

Self- Awareness & Self Confidence: Introduction to Self-Awareness- Understanding Strengths and Weaknesses- Building Self-Confidence- Practical Application

Time Management: Introduction to Time Management - Planning and Prioritizing Tasks-Overcoming Procrastination- Practical Time Management

Stress Management: Understanding Stress- Stress Management Techniques-Coping Strategies-Practical Application

Emotional Intelligence: Introduction to Emotional Intelligence- Managing Emotions- Social Awareness and Relationship Management-Practical Exercises

UNIT 5 **9 Hours**

Introduction to Higher Education, Competitive exams: Overview of Higher Education- Competitive Exams Overview - Exam Preparation Techniques

Introduction to Entrepreneurship: Understanding Entrepreneurship- Developing a Business Idea - Business Planning

Total No. Of Hours: 45

Text Book

1. Soft skills for Managers by Dr. T. KALYANA CHAKRAVATHI
2. Personal Development and Soft Skills by BARUN K MITRA, Oxford Higher Education

Reference Book

1. The Emotionally Intelligent Workplace by DANIEL GOLEMAN.
2. Communication skills and soft skills an integrated approach by E. SURESH KUMAR, P. SREEHARI, J SAVITHRI.
3. Top Talking in English (international communication skills) by CHARLES T. RAJENDRA
4. Soft skills by RAJ LAKSHMI SURYAVANSHI, Gurucool Publishing

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1								2	2	2	2
CO2					2			2			2
CO3							2	2			2
CO4								2	2		2
CO5						2	2				2

25UMCC11	IKS – CONCEPTS AND APPLICATIONS IN ENGINEERING AND SCIENCE	Category	L	T	P	C
		MCC	1	0	1	0

Prerequisite: Basic understanding of science and engineering fundamentals

Preamble/ Course Objective

This course introduces students to the rich heritage of Indian Knowledge Systems (IKS) and their contemporary applications in engineering and science. The objective is to:

- Familiarize students with traditional Indian knowledge systems and their scientific foundations
- Explore the integration of ancient wisdom with modern engineering practices
- Understand sustainable technologies and innovations rooted in Indian traditions
- Develop appreciation for indigenous knowledge in solving contemporary challenges
- Foster research mindset towards validating and modernizing traditional practices

Course Outcome	
On the successful completion of the course, students will be able to:	
CO1	Understand the historical development and scientific basis of Indian Knowledge Systems
CO2	Analyze traditional Indian practices in mathematics, astronomy, metallurgy, and medicine
CO3	Apply IKS principles to contemporary engineering and scientific problems
CO4	Evaluate the sustainability aspects of traditional Indian technologies
CO5	Create innovative solutions by integrating traditional knowledge with modern science

Syllabus

UNIT I: Introduction to Indian Knowledge Systems **9 Hours**

Historical overview of Indian Knowledge Systems - Scientific methodology in ancient India - Major texts and scholars: Vedas, Upanishads, Charaka Samhita, Sushruta Samhita - Transmission and preservation of knowledge - Contemporary relevance and global recognition

UNIT II: Mathematics and Astronomy in Ancient India **9 Hours**

Indian contributions to mathematics: Zero, decimal system, trigonometry - Aryabhata, Brahmagupta, Bhaskara‟s contributions - Astronomical observations and calendar systems - Navigation techniques and geographical knowledge - Applications in modern engineering calculations.

UNIT III: Metallurgy, Materials, and Architecture **9 Hours**

Ancient Indian metallurgy: Iron pillar of Delhi, Wootz steel - Traditional building materials and techniques - Architectural marvels: Structural engineering principles - Water harvesting and management systems - Sustainable construction practices.

UNIT IV: Medicine, Agriculture, and Life Sciences **9 Hours**

Ayurveda: Principles and scientific validation - Traditional agricultural practices and crop management - Biodiversity conservation methods - Food preservation techniques - Biotechnology applications in traditional practices.

UNIT V: Integration with Modern Science and Technology **9 Hours**

Validating traditional knowledge through modern scientific methods - Case studies of successful IKS-modern science integration - Intellectual property and traditional knowledge protection - Research opportunities and career prospects - Future directions and challenges

Total No. Of Hours: 45

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Text Books:

1. Subhash Kak, "The Nature of Physical Reality", Mount Meru Publishing, 2016
2. B.V. Subbarayappa, "Indian Astronomy: A Source Book", Nehru Centre, 2008
3. Kapila Vatsyayan, "Traditional Indian Art and Culture", Cambridge University Press, 2015

Reference Book & Web Resources:

1. P.P. Divakaran, "The Mathematics of India: Concepts, Methods, Connections", Springer, 2018
2. S.N. Sen, "Ancient Indian History and Civilization", New Age International, 2010
3. National Mission for Manuscripts - www.namami.gov.in
4. Digital Library of Traditional Ecological Knowledge - www.frlht.org
5. CSIR Traditional Knowledge Digital Library - www.tkdl.res.in

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	1	-	2	1	2	1	3		
CO2	3	2	2	1	2	-	1	1	2	2	3		
CO3	3	3	2	2	2	1	2	2	2	2	2		
CO4	2	2	2	2	3	2	3	2	3	3	3		
CO5	3	3	3	3	3	2	2	2	3	3	2		

25UMCC12	ENVIRONMENTAL SCIENCE & SUSTAINABILITY	Category	L	T	P	C
		MCC	2	0	0	0

Course Prerequisites: Basic knowledge of chemistry, biology, and physics

Course Objectives:

This course provides comprehensive understanding of environmental science principles and sustainability concepts essential for engineering professionals. The objectives are to:

- Understand fundamental concepts of environmental science and ecology
- Analyze environmental problems and their engineering solutions
- Develop awareness about sustainable development and green technologies
- Explore renewable energy systems and waste management strategies
- Foster environmental consciousness and responsible engineering practices

Course Outcomes:	
On the successful completion of the course, students will be able to	
CO1	Understand fundamental principles of environmental science and ecosystem dynamics
CO2	Analyze various types of pollution and their impact on human health and environment
CO3	Apply principles of sustainable development in engineering design and decision-making
CO4	Evaluate renewable energy technologies and waste management systems
CO5	Design environmentally sustainable solutions for engineering problems

Syllabus

UNIT I: Introduction to Environmental Science and Ecology **6 Hours**

Definition, scope and importance of environmental science - Structure and function of ecosystems - Biogeochemical cycles: Carbon, nitrogen, phosphorus, sulfur cycles - Biodiversity and its conservation - Environmental impact assessment principles.

UNIT II: Environmental Pollution and Control **6 Hours**

Air pollution: Sources, effects, and control measures - Water pollution: Industrial and domestic sources, treatment methods - Soil pollution: Causes, effects, and remediation techniques - Noise pollution: Sources, effects, and control - Solid waste management: 3R principles, waste-to-energy.

UNIT III: Sustainable Development and Green Technologies **6 Hours**

Concept of sustainable development and SDGs - Life cycle assessment (LCA) principles - Green building concepts and LEED certification - Cleaner production and industrial ecology - Environmental management systems (ISO 14001)

UNIT IV: Renewable Energy and Climate Change **6 Hours**

Solar energy systems: Photovoltaic and thermal applications - Wind energy: Technology and site assessment - Hydroelectric and geothermal energy systems - Climate change: Causes, effects, and mitigation strategies - Carbon footprint and carbon trading mechanisms

UNIT V: Environmental Regulations and Case Studies **6 Hours**

Environmental laws and regulations in India - Environmental clearance procedures - Corporate environmental responsibility - Case studies of environmental disasters and lessons lear,ned - Future trends in environmental technology.

Total No. Of Hours: 30

Text Books:

1. G. Tyler Miller Jr., "Environmental Science: Working with the Earth", Cengage Learning, 2019
2. C. Anil Kumar, "Environmental Science and Engineering", PHI Learning, 2018
3. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, 2017

Reference Book & Web Resources:

2. Richard T. Wright, "Environmental Science: Toward a Sustainable Future", Pearson, 2017
3. Daniel B. Botkin, "Environmental Science: Earth as a Living Planet", Wiley, 2018
4. Central Pollution Control Board - www.cpcb.nic.in
5. Ministry of Environment and Forests - www.moef.gov.in
6. UN Environment Programme - www.unep.org
7. NPTEL Environmental Science Courses - nptel.ac.in

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	1	-	3	2	3	2	3		1
CO2	2	2	2	1	2	1	3	2	3	3	3		1
CO3	3	2	2	2	3	2	3	3	3	3	3		1
CO4	3	3	3	3	3	3	3	3	3	3	3		1
CO5	3	3	3	3	3	3	3	3	3	3	3		1

SEMESTER–II

25UMAT21	DIFFERENTIAL EQUATIONS AND TRANSFORMS	Category	L	T	P	C
		BS	3	1	0	4

Course Prerequisite:

- Engineering Mathematics I (Matrices & Calculus)

Course Outcome		
On the successful completion of the course, students will be able to		
CO1	Solve higher order differential equations	Apply(K3)
CO2	Formulate and solve various types of partial differential equations	Apply(K3)
CO3	Apply Laplace transforms and initial and final value theorems to solve engineering problems involving step, impulse and periodic functions.	Apply(K3)
CO4	Apply Laplace transforms to solve ordinary differential equations with constant coefficients and simultaneous ordinary differential equations	Apply(K3)
CO5	Apply Fourier transform techniques, including Fourier integral theorem, properties of Fourier transforms, convolution, and Parseval's identity	Apply(K3)

Syllabus

UNIT I: ORDINARY DIFFERENTIAL EQUATIONS **12 Hours**

Differential Equations (Higher order): Linear differential equations of higher order – with constant coefficients, the operator D, Euler „s linear equation of higher order with variable coefficients - simultaneous linear differential equations, solution by variation of parameters method.

UNIT II: PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Formation of partial differential equations- Solutions of standard types of first order partial differential equations- Lagrange's linear equation- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT III: LAPLACE TRANSFORM **12 Hours**

Existence conditions-Transforms of elementary functions- Properties, Transform of unit step function and unit impulse function -Transforms of derivatives and integrals- Transforms of Periodic Functions- Initial and final value theorems.

UNIT IV: INVERSE LAPLACE TRANSFORM **12 Hours**

Inverse Laplace Transforms – Properties, Convolution theorem, Application - Solution of ordinary differential equations with constant coefficients -Solution of simultaneous ordinary differential equations.

UNIT V : FOURIER TRANSFORM **12 Hours**

Fourier Integral theorem (statement only), Fourier transform and its inverse – Properties, Fourier sine and cosine transform - Properties, Convolution and Parseval's identity.

Total No. Of Hours: 60

Text Books:

1. Veerarajan T., "Engineering Mathematics – I and II", Tata McGraw-Hill, New Delhi, 2014 and 2015.
2. Dr. M.K. Venkataraman, "Engineering Mathematics – Volume I and Volume II", The National Publishing Company, Chennai 2008.

Reference Book & Web Resources

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2015.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.
3. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition, 2011.
5. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.

Online Courses/NPTEL/SWAYAM:

1. https://nptel.ac.in/courses/111106139
2. https://nptel.ac.in/courses/111101153
3. https://nptel.ac.in/courses/111107119

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2					1		1	1	1
CO2	3	2	2	2					1		1	1	1
CO3	3	2	2	2					1		1	1	1
CO4	3	2	2	2					1		1	1	1
CO5	3	2	2	2					1		1	1	1

Assessment Methodology	Assessment Tools	Marks
Test		25
Mathematical modeling assignment	Analytical solution presentation	5
Transform applications project (MATLAB/Python)	Demo and viva	5
Attendance		5
Total		**40**

25UHST22	UNIVERSAL HUMAN VALUES-II	Category	L	T	P	C
		HS	2	0	0	2

Course Prerequisite:

- Universal Human Values 1

Course Objectives:

- To enable students to grasp the relevance of value-based living for personal and societal well-being.
- To help students identify the components of human existence and differentiate their individual needs.
- To promote an understanding of key human values that foster harmonious relationships.
- To develop an awareness of the symbiotic relationship between humans and nature
- To encourage ethical and humanistic behavior, particularly in professional and social contexts

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Understand the importance of value education in achieving happiness, prosperity, and holistic human development.	Understand
CO2	Distinguish between the needs of the self and the body to ensure inner harmony and well-being.	Distinguish
CO3	Illustrate trust, respect and justice in the family and society build harmony in human relationships.	Illustrate
CO4	Recognize the interconnectedness and mutual fulfillment among all orders of nature to live in harmony with existence.	Recognize
CO5	Describe the importance of ethical conduct based on natural acceptance of human values.re	Describe

Syllabus

UNIT-I INTRODUCTION TO VALUE EDUCATION 9 Hours

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) ; Understanding Value Education; Self-exploration as the Process for Value Education; Continuous Happiness and Prosperity – the Basic Human Aspirations; Happiness and Prosperity – Current Scenario; Method to Fulfill the Basic Human Aspirations: Exploring Natural Acceptance.

UNIT II – HARMONY IN THE HUMAN BEING: 9 Hours

Understanding Human being as the Co-existence of the Self and the Body; Distinguishing between the Needs of the Self and the Body; Exploring the difference of Needs of Self and Body; The Body as an Instrument of the Self; Understanding Harmony in the Self ; Harmony of the Self with the Body ; Programme to ensure self-regulation and Health; Exploring Harmony of Self with the Body.

UNIT III – HARMONY IN THE FAMILY AND SOCIETY: 9 Hours

Harmony in the Family – the Basic Unit of Human Interaction; „Trust' – the Foundational Value in Relationship; 'Respect' – as the Right Evaluation; Other Feelings, Justice in Human- to-Human Relationship; Understanding Harmony in the Society; Vision for the Universal Human Order.

UNIT IV – HARMONY IN THE NATURE/EXISTENCE: 9 Hours

Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature: - Exploring the Four Orders of Nature; Realizing Existence as Co-existence at All Levels; The Holistic Perception of Harmony in Existence: - Exploring Co-existence in Existence.

UNIT V– IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS: 9 Hours

Natural Acceptance of Human Values; Definitiveness of (Ethical) Human Conduct: - Exploring Ethical Human

Conduct; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order; Competence in Professional Ethics: - Exploring Humanistic Models in Education; Holistic Technologies, Production Systems and Management Models-Typical Case Studies; Strategies for Transition towards Value-based Life and Profession.

Total No. Of Hours: 45

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethic", Excel Books, 2nd Revised Edition, New Delhi, 2019.
2. RR Gaur, R Asthana, G P Bagaria, "Teachers‟ Manual for A Foundation Course in Human Values and Professional Ethics", Excel Books, 2nd Revised Edition New Delhi, 2019.ISBN 978-93-87034-53.

Reference Books:

1. Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak," Jeevan Vidya" 1999.
2. A.N. Tripathi, "Human Values" New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth".

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						3		3					
CO2						3	3	3			3	1	
CO3						3		3	3				1
CO4						3	3	3		3		1	1
CO5											3		1

Assessment Methodology	Assessment Tools	Marks
Test		25
Case study analysis	Group discussion and report	5
Value-based project proposal	Presentation and peer evaluation	5
Attendance		5
Total		**40**

25UEET23	ELECTRONIC DEVICES	Category	L	T	P	C
		ES	3	0	0	3

Course Prerequisite: Higher Secondary Physics & Chemistry

Course Objectives:

- To provide a comprehensive understanding of semiconductor materials and construction and working of PN junction diodes with its characteristics.
- To provide a comprehensive understanding of construction, operating principle and characteristics of bipolar junction transistors (BJTs) EEPCCT-203 Electronic Devices
- To explore the construction and fabrication of field-effect transistors (FETs).
- To examine the construction, operating principle of various electronics switching devices – SCS, SCR, TRIAC, DIAC, GTO, and schokkely diode with its characteristics.
- To discuss the construction and operating principle of special semiconductor devices

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Apply the fundamental concepts of semiconductor physics, including energy band structures and charge carrier behavior in intrinsic and extrinsic materials, to analyze the construction, operation, and characteristics of PN junction and Zener diodes under various biasing and temperature conditions.	Apply (K3)
CO2	Apply the construction and working principles of NPN and PNP transistors to analyze their operation in common-base (CB), common-emitter (CE), and common-collector (CC) configurations. Utilize transistor characteristics and DC load line analysis to determine the operating point, and implement suitable biasing and compensation techniques to ensure stability in amplifier and switching circuits.	Apply (K3)
CO3	Apply the construction principles and operating characteristics of JFET and MOSFET devices, including enhancement and depletion modes, to analyze and bias FET-based electronic circuits.	Apply (K3)
CO4	Apply knowledge of various power switching devices including SCR, TRIAC, DIAC, and UJT to compare their operational behavior and select appropriate components for effective circuit implementation.	Apply (K3)
CO5	Discuss the construction and operating principle of special semiconductor devices	Apply (K3)

SYLLABUS

UNIT I SEMICONDUCTOR THEORY AND DIODES 9 Hours

Introduction to Semiconductor materials – Energy band structure of insulators, conductors and semiconductors – intrinsic and extrinsic semiconductors – Construction of PN Diode – forward and reverse bias operation – mathematical model of a PN diode – Effects of temperature on diode operation – Static and dynamic resistances –- Transition and diffusion capacitances – Zener diode and its characteristics- Applications of diodes.

UNIT II BIPOLAR JUNCTION TRANSISTORS 9 Hours

Construction and operation – NPN and PNP transistors – CB, CE and CC configurations – Transistor characteristics and regions of operation – Biasing of BJTs– DC load line characteristics – Operating point – stabilization – Biasing circuits – Bias compensation techniques.

UNIT III FIELD EFFECT TRANSISTORS 9 Hours

Comparison between JFET and BJT, JFET – Construction – drain and transfer characteristics – Shockley's equation — MOSFET –characteristics of Enhancement and Depletion modes. – Biasing of FETs -Comparison of MOSFET with JFET.

UNIT IV POWER DEVICES **9 Hours**

Construction, principle of operation and characteristics of Power Diode – Shockley diode – SCR – SCS – GTO–DIAC – TRIAC – UJT

UNIT V SPECIAL SEMICONDUCTOR DEVICES **9 Hours**

Apply the construction and characteristics of advanced semiconductor devices such as Schottky barrier diode, MESFET, FINFET, PINFET, CNTFET, and Dual Gate MOSFET to implement circuit solutions in high-speed, low-power, or nanoscale applications.

Total No. Of Hours: 45

Text Books:

1. J. Millman, C. Halkias and S. Jit, Electronic Devices and Circuits, Tata McGrawHill, 4th edition, 2015
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall India, 2015
3. Donald Neamen , Dhrubes Biswas "Semiconductor Physics and Devices" McGraw-Hill Education, 4th edition, 2021.

Reference Book & Web Resources

1. Allen Mottershed, "Electronic Devices and Circuits: An Introduction", PHI Learning 2011.
2. Ben G Streetman, "Solid-state electronic devices", Prentice Hall of India, 6th edition, 2008.
3. Theodre. F. Boghert, „Electronic Devices & Circuits", Pearson Education, 6th Edition, 2003. Ben G. Streetman and Sanjay Banerjee, „Solid State Electronic Devices", Pearson Education, 2002 / PHI.

Online Courses/NPTEL/SWAYAM:

1. NPTEL Course - Fundamentals of Semiconductor Devices
2. NPTEL Course - Semiconductor Devices and Circuits
3. NPTEL Course - Introduction to Semiconductor Devices

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	1								1	1
CO2	3	3	1	1								1	1
CO3	3	3	1	1								1	1
CO4	3	3	1	1								1	1
CO5	3	3	1	1								1	1

Assessment Methodology	Assessment Tools	Marks
Test		25
Application based Hobby circuits	Presentations	5
Simulation (TCAD, PSPICE, LT SPICE) Project based assignment	Demo and viva	5
Attendance		5
Total		**40**

25UEET24	ELECTRIC CIRCUIT THEORY	Category	L	T	P	C
		PC	3	0	0	3

Course Prerequisite:

- Fundamentals of Electrical Engineering

Course Objectives:

- To impart knowledge on solving circuit equations using network theorems for DC circuits.
- To impart knowledge on solving circuit equations using network theorems for AC circuits.
- To analyze the two-port network.
- To impart knowledge on obtaining the transient response of RC, RL and RLC circuits.
- To familiarize the phenomenon of resonance in series and parallel circuits.

Course Outcomes:		
On the successful completion of the course, students will be able to		
CO1	Analyse DC circuits and apply circuit theorems	K3
CO2	Examine AC circuits using circuit theorems	K3
CO3	Analyse of two port networks functions	K3
CO4	Analyse series and parallel resonant circuits	K3
CO5	obtain the transient response of DC and AC Circuits	K3

SYLLABUS

Unit I: NETWORK REDUCTION AND THEOREMS FOR DC CIRCUITS

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenin's and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem

Unit II: NETWORK REDUCTION AND THEOREMS FOR AC CIRCUITS

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenin's and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem

Unit III: TWO PORT NETWORK AND NETWORK FUNCTIONS

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, and hybrid parameters, interconnections of two port networks.

Unit IV: RESONANCE AND COUPLED CIRCUITS

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

Unit V: TRANSIENT RESPONSE ANALYSIS

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

Text Books:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 9th edition, New Delhi, 2020.
2. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Schaum Series and Systems", Schaum"s Outlines, Tata McGrawHill, Indian. 5th Edison , 2017
3. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2019.

Reference Books:

1. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpat Rai & Sons, New Delhi, 2013.
2. Allan H. Robbins, Wilheim C. Miller, "Circuit Analysis: Theory and Practice", 5th Edition, Cengage publishers, 2013.
3. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley Sons, Inc. 2018.

Web Resources

1. https://www.electrical4u.com/
2. https://www.allaboutcircuits.com/
3. https://archive.nptel.ac.in/courses/108/104/108104139/
4. NPTEL:Electrical Engineering - NOC: Basic Electric Circuits
5. Example videos in www.circuitlab.com

		Mapping with Programme Outcomes											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	2	2	2	-	-			-	-	-	2
CO2	3	3	2	2	2	-	-			-	2	-	2
CO3	3	3	2	2	2	-	-			-	-	-	2
CO4	3	3	2	2	2	-	-			-	2	-	2
CO5	3	3	2	2	2	-	-			-	2	-	2

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
Application based Hobby circuits	Presentations	5
Simulation (MATLAB,TCAD, PSPICE, LT SPICE, VIRTUAL LAB) Project based assignment	Demo and viva	5
Attendance		5
Total		**40**

25UCSI26	PROGRAMMING IN C	Category	L	T	P	Credit
		ES	2	0	2	3

Course Prerequisite

- Basic programming skills.

Course Objective

- To impart the knowledge of basic programming constructs of C language, arrays and strings, functions, structures, pointers and input/output file handling.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Demonstrate knowledge on C Programming constructs and develop simple program in C using basic constructs.	Understand (K2)
CO2	Apply arrays and string operations to solve basic problems using C	Apply (K3)
CO3	Develop modular programs using functions, recursion, and pointers	Apply (K3)
CO4	Implement user-defined data types using structures, unions, and manage memory dynamically.	Apply (K3)
CO5	Implement file operations and manage memory dynamically using pointers and pre-processor directives.	Apply (K3)

Syllabus

UNIT I INTRODUCTION TO PROGRAMMING PARADIGMS: 9 Hours

Introduction to programming paradigms – Applications of C Language – Structure of C program – C programming: Data Types – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions – Input/Output statements, Assignment statements – Decision making statements – Switch statement – Looping statements – Compilation process.

UNIT II DECISION MAKING, ARRAYS AND STRINGS 9 Hours

Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays – String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS 9 Hours

Modular programming – Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.

UNIT IV STRUCTURES AND UNION 9 Hours

Structure – Nested structures – Pointer and Structures – Array of structures – Self-referential structures – typedef – Union – Storage classes and Visibility.

UNIT V FILE MANAGEMENT AND DYNAMIC MEMORY ALLOCATION 9 Hours

Files- Types of file processing, I/O Operations of File, Random access file, Command line arguments, Dynamic memory allocation – malloc, calloc, free, Preprocessor directive, Macro substitution, Compiler control directive.

TEXTBOOKS:

1. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. E. Balagurusamy, "Programming in C" McGraw-Hill, 8th Edition, 2019.
3. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", 8thedition, Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", 2ndEdition, Oxford University Press, 2013.
4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013

ONLINE/ NPTEL COURSES:

1. C for Everyone: Programming Fundamentals- https://www.coursera.org/learn/c-for-everyone
2. Art of C programming -https://onlinecourses.swayam2.ac.in/cec24_cs05/preview
3. Introduction to Programming in C.- https://onlinecourses.nptel.ac.in/noc22_cs40/preview

PRACTICE EXERCISES:

1. Study of Compilation and execution of simple C programs
2. Simple computational problems using arithmetic expressions (Arithmetic Operations, Area &circumference of a circle)
3. Problems involving if-then-else structures (ODD/EVEN numbers, Greatest Numbers)
4. Iterative problems e.g., sum of series (Factorial, Sum of Digits)
5. 1D and 2D, multi-dimensional arrays, traversal
6. Matrix problems, String operations (Addition, Subtraction, Multiplication, Palindrome String Operations, String Handling Functions)
7. Simple functions (nCr Program, Swapping using call-by-reference)
8. Programming for solving Numerical methods problems (Palindrome Checking, Searching and Sorting Names)
9. Recursive functions (Factorial using Recursion)
10. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
11. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
12. Files: reading and writing, File pointers, file operations, random access, processor directives

CO-PO Mapping - PROGRAMMING IN C

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	2	–	–	–	2	–	1	1	-
CO2	3	2	3	2	2	–	–	–	1	–	1	1	-
CO3	3	2	3	3	2	–	–	–	2	–	1	1	-
CO4	3	2	3	3	3	–	–	–	2	–	1	1	-
CO5	3	2	3	2	3	–	–	–	2	–	1	1	-

Assessment Methodology	Assessment Tools	Marks
Theory Test		15
Coding assignments	Online submission	10
Mini project implementation	Code demo and documentation	10
Model Practical		10
Attendance		5
Total		**50**

25UEEI26	DIGITAL ELECTRONICS	Category	L	T	P	C
		PC	3	0	2	4

Course Prerequisite:

- Basic Electron Devices

Course Objective:

- To understand the fundamental principles of number systems, binary codes, and error detection/correction mechanisms.
- To understand the fundamental concepts to build any combinational circuit with logic gates and exclusively using universal gates.
- To understand the concepts of Sequential logic circuits.
- To understand the sequential circuits, emphasize is given to the variety of counter circuits both under synchronous.
- To understand the Asynchronous sequential logic circuits.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Apply knowledge of number systems, binary codes, and logic families in digital design.	K3
CO2	Design and simplify combinational logic circuits using K-map and logic gates.	K3
CO3	Design sequential circuits using flip-flops, counters and shift registers	K3
CO4	Design synchronous sequential logic circuits Moore and Mealy models	K4
CO5	Analyze asynchronous sequential circuits and address hazards and race conditions.	K4

SYLLABUS

Unit I - NUMBER SYSTEM AND LOGIC FAMILIES **9 Hours**

Review of number systems, binary codes, error detection and correction codes. Digital Logic Families – Introduction to RTL, DTL, TTL, ECL and MOSL families – wired and operation, characteristics of digital logic family – comparison of different logic families.

UNIT II - COMBINATIONAL LOGIC **9 Hours**

Representation of logic functions – SOP and POS forms, K-map representations – minimization using K-maps-simplification and implementation of combinational logic – multiplexers and demultiplexers – code converters, adders, subtractors.

UNIT III- SEQUENTIAL LOGIC **9 Hours**

SR, JK, D and T flip-flops – level triggering and edge triggering – counters – Pulse forming circuits - asynchronous and synchronous type – Modulo counters – Shift registers – Ring counters.

UNIT IV -SYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS **9 Hours**

State table and excitation tables - state diagrams - Moore and Mealy models - design of counters - analysis of synchronous sequential logic circuits - state reduction and state assignment.

UNIT V -ASYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS **9 Hours**

Transition table, flow table – race conditions – circuits with latches, analysis of asynchronous sequential logic circuits – implication table – hazards.

TOTAL PERIODS: 45

TEXT BOOKS:

1. Morris Mano.M, "Digital Logic and Computer Design", Prentice Hall of India, 3rd Edition, 2005.
2. Donald D. Givone, „Digital Principles and Design", Tata McGraw Hill, 1st Edition, 2003.
3. Thomas L Floyd, „Digital fundamentals", Pearson Education Limited, 11th Edition, 2015.

REFERENCES

1. Tocci R.J., Neal S. Widmer, „Digital Systems: Principles and Applications", Pearson Education Asia, 2014.
2. Donald P Leach, Albert Paul Malvino, Goutam Sha, „Digital Principles and Applications", Tata McGraw Hill, 7th Edition, 2010.

ONLINE/ NPTEL COURSES:

1. https://nptel.ac.in/courses/117105080 – NPTEL Course: Digital Systems Design by IIT Delhi
2. https://www.allaboutcircuits.com – Resource for logic gates, flip-flops, and VHDL
3. https://www.tutorialspoint.com/vhdl – VHDL Tutorials
4. https://www.eetimes.com – Articles and updates in digital design
5. https://www.coursera.org/learn/digital-systems – Coursera Course: Introduction to Digital Systems

PRACTICE EXERCISES:

List of Experiments:

1. Design and implementation of the following Code convertors
   a. BCD to excess-3 code and vice versa b. Binary to gray code and vice-versa
2. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC7483
3. Magnitude comparator
   a. Study of 4-bit magnitude comparator IC
   b. Realization of 8-bit magnitude comparator using 4-bit magnitude comparator ICs.
4. Multiplexers and Encoders
   a. Realization of 16×1 multiplexer using 8×1 multiplexer ICs
   b. Realization of a combinational circuit using multiplexer
   c. Construction and study of a simple Priority Encoder
5. Decoders and DeMultiplexers
   a. Realization of 4 to 16 line decoder using 3 to 8 line decoder ICs
   b. Realization of a combinational circuit using a decoder IC
6. Shift register
   a. Construction of ring counter and Johnson counter using a shift register IC and study of their timing diagrams
   b. Designing a PN Sequence Generator using a shift register IC
7. Ripple Counters and their timing diagrams
   a. 3-bit binary up/down counter
   b. BCD counter using mod-10 counter ICs
8. Design and implementation of Synchronous Counters and study of their timing diagrams
   a. Binary counter
   b. Non-sequential binary counter
   c. 3-bit binary up/down counter
   d. A modulo-N-counter

9. Study of a Memory IC
   a. READ and WRITE operations involving memory chips
   b. Expansion of memory size
10. Simulate the following circuits:
   a. Half Adder and Full Adder
   b. Multiplexer and DeMultiplexer
   c. Binary Up-down Counter
   d. Shift Register

Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	**3**	**3**	**2**	**1**	**3**	**-**	**-**	**-**	-	**-**	**3**	**2**	**1**
2	**3**	**3**	**3**	**1**	**3**	**-**	**-**	**-**	-	**-**	**3**	**2**	**1**
3	**3**	**3**	**3**	**1**	**3**	**-**	**-**	**-**	-	**-**	**3**	**2**	**1**
4	**3**	**3**	**3**	**1**	**3**	**-**	**-**	**-**	-	**-**	**3**	**2**	**1**
5	**3**	**3**	**3**	**1**	**3**	**-**	**-**	**-**	-	**-**	**3**	**2**	**1**

Assessment Methodology	**Assessment Tools**	**Marks**
Theory Test		15
Logic design project	Hardware implementation	10
Digital system simulation (Quartus/Vivado)	Demo and viva	10
Model Practical		10
Attendance		5
Total		**50**

25UEEP27	ELECTRON DEVICES LAB	Category	L	T	P	C
		ES	0	0	2	1

Course Prerequisite:

- Basic Electrical Engineering lab

Course Objectives:

- To enable students to proficiently use basic electronic measurement instruments.
- To analyze and interpret the Voltage-Current (V-I) characteristics of semiconductor devices of diodes, transistors.
- To study and evaluate the V-I characteristics of power electronic devices of SCR, TRIAC and UJT.
- To implement and construct diode-based circuits including half-wave, full-wave, and bridge rectifiers, with and without filter components.
- To design and analyze transistor biasing circuits using transistor.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Proficient in using basic electronic measurement instruments such as multimeters, oscilloscopes, and function generators. They should be able to measure voltage, current, frequency, and other relevant parameters accurately	K3
CO2	Analyze the V-I characteristics of diodes, transistors	K3
CO3	Analyze the V-I characteristics of SCR, TRIAC and UJT	K3
CO4	Implement the application of diode by constructing the rectifiers with and without filters	K3
CO5	Design self-bias and fixed bias circuits using transistor	K3

List of experiments

1. Obtain the V-I characteristics of PN junction diode and determine its static, dynamic resistance and Impedance.
2. Determine the VI characteristics of zener diode.
3. Determine the input and output characteristics of BJT and identify cut-off, active and saturation region for CB configurations.
4. Determine the input and output characteristics of BJT and identify cut-off, active and saturation region for CE configurations.
5. Obtain the transfer and drain characteristics of JFET and determine their drain resistance, mutual conductance.
6. Obtain the transfer and drain characteristics of MOSFET and determine their drain resistance, mutual conductance.
7. Determine the characteristics of SCR
8. Determine the characteristics of TRIAC
9. Determination of intrinsic stand-off ratio of UJT.
10. Design of half wave, full wave rectifier circuits with and without filters and determine the ripple factor.
11. Design of self-bias and fixed bias circuits using transistor and compare their performance.

Virtual Lab:

https://sil-coep.vlabs.ac.in/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	1	1	1
CO2	3	3	2	2	-	-	-	-	-	-	1	1	1
CO3	3	3	2	2	-	-	-	-	-	-	1	1	1
CO4	3	3	2	2	-	-	-	-	-	-	1	1	1
CO5	3	3	2	2	-	-	-	-	-	-	1	1	1

Assessment Methodology	Assessment Tools	Marks
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	5
Circuit Construction Task	demo	5
Attendance		10
Total		**60**

25UEEP28	ELECTRIC CIRCUIT THEORY LAB	Category	L	T	P	C
		PC	0	0	2	1

Course Prerequisite:

- Fundamentals of Electrical Engineering

Course Objectives:

To understand the network theorem in DC circuits.
To verify the phenomenon of resonance in AC circuits.
To verify the phenomenon of two port network.
To obtain the transient response of DC circuits.
To verify the phenomenon of resonance in AC circuits

Course Outcomes:		
On the successful completion of the course, students will be able to		
CO1	Apply circuit theorems for DC circuits	K3
CO2	Apply circuit theorems for AC circuits	K3
CO3	Analyse of two port network	K3
CO4	obtain the transient response of DC circuits	K3
CO5	Analyse coupled circuits, series and parallel resonant circuits.	K3

LIST OF EXPERIMENTS

1. Simulation and experimental verification of electrical circuit problems using Thevenin‟s theorem.
2. Simulation and experimental verification of electrical circuit problems using Norton‟s theorem.
3. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
4. Simulation and experimental verification of Maximum Power transfer Theorem.
5. Study of Analog and digital oscilloscopes and measurement of sinusoidal voltage, frequency and power factor.
6. Simulation and Experimental validation of R-C electric circuit transients.
7. Simulation and Experimental validation of frequency response of RLC electric circuit.
8. Design and Simulation of series resonance circuit.
9. Design and Simulation of parallel resonant circuits.
10. Design the Impedance (Z) and admittance (Y) parameters of a two port network.
11. Design the transmission and hybrid parameters of a two-port network

ADDITIONAL EXPERIMENTS:

1. Experimental determination of power in three phase circuits by two-watt meter method
2. Determination of two port network parameters.
3. Simulation of three phases balanced and unbalanced star, delta networks circuits.

TOTAL: 30 PERIODS

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1:	3	3	2	2	2				1	1		1	1
CO2:	3	3	2	2	2				1	1	2	1	1
CO3:	2	3	2	2	2				1	1		1	1
CO4	3	3	2	2	2			1	1	1	2	1	1
CO5	3	3	2	2	2			1	1	1		1	1

Assessment Methodology	Assessment Tools	Marks
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	10
Attendance		10
Total		**60**

25UGEP29	DESIGN THINKING & IDEA LAB	Category	L	T	P	C
		ES	0	0	2	1

Course Prerequisite:

- Basic Knowledge of Science and interest in creative problem solving

Course Objectives:

- To introduce students to the principles, methodologies, and frameworks of design thinking for solving real-world problems.
- To cultivate user-centric, empathetic, and creative thinking through experiential learning and hands-on activities.
- To enable students to prototype, test, and present innovative solutions using collaborative tools and idea lab resources.

Course Outcomes:

On the successful completion of the course, students will be able to

CO. No	Description	Blooms level
CO1	Explain the fundamental concepts and stages of Design Thinking and their relevance to problem solving.	K1
CO2	Describe different learning styles, memory processes, and the role of empathy in user-centric design	K2
CO3	Apply engineering tools such as schematic design, PCB layout, 3D printing, and laser cutting to create prototypes.	K3
CO4	Analyze real-world user challenges and evaluate creative problem-solving approaches to develop innovative product designs.	K4
CO5	Interpret feedback from prototype testing and iteratively improve the design to better align with user needs.	K4

Syllabus

UNIT I: LEARNING, EMOTIONS, AND FOUNDATIONS OF DESIGN THINKING 6 Hours

Understanding the learning process, Kolb‟s learning styles, Assessing and interpreting learning types, Understanding the memory process, Memory retention issues, Memory enhancement techniques, Understanding emotions – experience and expression, Assessing and applying empathy, Definition and need for Design Thinking.

UNIT II: IDEATION, PRODUCT DESIGN, AND PROTOTYPING 6 Hours

Objectives of Design Thinking, Stages of Design Thinking with examples (Empathize, Define, Ideate, Prototype, Test), Understanding creative thinking, understanding problem-solving, Testing creative problem-solving, Engineering product design process, Examples of innovative product designs, Introduction to prototyping and its purpose, Rapid prototyping and testing methods.

UNIT III: CUSTOMER-CENTRIC INNOVATION AND ITERATIVE DESIGN 6 Hours

Understanding individual uniqueness, Team activities for diversity appreciation, Real-life customer challenge examples, Applying Design Thinking to improve customer experience, Parameters of customer-centric product experience, Aligning product design with user expectations, Feedback loop and user testing, User-focused design and ergonomic considerations, Final product pitch and presentation.

UNIT IV: List of Lab Activities and Experiments (Phase-1) 6 Hours

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as softwood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.

UNIT V: List of Lab Activities and Experiments (Phase-2) **6 Hours**

6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.
10. Discussion and implementation of a mini project.
11. Documentation of the mini project (Report and video).

Total No of Hours:30 Hours

Text Books:

1. Tim Brown, Change by Design: How Design Thinking Creates New Alternatives for Business and Society**,** Harper Business, 2009.
2. Karl T. Ulrich and Steven D. Eppinger, Product Design and Development**,** McGraw-Hill Education, 2015.
3. Don Norman, The Design of Everyday Things, Basic Books, 2013.

Reference Book s:

1. Peter G. Rowe, **Design Thinking: Understanding How Designers Think and Work**, MIT Press, 1991.
2. Don Norman, **The Design of Everyday Things**, Basic Books, 2013.
3. Tom Kelley and David Kelley, **Creative Confidence: Unleashing the Creative Potential Within Us All**, Crown Business, 2013.
4. Todd Zaki Warfel, **Prototyping: A Practitioner's Guide**, Rosenfeld Media, 2009.
5. Clive L. Dym, Patrick Little, Elizabeth J. Orwin, **Engineering Design: A Project-Based Introduction**, Wiley, 2011.
6. Karl T. Ulrich and Steven D. Eppinger, **Product Design and Development**, McGraw-Hill Education, 2015.
7. Charles Platt, **Make: Electronics: Learning Through Discovery**, Maker Media, 2011.

Web Resources

https://onlinecourses.nptel.ac.in/noc23_mg72

		Mapping with Programme Outcomes											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	2			1	2	1	1		2		
CO2	2	2	1	1	3			1	1		1		
CO3	3	2	3	2	1	1	1	1	2		2		
CO4	3	3	3	3	3	1	1	1	2		2		
CO5	3	3	3			1	2	1	1		2		

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	10
Attendance		10
Total		**60**

25UPCE21	COMMMUNICATION SKILLS	Category	L	T	P	C
		EEC	0	0	2	1

Prerequisite: Carrier Development Skills

Course Objective:

- Ability to plan and manage their career paths effectively.
- It focuses on developing self-assessment, goal setting, and decision-making skills.
- Students will learn to research career options and align them with personal strengths and values.

Course Outcome

On the successful completion of the course, the students will be able to

CO1	Develop sustained motivation and enhance interpersonal skills for effective communication and teamwork.
CO2	Build active listening and conversation skills essential for collaborative and respectful team interactions
CO3	Strengthen reading comprehension and writing clarity through critical analysis and audience-focused expression.
CO4	Improve public speaking and presentation skills while fostering self-assessment through SWOT analysis.
CO5	Promote team collaboration and communication through practical activities like debates and group problem-solving

Syllabus

UNIT 1 **6 Hours**

Motivation – II: Intrinsic vs. Extrinsic Motivation- Goal Setting and Achievement - Building and Sustaining Motivation

Interpersonal skills: Effective Communication - Active Listening - Conflict Resolution - Teamwork and Collaboration

UNIT 2 **6 Hours**

Listening Skills: Roles and Responsibilities in a Team - Building Trust and Respect Among Team Members – Effective Team Communication

Conversation skills: Starting and Maintaining a Conversation - Non-Verbal Communication Cues- Active Listening and Responding.

UNIT 3 **6 Hours**

Reading Skills: Skimming and Scanning Techniques – Critical reading and Interpretation

Writing Skills: Grammar and Syntax - Clarity and Conciseness- Audience Awareness

UNIT 4 **6 Hours**

Presentation Speaking Skills: Speech Structure and Organization – Verbal Delivery Techniques

Public speaking skills: Confidence and overcoming Anxiety –Effective message Delivery

SWOT Analysis: Identifying Internal Factors – Analyzing External Factors

UNIT 5: **6 Hours**

Team Building: Roles and Responsibilities in a team – Communication and Trust – Conflict resolution and Problem Solving

Active Sessions: Debate – Picture Connector

Total No of Hours: 30 Hours

Text Book

1. Soft skills for Managers by Dr. T. kalyana chakravathi
2. Personal Development and Soft Skills by Barun K Mitra, Oxford Higher Education

Reference Book

1. The Emotionally Intelligent Workplace by Daniel Goleman.
2. Communication skills and soft skills an integrated approach by E. Suresh kumar, P. Sreehari, j savithri.
3. Top Talking in English (international communication skills) by charles t. Rajendra
4. Soft skills by Raj Lakshmi Suryavanshi, Gurucool Publishing

Mapping with Programme Outcomes

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1:								2	2	2	2		
CO2:									3	3			
CO3:										3			
CO4:								2		2	2		
CO5:									3	3			

25UMCC21	IKS IN HUMANITIES AND SOCIAL SCIENCE	Category	L	T	P	C
		MCC	1	0	1	0

Course Prerequisite:

- Basic understanding of Indian history and culture

Course Objectives:

This course explores Indian Knowledge Systems in the context of humanities and social sciences, providing students with a deeper understanding of India's intellectual heritage. The objectives are to:

- Understand the philosophical foundations of Indian knowledge traditions
- Explore Indian contributions to social sciences, literature, and arts
- Analyze the relevance of ancient wisdom in contemporary social contexts
- Develop appreciation for cultural diversity and heritage
- Foster critical thinking about knowledge systems and their applications

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1	Understand the philosophical foundations and methodologies of Indian knowledge systems in humanities
CO2	Analyze Indian contributions to literature, arts, social organization, and governance systems
CO3	Apply principles from Indian philosophical traditions to contemporary social and ethical issues
CO4	Evaluate the relevance and adaptability of traditional knowledge in modern social contexts
CO5	Create connections between ancient wisdom and contemporary challenges in society

Syllabus

UNIT I: Philosophical Foundations of Indian Knowledge Systems **6 Hours**

Darshanas (Schools of Philosophy): Samkhya, Yoga, Nyaya, Vaisheshika, Mimamsa, Vedanta - Epistemology in Indian philosophy: Pramanas (means of knowledge) - Ethics and moral philosophy in Indian traditions - Concept of Dharma, Artha, Kama, and Moksha - Comparative study with Western philosophical traditions

UNITII: Indian Literary and Artistic Traditions **6 Hours**

Sanskrit literature: Vedas, Upanishads, Puranas, Epics (Ramayana, Mahabharata) - Classical poetry and drama: Kalidasa, Bhartrhari, Bhasa - Regional literature and folk traditions - Indian classical music and dance: Theoretical foundations - Visual arts: Sculpture, painting, and architectural styles - Aesthetics in Indian tradition: Rasa theory and Alamkara shastra.

UNIT III: Social Organization and Governance **6 Hours**

Ancient Indian social structure and organization - Varna and Ashrama systems: Historical context and evolution - Village self-governance: Panchayati Raj origins - Arthashastra: Principles of statecraft and administration - Justice system: Dharmashastra and Rajadharma - Economic systems: Trade, agriculture, and crafts

UNIT IV: Educational Systems and Knowledge Transmission **6 Hours**

Gurukula system: Teacher-student relationship - Ancient universities: Nalanda, Takshashila, Vikramshila - Oral tradition and preservation of knowledge - Women‟s education in ancient India - Integration of spiritual and material learning - Comparison with modern educational approaches.

UNIT V: Contemporary Relevance and Applications **6 Hours**

Indian knowledge systems in modern governance - Traditional conflict resolution mechanisms - Environmental consciousness in Indian traditions - Community-based development models - Gender studies: Women in Indian philosophical traditions - Relevance of Indian ethics in corporate governance - Cultural preservation and modernization challenges.

Total No of Hours: 30 Hours

Learning Activities

Research Projects: 1. **Philosophical Analysis Project** - Study of a specific philosophical school - Comparison with contemporary thought - Presentation of findings

2. **Literary Heritage Study**
   - Analysis of classical texts
   - Cultural significance evaluation
   - Creative interpretation through modern media
3. **Social Systems Research**
   - Historical analysis of governance models
   - Contemporary applications study
   - Policy recommendation development
4. **Case Study Analysis**
   - Traditional knowledge applications
   - Success stories and challenges

Future implementation strategies

Text Books:

1. S. Radhakrishnan, "Indian Philosophy", Oxford University Press, 2008
2. A.L. Basham, "The Wonder That Was India", Rupa Publications, 2017
3. Kapila Vatsyayan, "Traditional Indian Art and Culture", Cambridge University Press, 2015

Reference Books& Web Resources

1. Heinrich Zimmer, "Philosophies of India", Princeton University Press, 1989
2. Romila Thapar, "Early India: From the Origins to AD 1300", Penguin Books, 2015
3. K.M. Munshi, "The History and Culture of the Indian People", Bharatiya Vidya Bhavan
4. Digital Library of India: https://www.dli.gov.in
5. Sahapedia - Encyclopedia of Indian Culture: https://www.sahapedia.org
6. Indian Council of Historical Research: https://ichr.ac.in
7. Archaeological Survey of India: https://asi.nic.in

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	-	-	1	-	2	2	2	2	3		
CO2	2	2	1	1	2	1	2	2	3	3	3		
CO3	2	2	2	2	3	2	3	3	3	3	3		
CO4	2	2	2	2	3	3	3	3	3	3	3		
CO5	3	3	3	3	3	3	3	3	3	3	3		

25UMCC22	HOLISTIC WELLNESS	Category	L	T	P	C
		MCC	0	0	1	0

Course Prerequisite:

- Basic physical fitness and medical clearance

Course Objectives:

This course promotes physical fitness, mental well-being, and holistic development of students. The objectives are to:

- Develop physical fitness and motor skills through sports activities
- Learn yoga techniques for stress management and mental clarity
- Understand the importance of physical activity for academic performance
- Promote teamwork, leadership, and sportsmanship
- Establish lifelong habits for health and wellness

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1	Demonstrate improved physical fitness and coordination through regular sports participation
CO2	Apply yoga techniques for stress management and mental well-being
CO3	Exhibit teamwork, leadership, and fair play in sports activities
CO4	Analyze the relationship between physical activity and academic performance
CO5	Develop personal fitness plans for lifelong health and wellness

Syllabus

UNIT I: INTRODUCTION TO PHYSICAL FITNESS **3 Hours**

Importance of physical fitness for students - Components of fitness: strength, endurance, flexibility, coordination - Fitness assessment and goal setting - Safety guidelines and injury prevention - Warm-up and cool-down techniques

UNIT II: SPORTS ACTIVITIES **6 Hours**

Option A: Team Sports (Choose any two) - Cricket: Basic skills, rules, and match play - Football: Fundamental techniques and game strategies - Basketball: Shooting, dribbling, and team coordination - Volleyball: Serving, spiking, and court positioning - Badminton: Strokes, footwork, and doubles play

Option B: Individual Sports (Choose any two) - Athletics: Running, jumping, and throwing events - Table Tennis: Basic strokes and match play - Tennis: Forehand, backhand, and court coverage - Swimming: Basic strokes and water safety - Cycling: Technique and endurance building

UNIT III: YOGA AND MINDFULNESS **3 Hours**

Introduction to yoga philosophy and benefits - Basic yoga asanas (postures): Sun salutation, standing poses, seated poses - Pranayama (breathing techniques): Deep breathing, alternate nostril breathing - Meditation and mindfulness practices - Relaxation techniques and stress management.

Practical Activities

Sports Training Sessions: - Skill development workshops - Regular practice sessions - Inter-class tournaments - Sports day participation - Fitness challenges and competitions

Yoga Sessions: - Daily morning yoga practice - Guided meditation sessions - Breathing exercise workshops - Stress relief techniques - Mindfulness activities

Assessment Pattern

- Continuous Assessment: 100%
  - Regular participation: 40%
  - Skill demonstration: 30%
  - Sports performance/tournament participation: 20%
  - Yoga practice and improvement: 10%

Text Books:

1. "Complete Guide to Physical Fitness" - Physical Education Department Manual
2. B.K.S. Iyengar, "Light on Yoga", Harper Thorsons, 1991

Reference Book & Web Resources

1. "Sports Training Principles" by Frank W. Dick, A&C Black, 2007
2. Swami Muktibodhananda, "Hatha Yoga Pradipika", Yoga Publications Trust, 2012
3. Yoga Alliance - Professional Yoga Resources: https://www.yogaalliance.org
4. Sports Authority of India Training Materials
5. Olympic training videos and resources
6. Isha Foundation Yoga Programs: https://isha.sadhguru.org

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	1	-	2	1	2	2	2		
CO2	-	-	-	-	2	-	2	2	2	2	2		
CO3	-	-	-	-	2	2	3	3	3	3	3		
CO4	1	1	-	1	2	1	2	2	2	2	2		
CO5	-	-	-	1	3	2	3	3	3	3	3		

SEMESTER III

FOURIER SERIES & NUMERICAL TECHNIQUES			
Course Code:	25UMAT34	**Course Type:**	Theory
Teaching Periods / Week (L: T:P: SL)	3:1:0:1	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

- To expand functions into Fourier series using Dirichlet's conditions and half-range series.
- To compute RMS value and Fourier coefficients using Parseval's theorem and harmonic analysis.
- To solve linear systems using direct and iterative methods and numerical integration using Trapezoidal and Simpson's rules.
- To apply numerical methods to solve ordinary differential equations using Runge-Kutta and Adams' methods.
- To determine numerical solutions of Laplace, Poisson, heat and wave equations using finite difference methods.

Unit 1	**FOURIER SERIES**	**12 Periods**

Dirichlet 's conditions – General Fourier series - Expansion of periodic function into Fourier series – Fourier series for odd and even functions – Half-range Fourier cosine and sine series – Change of interval – Related problems.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching (Signal Visualization) & Problem-Based Learning. **Tools:** Wolfram Alpha for visualizing wave synthesis; Kahoot Quiz for symmetry and Dirichlet properties.
	RBT Level: K3

Unit 2	**PARSEVAL'S THEOREM & HARMONIC ANALYSIS**	**12 Periods**

Root Mean Square Value – Parseval 's theorem on Fourier Coefficients. Complex form of Fourier series – Harmonic Analysis.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching & Simulation-Based Learning. **Tools:** Wolfram Alpha to verify RMS values and harmonic distortion; Kahoot Quiz on frequency domain concepts.
	RBT Level: K3

Unit 3	**SOLUTION OF LINEAR SYSTEM AND NUMERICAL INTEGRATION**	**12 Periods**

Gaussian elimination and Gauss – Jordan methods – LU – decomposition methods – Crout's method – Jacobi and Gauss – Seidel iterative methods – sufficient conditions for convergence – Power method to find the dominant eigen value and eigen vector and Integration by Trapezoidal and Simpson's Rules.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching & Algorithmic Computational Learning. **Tools:** Wolfram Alpha for matrix operations and eigenvalue computation; Kahoot Quiz on convergence criteria.
	RBT Level: K3

Unit 4	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**12 Periods**

Euler's method – Euler's modified method – Taylor's method and Runge – Kutta method for simultaneous equations and 2^{nd} order equations – Stability analysis of single step methods – Multistep methods – Milne's and Adams' methods.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching & Mind Mapping Concepts. **Tools:** Mind Mapping to differentiate Single-step vs. Multistep methods; Wolfram Alpha for verifying solution stability.
	RBT Level: K3

Unit 5	**NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS**	**12 Periods**

Numerical solution of Laplace equation and Poisson equation by Liebmann's method – solution of one-dimensional heat flow equation – Bender – Schmidt recurrence relation – Crank – Nicolson method – Solution of one – dimensional wave equation.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching & Mind Mapping Concepts. **Tools:** Mind Mapping for grid/mesh discretization logic; Wolfram Alpha for 3D plotting of heat and wave propagation.
	RBT Level::K3

Total	**60 Periods**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Expand periodic functions into Fourier series using Dirichlet's conditions, odd, even and half-range cosine and sine series with change of interval.

CO2: Compute RMS value and Fourier coefficients by applying Parseval's theorem and perform harmonic analysis using complex form of Fourier series.

CO3: Compute RMS value and Fourier coefficients by applying Parseval's theorem and perform harmonic analysis using complex form of Fourier series.

CO4: Apply numerical methods such as Euler's, Runge-Kutta, Milne's and Adams' methods to solve ordinary differential equations.

CO5: Determine numerical solutions of Laplace, Poisson, heat flow and wave equations using Liebmann's, Bender-Schmidt and Crank-Nicolson methods.

Textbooks:

T1: Grewal's., Higher Engineering Mathematics, Khanna Publisher, Delhi, 43rd Edition, 2012

T2: Debnath L and Dambaru Bhatta, Integral Transforms and Their Applications, 2nd Edition, (Special Indian Ed). Chapman & Hall/CRC, Indian Edition, 2010.

T3: Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2010.

References:

R1: David Kincaid and Ward Cheney, "Numerical Analysis", 3rd edition, American Mathematics Society, (Indian Edition) – 2010.

R2: Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015.

R3: Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016

R4: B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi 2018.

Web links and Video Lectures (e-Resources):

1. https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-ma33/
2. https://onlinecourses.swayam2.ac.in/arp20_ap32/preview
3. https://www.classcentral.com/course/swayam-ordinary-and-partial-differential-equations-and-applications-17718
4. https://onlinecourses.swayam2.ac.in/cec23_ma21/preview

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	2	2	2	1				1		1		
CO2	3	2	2	2	1				1		1		
CO3	3	2	2	2					1		1		
CO4	3	2	2	2					1		1		
CO5	3	2	2	2					1		1		
AVG	3	2	2	2	1				1		1		

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

DC MACHINES AND TRANSFORMERS			
Course Code:	25UEET31	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:0:0:1	**Credits:**	3
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

1. To understand the principles of electromechanical energy conversion and analyze the generation of forces and torque in magnetic systems.
2. To explain the construction and working of DC generators, evaluate their characteristics, and explore methods to enhance performance and efficiency.
3. To examine the operational behavior of DC motors and apply appropriate testing techniques to determine their performance parameters.
4. To analyze the operation of single-phase transformers, interpret their test results, and assess efficiency and voltage regulation for practical use.
5. To apply knowledge of three-phase transformer connections, assess their load performance, and understand their industrial applications effectively

Unit 1	**ELECTROMECHANICAL ENERGY CONVERSION**	**9 Periods**

Electromechanical energy conversion: Review of magnetic circuits; Statically and dynamically induced EMF; Lorentz's force law; Forces and torque in single and double excited magnetic systems; Determination of magnetic force, torque from energy and co-energy.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching& Problem-Based Learning
	RBT Level: K2

Unit 2	**DC GENERATORS**	**9 Periods**

Generator: Principle of operation, construction, armature windings, commutator; EMF equation; Types of DC generators; Critical field resistance and critical speed; Generator characteristics: Losses and efficiency; Armature reaction; Commutation; Methods of improving commutation ,Applications.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Simulation-Based Learning & Project-Based Learning
	RBT Level: K3

Unit 3	**DC MOTORS**	**9 Periods**

Principle of operation, back EMF, torque equation, condition for maximum power developed; Types of DC motors; Various characteristics; Methods of speed control; Types of starters; Calculation of losses and efficiency; Testing of DC machines: Swinburne's test, brake test, regenerative testing and Hopkinson's test; Applications.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Simulation-Based Learning & Project-Based Learning
	RBT Level: K3

Unit 4	**SINGLE PHASE TRANSFORMERS**	**9 Periods**

Principle of operation, construction; Types of transformers; EMF equation; Leakage flux and leakage reactance; Operation of transformer under no load and on load; Phasor diagrams; Equivalent circuit; Losses and efficiency; Regulation and all-day efficiency; Testing of single-phase transformer: OC and SC test, back-to-back test; Parallel operation; Auto Transformer, Copper saving in auto transformer

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Simulation-Based Learning &Project-Based Learning
	RBT Level: K3

Unit 5	**THREE PHASE TRANSFORMERS**	**9 Periods**

Principle of operation, star to star, delta to delta, star to delta, delta to star, three phase to two phase, open delta connection, Scott connection; applications of Scott connection; off load and on load tap changers.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Simulation-Based Learning & Project-Based Learning
	RBT Level: K3

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Active Learning: Tutorials & Gate-Oriented MCQs.

Practical Activities: Mini Projects & Student presentations

Digital Tools: Online quiz platforms and digital learning resources.

Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.
Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Explain the principles of electromechanical energy conversion and analyze the relationship between magnetic field, torque, and energy in electrical machines.

CO2: Describe the construction and functioning of DC generators and evaluate their performance characteristics, losses, efficiency, and methods to improve commutation.

CO3: Analyze the characteristics and operation of DC motors and determine their performance using standard testing methods

CO4: Interpret the characteristics of single-phase transformers and assess their regulation and efficiency through testing and equivalent circuit analysis

CO5: Apply appropriate three-phase transformer connections and evaluate their suitability for various industrial applications including load performance and tap-changing operations.

Textbooks:

T1: A.E. Fitzgerald, Charles Kingsley, Jr, Stephen D Umans, "Electric Machinery", 2017, 5th Edition, Tata McGraw Hill Education, India

T2: P. S. Bimbhra, "Electric Machinery", Khanna Publishers, 2nd Edition, 2021.

T3: B. L. Theraja and A. K. Theraja, —A Textbook of Electrical Technology-Vol. II, S. Chand & Co. Ltd., New Delhi, 23rd Multicolor Edition, 2016.

T4: Chapman, Stephen J "Electric machinery fundamentals", Tata McGraw Hill Education,5th edition, 2012

References:

R1: DP Kothari, IJ Nagrath, '' Electric Machines", 2017, 5th Edition, Tata McGraw Hill Education, India 2

R2: Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016

R3: J. B. Gupta, —Theory and Performance of Electrical Machines, S. K. Kataria and Sons, New Delhi, 14th Edition, 2010.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/108105155
2. https://nptel.ac.in/courses/108102146
3. https://www.youtube.com/playlist?list=PLbRMhDVUMngeAJH0n1H7bhTbiS2hgwI-W

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	3	2	2	1	-	-	1	1	-	1	1	1
CO2	3	3	2	2	1	-	-	1	1	-	1	1	1
CO3	3	3	2	2	1	-	-	1	1	-	1	1	1
CO4	3	3	2	2	1	-	-	1	1	-	1	1	1
CO5	3	3	2	2	1	-	-	1	1	-	1	1	1
AVG	3	2	2	2	1			1	1		1	1	1

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

ELECTRONIC CIRCUITS			
Course Code:	25UEET32	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:0:0:1	**Credits:**	3
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

1. To impart knowledge on frequency response of small signal and large signal amplifiers.
2. To explore the working of amplifiers with positive and negative feedback systems.
3. To impart the importance of multi stage amplifier.
4. To introduce stable operating point for BJT on various classes of power amplifiers

Unit 1	**SMALL SIGNAL AMPLIFIERS**	**9 Periods**

Introduction - Transistor hybrid model and h-parameters – Determination of h-parameters from transistor characteristics – Analysis of CB, CE and CC circuits using h-parameter model – Comparison of CB, CE and CC circuits – CE amplifier with unbiased emitter resistance – Transistor Re model – Small signal equivalent model – High frequency transistor model – Low frequency FET model.

Teaching Learning Process	**Pedagogy:** Chalk & Talk, Problem-Based Learning
	RBT Level: K2 (Understand), K3 (Apply)

Unit 2	**LARGE SIGNAL AMPLIFIERS**	**9 Periods**

Classification of Power amplifiers – Class A power amplifier – Direct coupled and transformer coupled – Class B amplifier – push-pull arrangement and complementary symmetry amplifiers – Conversion efficiency calculations – cross-over distortion – Class AB amplifier – Amplifier distortion – Power transistor heat sinking – Class C, Class D Amplifiers.

Teaching Learning Process	**Pedagogy:** Simulation, Numerical problem solving, chalk and talk
	RBT Level: K2

Unit 3	**MULTISTAGE AMPLIFIERS**	**9 Periods**

Cascading amplifier – Direct and RC coupled two stage CE amplifiers – Darlington pair – Cascade amplifier – Tuned amplifier: Single tuned – Double tuned – Stagger tuned amplifiers.

Teaching Learning Process	**Pedagogy:** Problem-Based Learning, Simulation, chalk and talk
	RBT Level: K2

Unit 4	**FEEDBACK AMPLIFIERS**	**9 Periods**

Feedback concept – Gain with feedback – General characteristics of negative feedback amplifiers – Four basic types of feedback and the effect on gain, input and output resistances – Multistage feedback amplifiers

Teaching Learning Process	**Pedagogy:** Interactive lecture, Analytical problem solving
	RBT Level: K2

Unit 5	**OSCILLATORS**	**9 Periods**

Conditions for sustained oscillations – Barkhausen criterion – RC Phase shift, Wein-bridge oscillators –LC oscillators – Analysis of Hartley, Colpitts, Tuned oscillators-Crystal oscillators and frequency stability – UJT relaxation oscillators.

Teaching Learning Process	**Pedagogy:** Design-based learning, Simulation, Chalk and talk
	RBT Level: K2

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Active Learning: Tutorials & Gate-Oriented MCQs.
Practical Activities: Mini Projects & Student presentations
Digital Tools: Online quiz platforms and digital learning resources.
Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.
Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Design the transistor Amplifiers using its small signal model.

CO2: Design cascade amplifiers

CO3: Evaluate the performance analysis of large signal amplifier.

CO4: Design the feedback amplifiers and analyze frequency response.

CO5: Design oscillators for different types of signal generation.

Textbooks:

T1: David A. Bell, "Electronic devices and circuits", Oxford University higher education, 5th Edition, 2008.

T2: Muhammad H. Rashid, "Microelectronic Circuits: Analysis & Design", Cengage learning Inc, 2nd Edition, 2011.

T3: G.S. Tomar, Ashish Bagwari, "Fundamentals of Electronic Devices and Circuits", Springer Nature, 2019.

References:

R1: Robert L. Boylestad and Louis Nashelsky, "Electronic Devices & Circuit theory" Pearson Education, 9th Edition, 2007.

R2: 2. R. S. Sedha, "A textbook of Applied Electronics", S. Chand Publications, Multicolor Edition, 2019

Web links and Video Lectures (e-Resources):

NPTEL: Analog Circuits & Linear Integrated Circuits
MIT Open Courseware – Analog Electronics
All About Circuits (Educational Articles)
GATE Academy & Unacademy (Concept-oriented videos)

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	2	-
CO2	3	2	3	2	2	-	-	-	-	-	-	2	-
CO3	3	3	2	2	2	-	-	-	-	-	-	3	-
CO4	3	3	2	3	2	-	-	-	-	-	-	2	-
CO5	3	3	3	3	2	-	-	-	-	-	-	3	-
AVG	3	2.6	2.4	2.4	2	-	-	-	-	-	-	2.4	-

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

ENGINEERING ELECTRO MAGNETICS			
Course Code:	25UEET33	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:0:0:1	**Credits:**	3
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

1. To understand the fundamental laws of electrostatics and analyze electric fields, electric flux, potentials, and energy associated with various charge distributions.
2. To study electric field behavior in conductors and dielectrics, including current flow, boundary conditions, capacitance, polarization, and electrostatic applications.
3. To learn the basic laws of magnetostatics and compute magnetic fields, potentials, and forces on charges and current-carrying conductors.
4. To understand magnetic materials and magnetic circuits, including magnetization, induced EMF, inductance, and energy in magnetic systems.
5. To acquire foundational knowledge of electromagnetic wave propagation using Maxwell's equations and analyze wave parameters in free space, dielectrics, and conductors.

Unit 1	**ELECTROSTATIC FIELDS**	**9 Periods**

Introduction- Coulomb's law – Electric field intensity – electric fields due to point line, surface and volume charge distributions – Electric flux density – Gauss law – Applications of Gauss' Law – Divergence –Divergence theorem- Electric potential –Potential field - Potential gradient –Field due to dipoles– dipole moment– Energy density.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching& Problem-Based Learning
	RBT Level: K3

Unit 2	**ELECTRIC FIELDS**	**9 Periods**

Current and current density– Continuity of current – Conductor properties - Boundary conditions–Capacitance– Capacitance of system of conductors– Polarization in dielectrics – Dielectric constant and Dielectric strength - Energy stored in capacitor - Poisson's and Laplace equations–Electrostatic applications in Van de Graff generator.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching& Problem-Based Learning
	RBT Level: K3

Unit 3	**MAGNETIC FIELDS**	**9 Periods**

Introduction– Biot- Savart Law–Ampere's Circuital Law–Applications–Curl and Stoke's theorem – Magnetic flux and Magnetic flux density – Scalar and Vector magnetic potentials– Force on a moving charge and current elements– Force and Torque on closed circuit.

Teaching Learning Process	**Pedagogy:** Problem-Based Learning, Simulation, chalk and talk
	RBT Level: K3

Unit 4	**MAGNETIC MATERIALS, CONCEPTS AND APPLICATIONS**	**9 Periods**

Introduction to magnetic materials – Faraday's laws, Induced EMF - Transformer and Motional EMF -Magnetization and Permeability – Magnetic boundary conditions – Magnetic circuit–Potential energy and forces on Magnetic materials–Inductance and mutual inductance–Inductance of solenoid, toroid and transmission lines.

Teaching Learning Process	**Pedagogy:** Problem-Based Learning, Simulation, chalk and talk
	RBT Level: K3

Unit 5	**ELECTROMAGNETIC WAVE PROPAGATION**	**9 Periods**

Maxwell's equation in point and integral forms, Power and the Poynting Vector – Wave parameters; velocity, intrinsic impedance, propagation constant; skin depth Wave propagation in free space– Wave propagation in Dielectrics— Propagation in good conductors.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching& Problem-Based Learning
	RBT Level: K3

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Active Learning: Tutorials & Gate-Oriented MCQs.

Practical Activities: Mini Projects & Student presentations
Digital Tools: Online quiz platforms and digital learning resources.
Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.
Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Understand and apply the fundamental laws of electrostatics to determine electric fields, electric flux, potentials, and energy for different charge configurations.

CO2: Analyze electric fields in conductors and dielectrics, evaluate capacitance of various configurations and apply Poisson's/Laplace equations in electrostatic problems

CO3: Apply the laws of magnetostatics to compute magnetic fields, magnetic potentials, and evaluate forces and torques on moving charges and current-carrying conductors.

CO4: Examine the behaviour of magnetic materials, analyze magnetic circuits, and compute self and mutual inductances in practical configurations such as solenoids and toroids.

CO5: Interpret Maxwell's equations and analyze electromagnetic wave propagation, wave parameters, power flow and behavior of waves in free space, dielectrics, and conductors

Textbooks:

T1: David K. Cheng, —Field and Wave Electromagnetics, Second Edition, Pearson Education, Asia, 2008.

T2: Edward C. Jordan and Keith G. Balaman, —Electromagnetic waves and radiating systems, PHI Learning, 2nd Edition, 2007.

T3: William H Hayt, —Engineering Electromagnetics, McGraw Hill, 5th Edition, 2008.

References:

R1: N. Narayana Rao, "Elements of Engg. Electro Magnetics", Prentice Hall of India, 6th Edition,2008

R2: Sadiku MH, —Principles of Electromagnetics, Oxford University Press Inc, New Delhi, 2009

Web links and Video Lectures (e-Resources):

1. nptel.ac.in/courses/115106122
2. nptel.ac.in/courses/108104087

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	3	2	2	2	-	-	-	-	-	1	3	-
CO2	3	3	2	2	2	-	-	-	-	-	1	3	-
CO3	3	3	2	2	2	-	-	-	-	-	1	3	-
CO4	3	3	3	2	3	-	-	-	-	-	2	3	-
CO5	3	2	2	3	3	-	-	-	-	-	2	3	-
AVG	3	3	2	2	2						2	3	

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

MEASUREMENT AND INSTRUMENTATION			
Course Code:	25UEET34	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:0:0:1	**Credits:**	3
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

1. To understand the fundamentals of measurement systems including functional elements, instrument classification, characteristics and various types of measurement errors.
2. To study the operating principles and construction of electrical measuring instruments such as ammeters, voltmeters, wattmeters, energy meters, and frequency/power factor meters.
3. To analyze the working of instrument transformers and electronic measuring instruments and perform measurements using CRO and digital instruments for electrical quantities.
4. To apply DC and AC bridge networks and study different display devices used in modern electrical and electronic measurement systems.
5. To understand transducer principles and data acquisition systems and to select suitable sensors for practical engineering and industrial applications.

Unit 1	**FUNDAMENTALS OF MEASUREMENT SYSTEMS**	**9 Periods**

Functional elements of Generalized measurement system - Types of measurement - Classification of instruments - Static and Dynamic characteristics of instruments - Probability of errors- Errors in Measurements - Systematic and random errors, propagation of errors, Limiting errors of instruments.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching & Inquiry-Based Learning
	RBT Level: K3

Unit 2	**ELECTRICAL INSTRUMENTS**	**9 Periods**

Essential requirements of an instrument - Ammeter and voltmeter - Moving coil - Moving Iron - Extension of voltmeter and ammeter range - Electro dynamo meter type Wattmeter - Induction type Energy meter - Principle of operation, construction, Torque equation, types, testing and Calibration using direct and phantom loading – Power factor meter – Frequency meter – Synchroscope.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Experiential Learning
	RBT Level: K2

Unit 3	**INSTRUMENT TRANSFORMER & ELECTRONIC MEASUREMENTS**	**9 Periods**

Magnetic measurements – Determination of B-H curve and measurement of iron loss. Current Transformer (CT) and Potential Transformer (PT): Construction and working, Ratio and phase angle errors - Electronic Voltmeter - Ammeter, Multimeter, Wattmeter & Energy meter - Principle of Digital Storage Oscilloscope (DSO), Time, Frequency and phase angle measurements using DSO - Spectrum & Wave analyzer and Digital Voltmeter.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Experiential Learning
	RBT Level: K2

Unit 4	**BRIDGES AND DISPLAY DEVICES**	**9 Periods**

D.C potentiometers - D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges) -Transformer ratio bridges - Self-balancing bridges - Display Devices: CRT display - analog and digital - DSO, LED and LCD - Dot matrix display - Data Loggers.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Project based Learning
	RBT Level: K3

Unit 5	**TRANSDUCERS AND DATA ACQUISITION SYSTEMS**	**9 Periods**

Classification of transducers – Selection of transducers – Resistive, Capacitive & Inductive transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – A/D, D/A converters – Smart sensors (Level, Temperature, Pressure, Infrared, Proximity sensor)

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Project based Learning
	RBT Level: K2

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Active Learning: Tutorials & Gate-Oriented MCQs.
Practical Activities: Mini Projects & Student presentations
Digital Tools: Online quiz platforms and digital learning resources.
Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.
Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Explain the functional elements of a generalized measurement system and classify types of measurements and instruments. They will analyze static and dynamic characteristics and evaluate different types of measurement errors and their propagation.

CO2: Describe the operating principles, construction and torque equations of various electrical instruments such as ammeters, voltmeters, wattmeter's, energy meters and frequency meters. They will also be able to extend instrument ranges and perform testing and calibration using direct and phantom loading.

CO3: Determine magnetic characteristics including the B-H curve and iron losses and explain the working of CTs and PTs with associated errors. They will perform voltage, current, time, frequency and phase measurements using CRO and electronic measuring instruments.

CO4: Analyze and apply DC and AC bridge techniques for accurate measurement of electrical parameters. They will also understand the working principles and applications of various display devices and data logging systems.

CO5: Select suitable transducers for specific applications and explain the working of different types of sensors. They will also understand the elements of a data acquisition system including A/D and D/A converters and utilize smart sensors in practical measurement systems.

Textbooks:

T1: A.K. Sawhney, "A Course in Electrical & Electronic Measurements and Instrumentation", Dhanpat Rai and Co., New Delhi, 19th Edition, 2015.

T2: J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, Delhi, 12th Edition, 2009.

T3: E. O. Doebelin and D. N. Manik, "Measurement Systems – Applications and Design", Tata McGraw Hill Education Pvt. Ltd., Special Indian Edition, 2007.

References:

R1: David Bell, "Electronic Instrumentation and Measurements", Oxford University Press, 1st Edition, 2013.

R2: A. J. Bouwens, "Digital Instrumentation", Tata McGraw Hill Publications, 16th Reprint Edition, 2008.

R3: H.S. Kalsi, "Electronic Instrumentation", Tata McGraw Hill Education, 4th Edition, 2019.

Web links and Video Lectures (e-Resources):

1. https://www.omega.de/green/pdf/CAP_LEV_MEAS.PDF
2. http://www.digimat.in/nptel/courses/video/108105153/L27.html
3. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
4. http://vlabs.iitkgp.ernet.in/asnm/
6. http://www.wisegeek.com/what-are-transducers.htm-

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	1	1	-	2	2	1
CO2	3	2	2	1	-	-	-	1	1	-	2	2	1
CO3	3	2	2	1	-	-	-	1	1	-	2	2	1
CO4	3	2	2	1	-	-	-	1	1	-	2	2	1
CO5	3	2	2	1	-	-	-	1	1	-	2	2	1
AVG	3	3	2	1	-	-	-	1	1	-	2	2	1

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

PROBLEM SOLVING USING PYTHON			
Course Code:	25UCSI31	**Course Type:**	INTEGRATED
Teaching Periods / Week (L: T:P:SL)	3:0:2:1	**Credits:**	4
Total Teaching Periods:	45	**CAT+ ESE Marks:**	4
Teaching Department:	Information Technology		

Course Objectives:

To impart the knowledge of Python basic structure, components, object storage, exception handling, and graphics toolkit using Tinker

Unit 1	**INTRODUCTION**	**9 Periods**

History - Features -basic syntax - Data types - variables - Manipulating Numbers - Text Manipulations - Control Statements- Python Built-in Functions.

Practicals:

1. Identify and solve simple real-life/scientific/technical problems. (Electricity Billing, Retail shop billing, Sin series, etc).
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).

Teaching Learning Process	**Pedagogy:** Chalk and Talk & PPT
	RBT Level: K3

Unit 2	**COMPONENTS OF PYTHON PROGRAMMING**	**9 Periods**

Operator Basics - Numbers - String - List - Tuples - Dictionaries - Files - Object Storage - Type Conversion - Type Comparison - Statements – Assignments.

Practicals:

3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists and tuples.

Teaching Learning Process	**Pedagogy:** Chalk and Talk & PPT
	RBT Level: K3

Unit 3	**FUNCTIONS AND PACKAGE**	**9 Periods**

Classes and Objects - creating a class, class methods, class inheritance. Functions Definition and Execution - Arguments - Return Values - Advanced Function Calling - Modules - Importing modules – Packages and Interfaces - Creating a module.

Practicals:

5. Implementing real-time/technical applications using Sets and dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of a shape)

Teaching Learning Process	**Pedagogy:** Chalk and Talk & PPT
	RBT Level: K3

Unit 4	**EXCEPTION HANDLING AND FILES**	**9 Periods**

Exception Handling- Building in Exceptions- Files, File operations, reading a file content, writing a file, modifying files pos, controlling file I/O, Manipulating file paths.

Practicals:

7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)

Teaching Learning Process	**Pedagogy:** Chalk and Talk & PPT
	RBT Level: K3

Unit 5	**GUI PROGRAMMING AND GRAPHICS**	**9 Periods**

GUI Programming toolkits – Introduction to Tkinter – Creating GUI widgets – Resizing – Configuring widget options – Creating Layouts – Radio buttons – Check boxes – Dialog boxes – Drawing using Turtle

Practicals:

9. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age, validity, student mark range validation)
10. Exploring Pygame tool. Developing a game activity using Pygame, like bouncing ball, car race, etc.

Teaching Learning Process	**Pedagogy:** Chalk and Talk & PPT
	RBT Level: K3

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Active Learning: Tutorials & Gate-Oriented MCQs.

Practical Activities: Mini Projects & Student presentations

Digital Tools: Online quiz platforms and digital learning resources.

Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.

Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Understand Python's basic concepts, data types, variables, and control statements.

CO2: Understand the components of Python programming and storage statements.

CO3: Understand the functions, modules, packages, and interfaces in Python.

CO4: Understand the exception handling techniques and file operations.

CO5: Develop an application using GUI toolkits and widgets.

Textbooks:

T1: Martin C. Brown, "The Complete Reference - Python", Tata McGraw Hill Indian Edition,2010. (UNIT 1-4)

T2: Alan D. Moore Python GUI programming with Tkinter: Design and build functional and user-friendly GUI applications,2021. (Unit-5)

References:

R1: Wesley J Chun, -Core Python Applications Programming, Prentice Hall, 2012. Eric Matthes, "A Hands-On, Project-Based Introduction to Programming", 2nd Edition,2019.

Web links and Video Lectures (e-Resources):

1. Programming, Data Structures and Algorithms using Python-Algorithms using Python-https://nptel.ac.in/courses/106106145
2. The Joy of Computing using Python-https://nptel.ac.in/courses/106106182 Python for Data Science-https://nptel.ac.in/courses/106106212

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	3	2	1	-	-	-	-	-	-	1	-	-
CO2	3	3	2	1	1	-	-	-	-	-	1	-	-
CO3	3	3	2	1	1	-	-	-	-	-	1	-	-
CO4	3	3	2	1	1	-	-	-	-	-	1	-	-
CO5	3	3	2	1	1	-	-	-	-	-	1	-	-
AVG	3	3	2	1	1	-	-	-	-	-	1	-	-

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

DC MACHINES AND TRANSFORMERS LAB			
Course Code:	25UEEP35	**Course Type:**	Practical
Teaching Periods / Week (L: T:P)	0:0:2	**Credits:**	1
Total Teaching Periods:	30	**IAT + ESE Marks:**	60+40
Teaching Department:	EEE		

Course Objectives:

- To understand the performance characteristics of DC motors and analyze their behavior under different loading conditions.
- To evaluate the characteristics and efficiency of DC generators through various practical testing methods.
- To perform standard efficiency tests on DC machines such as Swinburne's test and compare theoretical and practical results.
- To examine the voltage regulation, efficiency, and operational behavior of single-phase and three-phase transformers through laboratory experiments.
- To demonstrate parallel operation and connection methods of transformers and assess their load sharing and performance.

Practical Exercises: **30 Periods**

(A minimum of TEN experiments to be conducted in the following Topics)

DC MACHINES

1. Load test on DC shunt Motor
2. Load test on DC series Motor
3. Load test on DC Compound Motor
4. Open Circuit Characteristics of self-excited / separately excited DC shunt Generator
5. Load test on self-excited / separately excited DC shunt Generator
6. Load test on DC series Generator
7. Swinburne's Test
8. Study on Speed control of DC Motors.

TRANSFORMERS

10. Load test on single phase transformer
11. O.C and S.C test on single phase transformer
12. Load test on three phase transformer
13. Parallel operation of single-phase transformers
14. Study of three phase transformer connections

Course Outcomes:

After Successful completion of this course, the student should be able to

1. To measure and analyze the performance of DC motors under various load conditions.
2. Evaluate the characteristics and efficiency of DC generators through practical tests.
3. Conduct standard DC machine tests and compare practical results with theoretical values.
4. Assess transformer performance, efficiency, and regulation using appropriate testing methods.
5. Demonstrate transformer parallel operation and connection techniques used in real power systems.

Textbooks:

T1: D. P. Kothari, B. S. Umre, "Laboratory Manual for Electrical Machines", I.K. International Publishing House, New Delhi, 2nd Edition, 2017.
T2: D. R Kohli and S.K Jain, "A laboratory course in electrical machines", New Chand and Bros, Roorkee, 2nd Edition, 2000.

Web links and Video Lectures (e-Resources):

1. **https://em-coep.vlabs.ac.in/List%20of%20experiments.html**
2. **https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html**

CO–PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	1	1	-	1	1	1
CO2	3	2	2	2	2	-	-	1	1	-	1	1	1
CO3	3	2	2	2	2	-	-	1	1	-	1	1	1
CO4	3	2	2	2	2	-	-	1	1	-	1	1	1
CO5	3	2	2	2	2	-	-	1	1	-	1	1	1
AVG	3	2	2	2	2	-	-	1	1	-	1	1	1

1–Low, 2–Medium, 3–High, '-' –No correlation

ELECTRONIC CIRCUITS LAB

Course Code:	25UEEP36	**Course Type:**	Practical
Teaching Periods / Week (L: T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	30	**IAT + ESE Marks:**	60+40
Teaching Department:	EEE		

Course Objectives:

- To provide hands-on experience in analyzing small and large signal amplifier characteristics.
- To enable students to design, simulate, and test multistage, feedback amplifiers, and oscillator circuits.
- To develop practical skills in measurement, simulation tools, debugging, and troubleshooting of analog electronic circuits.

Practical Exercises: **30 Periods**

(A minimum of TEN experiments to be conducted in the following Topics)

1. Frequency response characteristics of RC coupled amplifier single stage.
2. Determination of h-Parameters of CE Transistor
3. Frequency response characteristics of RC coupled amplifier using PSPICE.
4. Determination of Band width from the frequency response of the common source FET Amplifier.
5. Design and Characterization of Class A amplifier.
6. Design and Characterization of Class B amplifier.
7. Design and Characterization of Class A amplifier using PSPICE
8. Frequency response characteristics of two stage R-C coupled amplifier using Multisim.
9. Frequency response characteristics of single tunes amplifier.
10. Frequency response of a series feedback amplifier.
11. Frequency response of a shunt feedback amplifier.
12. Design and simulation of high frequency Colpitts oscillator based on BJT amplifier
13. Design of Hartley Oscillator For 10khz frequency.
14. Design verification of RC phase shift oscillator.
15. Design verification of UJT relaxation oscillator.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Understand small and large signal behavior of electronic amplifiers.
CO2: Analyze performance of multistage and feedback amplifiers.
CO3: Design and test oscillator circuits.
CO4: Develop practical skills in measurement and troubleshooting.

Textbooks:

T1: Robert L. Boylestad and Louis Nashelsky, "Electronic Devices & Circuit theory" Pearson Education, 9th Edition, 2007.
T2: R. S. Sedha, "A textbook of Applied Electronics", S. Chand Publications, Multicolor Edition, 2019

CO–PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	–	2	–	–	–	–	–	–	–	2	–
CO2	2	3	1	2	2	–	–	–	–	–	–	–	3	–
CO3	2	2	3	2	2	–	–	–	–	–	–	–	2	–
CO4	2	2	–	3	3	–	–	2	3	–	2	–	2	–
AVG	2	2	1	2	2	–	–	–	–	–	–	–	2	–

1–Low, 2–Medium, 3–High, '-' –No correlation

MEASUREMENT AND INSTRUMENTATION LAB			
Course Code:	25UEEP37	**Course Type:**	Practical
Teaching Periods / Week (L: T:P)	0: 0: 2	**Credits:**	01
Total Teaching Periods:	30	**IAT + ESE Marks:**	60 + 40
Teaching Department:	EEE		

Course Objectives:

- To provide students with a strong foundation in the principles of electrical and electronic measurements and the operation of basic measuring instruments.
- To develop practical skills in calibration, extension of range, and accuracy evaluation of electrical measuring devices.
- To train students in the use of bridge networks, DSO, Q-meter, CTs, PTs, and transducers for precise measurement of electrical parameters.
- To enable students to design, implement, and analyze signal conditioning circuits and measurement systems for real-world engineering applications.
- To inculcate professional laboratory practices including safety, documentation, error analysis, and result interpretation in electrical measurement experiments.

Practical Exercises: **30 Periods**

(A minimum of TEN experiments to be conducted in the following Topics)

LIST OF EXPERIMENTS

1. Calibration of single phase energy meter.
2. Extension of range of voltmeter and ammeter.
3. Measurement of resistance – (a) Wheatstone bridge (b) Kelvin double bridge
4. Measurement of inductance using Maxwell's bridge.
5. Measurement of capacitance using Schering Bridge.
6. Measurement of B–H curve using CRO.
7. Measurement of displacement using LVDT.
8. Signal Convertor (voltage to current convertor & current to voltage convertor)
9. Measurement of gain of an instrumentation amplifier.
10. Measurement of power factor of an AC load using voltmeter–ammeter method.
11. Measurement of high resistance using loss of charge method.
12. Q meter experiment- To determine the quality factor of an unknown coil.
13. Measurement of power using CT and PT

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Calibrate and verify the accuracy of single-phase energy meters using standard testing procedures and analyze percentage error.

CO2: Extend the measuring range of voltmeters and ammeters and accurately measure low, medium, and high resistances using Wheatstone bridge, Kelvin bridge, loss of charge method, and Megohm bridge.

CO3: Determine unknown inductance, capacitance, quality factor (Q), and magnetic characteristics (B–H curve) using Maxwell's bridge, Schering bridge, Q-meter, and CRO.

CO4: Measure displacement using LVDT and evaluate the performance of signal converters and instrumentation amplifiers in terms of gain and linearity.

CO5: Measure AC power and power factor of single-phase/three-phase loads using voltage-current method and instrument transformers (CT & PT), and justify their practical applications.

TEXT BOOKS:

T1. A.K. Sawhney and Puneet Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co.

T2. Raghuwanshi, B.M., Electrical Measurements and Measuring Instruments, Tata McGraw-Hill.

REFERENCES:

R1. Golding, E.W. and Widdis, F.C., Electrical Measurements and Measuring Instruments, Wheeler Publishing.

R2. Helfrick, A.D. and Cooper, W.D., Modern Electronic Instrumentation and Measurement Techniques, Pearson

Education.

R3. Doebelin, E.O. and Manik, D.N., Measurement Systems: Application and Design, McGraw-Hill Education.

CO–PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	1	-	-	-	-	2	-	2	2
CO2	3	3	2	2	2	-	-	-	-	2	1	2	2
CO3	3	2	1	2	2	-	-	-	-	2	1	2	2
CO4	3	2	3	2	2	-	-	-	-	2	1	2	2
CO5	3	3	3	3	3	-	-	-	-	2	1	2	2
AVG	3	2	2	2	2	-	-	-	-	2	1	2	2

1–Low, 2–Medium, 3–High, '-' –No correlation

PERSONALITY DEVELOPMENT SKILLS			
EEE, ECE, CSE, IT and ME			
Course Code:	25UPCE31	Course Type:	EEC
Teaching Periods / Week (L: T:P:SL)	2:0:0:1	**Credits:**	NIL
Total Teaching Periods:	48	**CAT + ESE Marks:**	50
Teaching Department:	Placement cell		

Course Objectives:

To impart knowledge on:

1. Enable students to develop a well-rounded personality by enhancing essential personal and professional skills.
2. The course aims to foster self-awareness, effective communication, interpersonal abilities, emotional intelligence, confidence, leadership, and goal-setting strategies

Unit 1	**WORKPLACE AND EMAIL & MICROSOFT OFFICE SUITE**	**Periods: 10**

Workplace and Email Etiquette: Professional Behavior and Dress Code – Email and Meeting Etiquette

Microsoft office suite: MS Word (Document Creation and Formatting) - MS Excel (Data Analysis and Functions) - MS PowerPoint (Creating Effective Presentations)

Teaching Learning Process	**Pedagogy:** Demonstration-based teaching combined with hands-on practice sessions, guided exercises, role plays for workplace and email etiquette, practical assignments using MS Word, Excel, and PowerPoint, and mini-projects to apply professional digital skills.
	RBT Level: K4

Unit 2	**BUSINESS COMMUNICATION, SALES AND NEGOTIATIONS & CUSTOMER SERVICE**	**Periods: 10**

Business Communication: Verbal and Non - Verbal Communication – Written Communication in Business.

Sales and Negotiations: Sales Techniques and Strategies – Negotiation Tactics and Styles.

Customer Service: Effective Communication Skills- Customer support channels and Tools

Teaching Learning Process	**Pedagogy:** Interactive lectures with role plays, group discussions, case studies, and simulations; practical exercises in business writing, sales pitch creation, negotiation practice, and customer service scenarios to enhance communication, persuasion, and problem-solving skills.
	RBT Level: Theory: K4

Unit 3	**DECISION MAKING & PROBLEM SOLVING**	**Periods: 10**

Decision Making: Types of Decision Making – Decision Making models and Techniques – Cognitive Biases and Risk Assessment

Problem Solving: Problem Identification and Analysis – Creative and Critical Thinking techniques – Implementation and Evaluation techniques

Teaching Learning Process	**Pedagogy:** Conceptual lectures combined with case studies, group discussions, problem-solving workshops, scenario-based exercises, and reflective activities to practice decision-making models, cognitive bias recognition, and structured problem-solving techniques
	RBT Level: K4

Unit 4	**INTERVIEW SKILLS, RESUME BUILDING, MANNERISM & BEHAVIORAL SKILLS**	**Periods: 10**

Interview Skills: Preparation and Research – Effective Communication and Presentation

Resume Building: Resume Formats and Structure – Tailoring Resumes for Specific Jobs

Mannerism: Body Language – Respect and Courtesy in Interactions

Behavioral skills: Emotional Intelligence – Adaptability and flexibility.

Teaching Learning Process	**Pedagogy:** Interactive lectures with hands-on workshops, mock interviews, resume-building exercises, role-plays, video analysis of body language, and reflective activities to develop emotional intelligence, adaptability, and professional behavioral skills.
	RBT Level: K4

Unit 5	**GROUP DISCUSSION & MONK INTERVIEW**	**Periods: 8**

Group Discussion: Effective communication and Active Listening – Leadership and Participation skills – Critical Thinking and Topic Analysis

Monk Interview: Common Interview Questions and Ideal Responses – Feedback and Self-Assessment

Teaching Learning Process	**Pedagogy:** Interactive sessions with mock group discussions and interviews, peer and instructor feedback, role-plays, reflective exercises, and topic-analysis

	workshops to enhance communication, leadership, critical
	RBT Level: K4
Total	**Periods: 48**

Suggested Activities and Evaluation Methods:

- SWOT analysis (personal), Group discussions, Role-play, case studies, Resume writing and mock interviews
- Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After successful completion of this course, the student should be able to:

CO1: Apply workplace etiquette and use Microsoft Office tools effectively for professional communication and documentation.

CO2: Demonstrate effective communication skills in business contexts, including sales, negotiation, and customer service scenarios.

CO3: Apply structured decision-making and problem-solving techniques in professional and organizational settings.

CO4: Prepare for interviews and present oneself professionally with an effective resume, proper mannerisms, and behavioral skills.

CO5: Demonstrate confidence and clarity in group discussions and interviews through guided practice and feedback.

Textbooks:

T1: Personal Development and Soft Skills By BARUNKMITRA, Oxford Higher Education

T2: Seven Habits of Highly Effective People by STEPHENCOVEY.

References:

R1: Communication Skills by SANJAY KUMAR, PUSHP, Oxford Higher Education.

R2: Communication Skills for Professionals by NIRAKONAR, PHI learning Pvt. Ltd.

Web Links and Video Lectures (e-Resources):

1. https://careerbridgesolutions.com/skills-and-personality-development

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1					2				2	2			
CO2								2	2	2			
CO3	2			2							2		
CO4									2	2	2		
CO5									2	2	2		
AVG	0.4			0.4				0.4	1.6	1.6	1.4		

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

INDIAN CONSTITUTION AND HUMAN RIGHTS			
(Common to All Branches of UG Engineering Programs)			
Course Code:	25UMCC31	**Course Type:**	Mandatory Course (Audit)
Teaching Periods / Week (L: T:P)	2:0:0	**Credits:**	0 (Zero)
Total Teaching Periods:	30	**CAT + ESE Marks:**	Pass / Fail (Satisfactory / Unsatisfactory)
Teaching Department:	General Engineering		

Course Objectives:

To impart knowledge on:

1. Historical background, Preamble, and salient features of the Indian Constitution
2. Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties
3. Structure and functioning of Union, State, and Local Self Governments
4. Universal Human Rights principles and international protection frameworks
5. Contemporary human rights issues and remedial mechanisms in India

Unit 1	**INTRODUCTION TO INDIAN CONSTITUTION**	**Periods: 6**

Historical Background: Making of the Constitution - Constituent Assembly and its key members - Draft Committee. Preamble: Philosophy and Core Values - Sovereign, Socialist, Secular, Democratic, Republic - Justice, Liberty, Equality, Fraternity. Salient Features of Indian Constitution: Written Constitution - Lengthy document - Blend of Rigidity and Flexibility - Federal Structure with Unitary Bias - Parliamentary System.

Instructional Activity

Timeline Activity on Constitutional History (or) Preamble Analysis Worksheet

Teaching Learning Process	**Pedagogy:** Interactive Lecture, Think-Pair-Share, Video-based Learning (Documentary on Constituent Assembly), Group Discussion
	RBT Level: K2

Unit 2	**FUNDAMENTAL RIGHTS AND DUTIES**	**Periods: 6**

Fundamental Rights (Articles 12-35): Right to Equality (Art. 14-18) - Right to Freedom (Art. 19-22) - Right Against Exploitation (Art. 23-24) - Right to Freedom of Religion (Art. 25-28) - Cultural and Educational Rights (Art. 29-30) - Right to Constitutional Remedies (Art. 32): Writs - Habeas Corpus, Mandamus, Prohibition, Certiorari, Quo Warranto. Directive Principles of State Policy (Articles 36-51): Classification - Socialistic, Gandhian, Liberal-Intellectual Principles. Fundamental Duties (Article 51A): Citizen Responsibilities - 11 Duties. Relationship and Conflict between Fundamental Rights and Directive Principles.

Instructional Activity

Case Study Analysis on Landmark Supreme Court Judgments (or) Mock PIL Filing Exercise (or) Rights Violation Scenario Analysis

Teaching Learning Process	**Pedagogy:** Case Study Method, Role Play (Mock Court), Jigsaw Activity, Debate Session (FR vs DPSP), Scenario-based Learning, Problem-Based Learning
	RBT Level: K2

Unit 3	**UNION AND STATE GOVERNMENT STRUCTURE**	**Periods: 6**

Union Executive: President - Election, Powers, Position - Vice-President - Prime Minister and Council of Ministers - Cabinet Committees. Union Legislature: Parliament - Lok Sabha and Rajya Sabha - Composition, Functions - Legislative Process - Bill to Act. State Executive: Governor - Chief Minister - State Council of Ministers. State Legislature: Legislative Assembly and Council - State Law-making Process. Centre-State Relations: Legislative, Administrative, and Financial Relations - Role of Finance Commission. Local Self Government: 73rd Amendment (Panchayati Raj) - 74th Amendment (Urban Local Bodies) - Three-tier System.

Instructional Activity

Flowchart Creation (Bill to Law) (or) Field Visit Report on Local Panchayat/Municipality

Teaching Learning Process	**Pedagogy:** Simulation Exercise, Collaborative Learning, Comparative Analysis (Venn Diagrams), Field Visit/Virtual Tour, Guest Lecture by Government Official
	RBT Level: K2

Unit 4	**HUMAN RIGHTS: CONCEPTS AND FRAMEWORKS**	**Periods: 6**

Evolution of Human Rights: Historical Development - Natural Rights Theory - Magna Carta - French Declaration - American Bill of Rights. Universal Declaration of Human Rights (UDHR) 1948: 30 Articles - Civil, Political, Economic, Social, Cultural Rights. International Human Rights Instruments: ICCPR - ICESCR - CEDAW - CRC - CAT - CERD. Human Rights in Indian Constitution: Part III and Part IV Provisions. National Human Rights Commission (NHRC): Composition - Functions - Powers - Procedure. State Human Rights Commissions - National Commission for Women, SC, ST, Minorities.

Instructional activities

NHRC Case Study Analysis

Teaching Learning Process	Pedagogy: Video Case Study, Seminar Presentation
	RBT Level: K2

Unit 5	CONTEMPORARY HUMAN RIGHTS ISSUES	Periods: 6

Rights of Vulnerable Groups: Women (POSH Act, Domestic Violence Act) - Children (POCSO, JJ Act) - Elderly (Maintenance Act) - Persons with Disabilities (RPWD Act 2016). Rights of Marginalized Communities: SC/ST (Prevention of Atrocities Act) - Minorities - LGBTQ+ (Navtej Singh Johar Case). Right to Information (RTI Act 2005): Provisions and Application. Right to Education (RTE Act 2009). Environmental Rights: Right to Clean Environment - Sustainable Development - PIL on Environmental Issues. Digital Rights: Right to Privacy (Puttaswamy Case) - Data Protection - Cyber Rights. Human Rights Violations and Remedies: Legal Aid - Grievance Redressal Mechanisms.

Instructional activities

RTI Application Drafting Workshop (or) Case Study on HR Violations

Teaching Learning Process	Pedagogy: Problem-Based Learning, Panel Discussion, RTI Workshop
	RBT Level: K2
	Total | **Periods: 30**

Suggested Activities and Evaluation Methods:

Active Learning: Case Studies, Role Play, Mock Court/Parliament, Group Discussions, Debates, Panel Discussions

Practical Activities: RTI Application Drafting, Field Visits to Panchayat/Municipal Offices,

Digital Tools: Kahoot Quizzes, Menti meter Polls, Online Discussion Forums, Digital Portfolios

Assessment Methods: Entry/Exit Tickets, One-Minute Papers, Peer Review, Reflective Journals, Group Presentations

Evaluation: Continuous Assessment through Formative Activities, End-Semester Viva-voce/Written Test

Course Outcomes:

After successful completion of this course, the student should be able to:

CO1: Explain the historical evolution, Preamble, and salient features of the Indian Constitution.

CO2: Describe Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties and explain their interrelationship

CO3: Describe the structure and functions of Union, State, and Local Self Governments in India.

CO4: Apply the principles of Universal Human Rights to identify international protection frameworks.

CO5: Illustrate contemporary human rights issues and demonstrate the use of remedial mechanisms available in India.

Textbooks:

T1: D.D. Basu, "Introduction to the Constitution of India", 24th Edition, LexisNexis, 2020.

T2: M.V. Pylee, "India's Constitution", 16th Edition, S. Chand Publishing, 2017.

T3: S.K. Kapoor, "Human Rights Under International Law and Indian Law", Central Law Agency, 2018.

References:

R1: Granville Austin, "The Indian Constitution: Cornerstone of a Nation", Oxford University Press, 2019.

R2: J.N. Pandey, "Constitutional Law of India", 57th Edition, Central Law Agency, 2020.

R3: K.K. Ghai, "Human Rights", Kalyani Publishers, 2019.

R4: P.M. Bakshi, "The Constitution of India", Universal Law Publishing, 2020.

Web Links and Video Lectures (e-Resources):

1. Constitution of India - https://legislative.gov.in/constitution-of-india
2. National Human Rights Commission - https://nhrc.nic.in
3. United Nations Human Rights - https://www.ohchr.org
4. SWAYAM Course on Indian Constitution - https://swayam.gov.in
5. NPTEL Course on Constitution of India - https://nptel.ac.in
6. Lok Sabha TV Documentaries - https://www.youtube.com/c/LokSabhaTVChannel
7. PRS Legislative Research - https://prsindia.org

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						2	2				1		
CO2						3	3	1	1		2		
CO3						2	2	1			1		
CO4						3	2		2		2		
CO5						3	3	2	2		2		
AVG						2.6	2.4	1.3	1.7		1.6		

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

SEMESTER IV

AC MACHINES			
Course Code:	25UEET41	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:0:0:1	**Credits:**	3
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

1. To help students understand the construction, operation, characteristics, and testing of single-phase and three-phase induction motors
2. To introduce students to the need for starters, different speed-control methods, braking techniques, and special operating conditions of induction motors.
3. To equip the students to understand and analyze the characteristics of alternator.
4. To learn characteristics of synchronous motor and effect of varying load and excitation.
5. To become familiar with the performance characteristics of specialized machines.

Unit 1	**THREE PHASE INDUCTION MOTOR**	**9Periods**

Three phase Induction Motors: Construction – principle of operation – Types - Effect of slip on rotor parameters – Torque equation - phasor diagram - torque slip characteristics - Power Stages - equivalent circuit – no load and blocked rotor test - circle diagram - Losses and efficiency.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Experiential Learning
	RBT Level: K3

Unit 2	**STARTING AND SPEED CONTROL OF 3-PHASE INDUCTION MOTOR AND SINGLE PHASE INDUCTION MOTOR**	**9Periods**

Starters: Need for starters – Starting methods. Speed control: Stator side – Rotor side – Solid state control. Cogging and Crawling - Electric Braking - deep bar and double cage rotor – Induction generator – Applications. Single phase Induction Motors: Construction – Principle of operation - Double revolving field theory - Torque-speed characteristics – starting methods.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Experiential Learning
	RBT Level: K3

Unit 3	**ALTERNATORS**	**9Periods**

Construction – operation – Types of rotors – EMF equation – Synchronous reactance – Armature reaction - Alternator on load – phasor diagram. Voltage regulation: EMF, MMF, ZPF. Synchronizing and parallel operation – effect of change of excitation and prime mover inputs – Overview of automatic voltage regulators – Two reaction theory of Salient pole machines – slip test - power angle diagram.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Experiential Learning
	RBT Level:K3

Unit 4	**SYNCHRONOUS MOTOR**	**9 Periods**

Construction - principle of operation - starting methods - Torque and power equations - speed control– phasor diagram – effect of varying load and excitation – V Curve and inverted-V Curves - hunting – synchronous condenser

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Experiential Learning
	RBT Level: K3

Unit 5	**SPECIAL MACHINES**	**9 Periods**

Stepper motors - Reluctance motor - Hysteresis motor– Servo motor– Linear induction motor– AC series motor - switched reluctance motor – Overview of Brushless DC motors and PMSM

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Project based Learning
	RBT Level: K3

	Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Active Learning: Tutorials & Gate-Oriented MCQs.

Practical Activities: Mini Projects & Student presentations

Digital Tools: Online quiz platforms and digital learning resources.

Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.

Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Evaluate and analyze the performance of three phase induction motor using equivalent circuits and circle diagram.

CO2: Apply suitable starting and speed control methods to enhance the performance of three phase induction Motors and understand the construction, operation of single phase induction motor.

CO3: Analyze the performance characteristics of alternator and compute voltage regulation with different methods.

CO4: Analyze the characteristics of synchronous motor and its performance with effect of varying load and excitation.

CO5: Recognize the characteristics of single-phase induction motors and special machines as well as choose an appropriate motor for any industrial application.

Textbooks:

T1: E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi,7th Edition, 2017.

T2: B. L. Theraja and A. K. Theraja, —A Textbook of Electrical Technology-Vol. II, S. Chand & Co. Ltd., New Delhi, 23rd Multicolor Edition, 2016

T3: J. Nagrath and D.P. Kothari, "Electric machines" T.M.H. publishing Co.Ltd., New Delhi, 5th Edition, 2017.

References:

R1: DP Kothari, IJ Nagrath, '' Electric Machines", 2017, 5th Edition, Tata McGraw Hill Education, India 2.

R2: Battacharya S K, "Electrical Machines", Technical Teachers Training institute", 2nd Edition.2003.

R3: J. B. Gupta, —Theory and Performance of Electrical Machines, S. K. Kataria and Sons, New Delhi, 14th Edition, 2010.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=G4PPPMyKHg&list=PL0qTgmmsRv4SDXfLmIFlElWLvbnBxlpD&index=1
2. https://www.youtube.com/shorts/CKwWMaOs_PU
3. https://www.youtube.com/watch?v=7Kuv_mxo4_A

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	3	2	2	1	-	-	1	-	-	1	1	1
CO2	3	3	2	2	1	-	-	1	-	-	1	1	1
CO3	3	3	2	2	1	-	-	1	-	-	1	1	1
CO4	3	3	2	2	1	-	-	1	-	-	1	1	1
CO5	3	3	2	2	1	-	-	1	-	-	1	1	1
AVG	3	3	2	2	1	-	-	1	-	-	1	1	1

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

TRANSMISSION AND DISTRIBUTION			
Course Code:	25UEET42	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:0:0:1	**Credits:**	3
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

- To understand the structure of power systems and analyze different distribution networks and distributor calculations.
- To analyze the electrical parameters of transmission lines considering conductor configuration and practical effects.
- To evaluate the performance, efficiency, regulation, and stability of transmission lines using equivalent circuits.
- To understand the characteristics and performance of insulators and underground cables in power systems.
- To introduce modern transmission technologies including HVDC systems, electrification planning, and FACTS.

Unit 1	**DISTRIBUTION**	**9 Periods**

Structure of electric power systems-one Line Diagram-generation, transmission and distribution Systems-comparison of distribution systems–radial and ring –two wire dc, ac single phase and three phase systems–current and voltage calculations in distributors with concentrated and Distributed loads – Kelvin's law for the design of feeders and its limitations.

Teaching Learning Process	**Pedagogy: chalk-and-talk, problem-based learning, schematic analysis**
	RBT Level: K3

Unit 2	**TRANSMISSION LINE PARAMETERS**	**9 Periods**

Resistance, inductance and capacitance of single and three phase transmission lines-symmetrical and unsymmetrical spacing–transposition-single and double circuits-stranded and bundled conductors-application of self and mutual GMD–Skin and Proximity effect-inductive interference- Corona characteristics.

Teaching Learning Process	**Pedagogy: Derivation-based learning, and guided problem solving**
	RBT Level: K3

Unit 3	**PERFORMANCE OF TRANSMISSION LINES**	**9 Periods**

Development of equivalent circuits for short, medium and long lines–efficiency and regulation- Attenuation constant and phase constant- surge impedance loading –power circle diagrams for sending and receiving ends/l-transmission capacity, steady state stability limit–voltage control of Lines–shunt and series compensation.

Teaching Learning Process	**Pedagogy: Problem-Based Learning, chalk and talk**
	RBT Level K3

Unit 4	**INSULATORS AND CABLES**	**9 Periods**

Insulators–types and comparison–voltage distribution in string insulator–string efficiency – Methods of improving string efficiency –Stress and sag calculations – effect of wind and ice – supports at different levels–capacitance of cables–insulation resistance – dielectric stress and grading- dielectric loss- thermal characteristics- capacitance of three core cables.

Teaching Learning Process	**Pedagogy: Analytical problem solving, and demonstration using models/charts**
	RBT Level: K3

Unit 5	**RECENT TRENDS IN TRANSMISSION**	**9 Periods**

Design of rural distribution, planning and design of town electrification schemes–comparison of EHVAC& HVDC system–economic distance for HVDC–terminal equipment for HVDC systems–description of DC transmission system–planning-advantages-interconnection of HVDC & AC systems–Introduction to FACTS technology.

Teaching Learning Process	**Pedagogy: Discussion-based learning, student seminars, Chalk and talk**
	RBT Level: K2

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Active Learning: Tutorials & Gate-Oriented MCQs.
Practical Activities: Mini Projects & Student presentations
Digital Tools: Online quiz platforms and digital learning resources.
Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.
Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Explain and analyze the structure and operation of electric power distribution systems and perform distributor calculations.

CO2: Analyze transmission line parameters considering conductor configuration and practical effects such as skin and proximity effects.

CO3: Evaluate the performance of short, medium, and long transmission lines using equivalent circuits.

CO4: Analyze the characteristics and performance of insulators and underground cables in power Systems.

CO5: Explain and compare modern power transmission technologies including HVDC systems and FACTS.

Textbooks:

T1: C.L.Wadhwa, Electrical Power Sytems, 5th edition, New Age International (P) Limited, New Delhi, 2006

T2: V.K.Metha&RohitMetha,"Principles of Power System", S.Chand, 2005.

References:

R1: S.L.Uppal, Electrical Power, Khanna Publishers, New Delhi, 2002.

R2: S.N. Singh, Electric Power Generation, Transmission& Distribution, Prentice Hall of India, New Edition, New Delhi, 2008.

R3: Chakrabarti. A, Soni MI, Gupta PV,"Text book on power system engineering", DhanpatRai & Co,2008.

Web links and Video Lectures (e-Resources):

1. Power System Generation, Transmission and Distribution – NPTEL (IIT Delhi)
2. Transmission and Distribution (Part-1) – IMS GATE Academy
3. Electric Power Systems Videos – University of Minnesota (CUSP)

GATE Academy & Unacademy (Concept-oriented videos)

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	–	–	1	–	–	–	–	1	–	2
CO2	3	3	–	2	1	–	–	–	–	–	1	–	2
CO3	3	3	2	2	1	1	–	–	–	–	1	–	3
CO4	3	2	2	2	1	1	–	–	–	–	1	–	2
CO5	2	2	2	1	2	2	1	–	–	1	2	2	3
AVG	2.8	2.4	1.4	1.4	1	1	0.2	-	-	0.2	1.2	0.4	2.4

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

CONTROL SYSTEMS			
Course Code:	25UEET43	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:1:0:1	**Credits:**	4
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

- To understand and analyze the representation of control systems using mathematical models, block diagrams, and signal flow graphs.
- To evaluate time-domain response and assess system performance under standard test inputs and controllers.
- To interpret frequency response characteristics and correlate them with time-domain specifications.
- To apply classical stability analysis techniques and analyze stability improvements using root locus.
- To formulate state-space models and determine controllability and observability of linear systems.

Unit 1	**CONTROL SYSTEMS AND THEIR REPRESENTATION**	**9 Periods**

Introduction to Control Engineering - Open and closed loop systems -Mathematical modelling of Electrical and Mechanical systems - electrical analogues systems -- Block diagrams reduction techniques - Signal flow graphs.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning & Tutorial Sessions
	RBT Level: K3

Unit 2	**TIME RESPONSE ANALYSIS**	**9 Periods**

Introduction to Time Domain Analysis- Standard test signals – Transient analysis of first and second order systems using step input -Time domain specifications – Error Analysis -Effects of P, PI, and PID Controllers.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning &Tutorial Sessions
	RBT Level: K3

Unit 3	**FREQUENCY RESPONSE ANALYSIS**	**9 Periods**

Frequency domain specifications - Bode plot - Polar plot - Nyquist stability criterion - Correlation between frequency domain and time domain specifications.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning &Tutorial Sessions
	RBT Level: K3

Unit 4	**STABILITY ANALYSIS**	**9 Periods**

Relative stability analysis using Routh stability criterion– Root locus concepts – Construction of root loci Stability analysis in frequency domain.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning & Tutorial Sessions
	RBT Level: K3

Unit 5	**STATE SPACE ANALYSIS**	**9 Periods**

Concept of state variables – State models for linear and time invariant Systems –state space to transfer function conversion; Solution of state and output equation in controllable canonical form – Concepts of controllability and observability.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning& Tutorial Sessions
	RBT Level: K3
Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Active Learning: Tutorials & Gate-Oriented MCQs.

Practical Activities: Mini Projects & Student presentations

Digital Tools: Online quiz platforms and digital learning resources.

Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.

Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Explain control system fundamentals and analyze mathematical representations using block diagrams and signal flow graphs.

CO2: Evaluate time-domain responses of first and second order systems and assess the effect of controllers on performance.

CO3: Analyze frequency response characteristics and establish correlation with time-domain specifications.

CO4: Determine system stability using classical methods and construct root locus for performance improvement.

CO5: Develop state-space models of linear systems and examine their controllability and observability.

Textbooks:

T1: Katsuhiko Ogata, "Modern Control Engineering", Pearson, 2015.

T2: Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014.

T3: Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017.

References:

R1: Richard C. Dorf and Robert. H. Bishop, "Modern Control Systems", Pearson Education, 12th Edition, 2011.

R2: John J. D'Azzo, Constantine H. Houpis and Stuart N. Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor and Francis Reprint, 6th Edition, 2014.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/107106081
2. https://www.youtube.com/playlist?list=PLxn52v8fxX5l5tGzU1NAxRDkgqxK0k5UZ
3. https://ce-dei.vlabs.ac.in/List%20of%20experiments.html
4. https://ocw.mit.edu/courses/16-30-feedback-control-systems-fall-2010/pages/lecture-notes/

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	3	2	2	1	-	-	1	1	-	1	1	1
CO2	3	3	2	2	1	-	-	1	1	-	1	1	1
CO3	3	3	2	2	1	-	-	1	1	-	1	1	1
CO4	3	3	2	2	1	-	-	1	1	-	1	1	1
CO5	3	3	2	2	1	-	-	1	1	-	1	1	1
AVG	3	3	2	2	1			1	1		1	1	1

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

LINEAR INTEGRATED CIRCUITS			
Course Code:	25UEET44	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:1:0:1	**Credits:**	4
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

- To provide fundamental knowledge on monolithic IC fabrication processes and technologies.
- To understand the characteristics, configurations, and applications of operational amplifiers.
- To design and analyze active filters, waveform generators, and oscillator circuits using operational amplifiers.
- To explore various analog IC applications including voltage regulators, power amplifiers, data converters, and comparators.
- To study the principles and real-time applications of Phase Locked Loops (PLL) and Timer ICs.

Unit 1	**IC FABRICATION**	**9 Periods**

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell, BJT FET & CMOS.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching& Project-Based Learning
	RBT Level: K2

Unit 2	**OPERATIONAL AMPLIFIERS AND APPLICATIONS**	**9 Periods**

Ideal OP-AMP equivalent circuit, AC and DC characteristics, Open and closed loop configuration, Properties of practical op-amps (LM741, LM124), Applications –Inverting and Non-Inverting amplifier, Summer and Subtractor, Differentiator and Integrator, V to I converter, I to V converter, Instrumentation amplifier, Comparator, Clipper and Clamper, S/H circuit.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning &Simulation-Based Learning
	RBT Level: K3

Unit 3	**ACTIVE FILTERS AND WAVEFORM GENERATOR USING OP AMP**	**9 Periods**

I and II order Active filter, Low pass, high pass, wide band pass and band stop Butterworth filters, Narrow band pass and notch filters, State variable filter, switched capacitor filter – Waveform generator: Triangular and saw tooth wave generator – Effect of Slew Rate on waveform generation – Schmitt trigger and Multivibrators - RC Phase shift and Wien bridge oscillators – Applications

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning &Simulation-Based Learning
	RBT Level: K3

Unit 4	**ANALOG IC APPLICATIONS**	**9 Periods**

Series op-amp regulator, Fixed IC voltage regulators: LM78XX, LM79XX, Adjustable voltage regulators: LM117, LM317, switching regulator, SMPS, MPY634 Analog Multiplier– LM 380 Power amplifier, IC LM311 Comparator, D/A converter (R- 2R ladder and weighted resistor types), A/D converters (Flash type, Successive approximation & Dual Slope) using OP-AMPs

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Project-Based Learning
	RBT Level: K3

Unit 5	**PHASE LOCKED LOOP & TIMER**	**9 Periods**

Phase locked loop – operating principles, applications of PLL. IC555 timer – Functional diagram – Multivibrators – Schmitt trigger – Missing pulse detector, Frequency counter – Dual timer SN74AH.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning & Simulation-Based Learning
	RBT Level: K3

Total	**45 Periods**

Suggested Activities and Evaluation Methods:
Active Learning: Tutorials & Gate-Oriented MCQs.

Practical Activities: Mini Projects & Student presentations
Digital Tools: Online quiz platforms and digital learning resources.
Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.
Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Explain control system fundamentals and analyze mathematical representations using block diagrams and signal flow graphs.

CO2: Evaluate time-domain responses of first and second order systems and assess the effect of controllers on performance.

CO3: Analyze frequency response characteristics and establish correlation with time-domain specifications.

CO4: Determine system stability using classical methods and construct root locus for performance improvement.

CO5: Develop state-space models of linear systems and examine their controllability and observability.

Textbooks:

T1: Ramakant A. Gayakward, "Op-amps and Linear Integrated Circuits", Pearson Education, 5th Edition, 2015.

T2: J. Michael Jacob, "Applications and Design with Analog Integrated Circuits", Prentice Hall of India, New Delhi, 2nd Edition, 2010.

T3: Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill, 1st Edition, 2018.

References:

R1: Muhammad H. Rashid, "Microelectronic Circuits: Analysis and Design", Cengage learning Inc, 2nd Edition, 2011.

R2: Roy Choudhary, Sheil. B. Jani, "Linear Integrated Circuits", New Age Publication, 5th Edition, 2018.

R3: Shrikrishna Yawale, Sangita Yawale, "Operational Amplifier Theory and Experiments", Springer Nature Singapore, 2022.

Web links and Video Lectures (e-Resources):

1. **https://nptel.ac.in/courses/108108111**
2. **https://nptel.ac.in/courses/108103378**
3. **https://www.youtube.com/watch?v=Zkrkq7wxc6E**

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	3	2	2	2	-	-	1	1	-	1	1	1
CO2	3	3	2	2	2	-	-	1	1	-	1	1	1
CO3	3	3	2	2	2	-	-	1	1	-	1	1	1
CO4	3	3	2	2	2	-	-	1	1	-	1	1	1
CO5	3	3	2	2	2	-	-	1	1	-	1	1	1
AVG	3	3	2	2	2	-	-	1	1	-	1	1	1

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

UTILIZATION OF ELECTRICAL ENERGY			
Course Code:	25UEET45	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:1:0:1	**Credits:**	4
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

- To design optimized illumination system for domestic and industrial applications.
- To acquire knowledge about the different types of heating and welding.
- To make awareness in the usage of refrigeration and air conditioning system.
- To familiarize with the construction and working of traction systems.
- To impart the knowledge on electroplating techniques and operations of batteries.

Unit 1	**ILLUMINATION**	**9 Periods**

Introduction – basic terminologies – laws of illumination – polar curves – Rousseau‟s construction – electrical lamps – Basic principles of light control – Types – Design of lighting – illumination calculation (for residential, industrial, commercial, health care, street lightings, sports, administrative complexes) – bureau of energy efficiency star rating for lamps.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching& Project-Based Learning
	RBT Level: K3

Unit 2	**ELECTRIC HEATING AND WELDING**	**9 Periods**

Role of electric heating for industrial applications – Types of Heating – Resistance – Induction -Arc furnace – Dielectric - solar – heating of building, domestic water heater, Electric oven. Welding methods – Resistance – Arc - Laser – Ultrasonic - Power supply equipment's for welding.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning &Simulation-Based Learning
	RBT Level: K2

Unit 3	**REFRIGERATION AND AIR CONDITIONING**	**9 Periods**

Electrical Circuit of Refrigerator – Trouble shooting of Refrigerator – Air conditioning types and their applications – smart air conditioning systems – Trouble shooting of air conditioning.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning &Simulation-Based Learning
	RBT Level: K2

Unit 4	**ELECTRIC TRACTION**	**9 Periods**

Traction system – Power supply – Traction drives – braking – Tractive effort calculations – speed time characteristics. Locomotives and train – Tram ways and Trolley bus – Recent trends – Metro and Mono rail systems.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching &Project-Based Learning
	RBT Level: K2

Unit 5	**ELECTROLYSIS AND DOMESTIC APPLIANCES**	**9 Periods**

Electrolysis- Laws of Electrolysis, power supply, Efficiency – Electro Plating. Batteries-Types – Components, rating of batteries – Methods of charging and maintenance. Domestic appliances: Electric iron, Electric toaster – Introduction to Green Building Concept and energy auditing.

Teaching Learning Process	**Pedagogy:** ICT-Enabled Teaching, Project-Based Learning & Simulation-Based Learning
	RBT Level: K3

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Active Learning: Tutorials & Gate-Oriented MCQs.
Practical Activities: Mini Projects & Student presentations
Digital Tools: Online quiz platforms and digital learning resources.
Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.
Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Develop a clear idea on lighting requirement for domestic and industrial needs in an efficient way

CO2: Analyze the different types of heating and welding schemes used in the industries.

CO3: Repair the minor faults that occurs in refrigerator and in air conditioning system.

CO4: Analyze the speed-time characteristics and performance of the electric traction.

CO5: Calculate the power requirement and efficiency of domestic appliances

Textbooks:

T1: J. B. Gupta, "Utilization of Electrical Power and Traction", Kataria Publications, Reprint Edition, 2020

T2: R. K. Rajput, "Utilization of Electrical Power", Lakshmi publications, 2nd Edition, 2016.

T3: . E. Openshaw Taylor and V. V. L. Rao, "Utilization of Electric Energy", Orient Longman, New Delhi, 2nd Edition, 2007.

References:

R1: S. K. Sahdev, "Utilization of electrical energy and electric traction", New Age International Publisher, 1st Edition, 2016.

R2: . H. Partap, "Art and Science of Utilization of Electrical Energy", Dhanpat Rai and Sons, Delhi, 2nd Edition, 2015.

Web links and Video Lectures (e-Resources):

- www.modernelectronics.org
- www.electronicsforyou.com
- www.npteliitm.ac.in
- https://www.eeweb.com

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	2	1	-	-	-	-	-	-	-	1(SL)	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	1(A)	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-
AVG	3	2	1	-	-	-	-	-	-	-	1(SL)	-	-

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

DATA STRUCTURES AND ALGORITHMS			
Course Code:	25UCSI46	**Course Type:**	INTEGRATED
Teaching Periods / Week (L: T:P:SL)	2:0:4:1	**Credits:**	4
Total Teaching Periods:	45	**CAT+ ESE Marks:**	50+50
Teaching Department:	Information Technology		

Course Objectives:

To impart knowledge on

- Fundamental concepts of data structures and list implementations using arrays and linked lists.
- Concepts, operations, and applications of stacks and queues including expression evaluation.
- Understanding of tree structures including binary trees, AVL trees, B-Tree, and B+ Tree indexing.
- Graph theory concepts including graph representations, traversal techniques, and hashing methods.

Unit 1	**LISTS**	**9 Periods**

LISTS: Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Multilists.

Practicals:

- Implementation of Singly Linked List, Doubly Linked List, Circular Linked List.

Teaching Learning Process	**Pedagogy: Chalk and Talk & PPT**
	RBT Level: Theory & Practical: Apply

Unit 2	**STACKS AND QUEUES**	**9 Periods**

STACKS AND QUEUES

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.

Practicals:

- Application of Stack for Converting an Arithmetic Expression into Postfix Form and Evaluation of Postfix Expression
- Implementation of Stack and Its Operations
- Implementation of Queue, Circular Queue, Priority Queue, Dequeue and Their Operations.

Teaching Learning Process	**Pedagogy:** Chalk and Talk & PPT
	RBT Level: Theory & Practical: Apply

Unit 3	**TREES**	**9 Periods**

TREES

Tree ADT – Tree Traversals – Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.

Practicals:

Implementation of Binary Search Tree.

Teaching Learning Process	**Pedagogy:** Chalk and Talk & PPT
	RBT Level: Theory & Practical: Apply

Unit 4	**MULTIWAY SEARCH TREES AND GRAPHS**	**9 Periods**

MULTIWAY SEARCH TREES AND GRAPHS

B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graph – Breadth-first traversal – Depth-first traversal — Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm

Practicals:

- Implementation of Binary Tree and Binary Traversal Techniques
- Implementation of Graph Traversal Techniques
- Implement Dijkstra's Algorithm to Obtain the Shortest Paths

Teaching Learning Process	**Pedagogy:** Chalk and Talk & PPT
	RBT Level: Theory & Practical: Apply

Unit 5	**SEARCHING, SORTING AND HASHING TECHNIQUES**	**9 Periods**

SEARCHING, SORTING AND HASHING TECHNIQUES

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Radix Sort –. Merge Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

Practicals:

- Sorting Algorithms: Insertion Sort, Selection Sort, Bubble Sort and Merge Sort
- Searching Algorithms Linear, Binary
- Implementation of Hash Tables and its Operations.

Teaching Learning Process	**Pedagogy:** Chalk and Talk & PPT
	RBT Level: Theory & Practical: Apply
Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Active Learning: Tutorials & Gate-Oriented MCQs.
Practical Activities: Mini Projects & Student presentations
Digital Tools: Online quiz platforms and digital learning resources.
Assessment Methods: Students' performance in continuous Assessment (CAT 1 & 2) & Model Exam.
Evaluation: End-Semester Written Test.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Understand and implement list ADTs using array and linked list representations.
CO2: Apply stack and queue ADTs to solve expression evaluation and scheduling problems.
CO3: Use tree data structures for efficient data organization and searching.
CO4: Apply multiway trees and graph algorithms to solve traversal and optimization problems.
CO5: Implement searching, sorting, and hashing techniques for efficient data management.

Textbooks:

T1: Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Source, Pvt. Ltd., 2004.
T2: D. Samanta, Classic Data Structures, 2nd, Prentice-Hall of India, Pvt. Ltd., India, 2012.

References:

R1: Thomas Cormen, Charles Lieserson, Ronald L Rive stand Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 4th Edition, 2022.
R2: John Canning, Alan Broder, Robert Lafore,"Data Structures &Algorithms in Python", Addison Wesley Professional,1stEdition, 2022.

Web links and Video Lectures (e-Resources):

1. Introduction to Programming, Data Structures and Algorithms Using Python: https://onlinecourses.nptel.ac.in/noc2 3 cs15

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	3	2	1	-	-	-	-	-	-	1	-	-
CO2	3	3	2	1	1	-	-	-	-	-	1	-	-
CO3	3	3	2	1	1	-	-	-	-	-	1	-	-
CO4	3	3	2	1	1	-	-	-	-	-	1	-	-
CO5	3	3	2	1	1	-	-	-	-	-	1	-	-
AVG	3	3	2	1	1	-	-	-	-	-	1	-	-

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

AC MACHINES LAB			
Course Code:	25UEEP47	**Course Type:**	Practical
Teaching Periods / Week (L: T:P)	0: 0: 2	**Credits:**	01
Total Teaching Periods:	24	**IAT + ESE Marks:**	60 + 40
Teaching Department:	EEE		

Course Objectives:

1. To provide hands-on experience in conducting performance tests on single-phase and three-phase induction motors and alternators.
2. To enable students to analyze operating characteristics such as efficiency, slip, voltage regulation, and power factor of induction and synchronous machines through experimental methods.
3. To develop practical skills in speed control, voltage regulation, and synchronization of synchronous and induction machines using standard laboratory procedures and instruments.

Practical Exercises: **24 Periods**

LIST OF EXPERIMENTS

(A minimum of TEN experiments to be conducted in the following Topics)

INDUCTION MACHINES

1. Load test on single-phase induction motor.
2. Load test on three-phase squirrel cage induction motor.
3. Load test on three-phase slip ring induction motor.
4. No-load and blocked rotor tests on three-phase induction motor.
5. Speed control of induction motor:
   (i) Stator voltage control
   (ii) Rotor resistance control

SYNCHRONOUS MACHINES

6. Load test on single-phase alternator.
7. Load test on three-phase alternator.
8. Determination of voltage regulation of alternator by:
   - EMF method
   - MMF method
   - Zero Power Factor (ZPF) method
9. Synchronization of three-phase alternator with infinite bus bar.
10. Determination of V and inverted -V curves of synchronous motor.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Test the performance of induction and synchronous machines by conducting suitable experiments and report the results. (K3)

CO2: Predetermine the different performance characteristics of single phase and three phase induction motors. (K3)

CO3: Analyze the speed control techniques and electrical braking of induction motor. (K3)

CO4: Experiment the synchronization of alternators and analyze the power exchange with the grid. (K3)

CO5: Develop any prototype modules implementing different control techniques in Induction and Synchronous machines for various applications. (K3)

TEXT BOOKS:

T1: D. P. Kothari, B. S. Umre, "Laboratory Manual for Electrical Machines", I.K. International Publishing Ho, New Delhi, 2nd Edition, 2017.

T2: B. L. Theraja and A. K. Theraja, —A Textbook of Electrical Technology-Vol. II, S. Chand & Co. Ltd., New Delhi, 23rd Multicolor Edition, 2016.

REFERENCES:

R1: Bimbhra, P.S., Electrical Machinery, Khanna Publishers.

R2: Fitzgerald, A.E., Kingsley, C., and Umans, S.D., Electric Machinery, McGraw-Hill.

R3: Nagrath, I.J. and Kothari, D.P., Electric Machines, Tata McGraw-Hill.

CO–PO & PSO Mapping													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	2	2	2	-	-	-	-	-	1	1	1
CO2	3	2	2	2	2	-	-	-	-	-	1	1	1
CO3	3	2	2	2	2	-	-	-	-	-	1	1	1
CO4	3	2	2	2	2	-	-	-	-	-	1	1	1
CO5	3	2	2	2	2	-	-	-	-	-	1	1	1
AVG	3	2	2	2	2	-	-	-	-	-	1	1	1
1–Low, 2–Medium, 3–High, '-' –No correlation													

LINEAR INTEGRATED CIRCUITS LAB			
Course Code:	25UEEP48	**Course Type:**	Practical
Teaching Periods / Week (L:T:P)	0:0:2	**Credits:**	1
Total Teaching Periods:	30	**IAT + ESE Marks:**	60+40
Teaching Department:	EEE		

Course Objectives:

- To learn the design, analysis, testing, and characterization of circuits using IC 741 operational amplifier.
- To understand the AC and DC characteristics and practical limitations of OP-AMP 741.
- To familiarize the design and analysis of amplifier and linear application circuits using OP-AMP 741.
- To introduce the design of comparator, filter oscillator, waveform generator, and A/D–D/A converter circuits using OP-AMP 741.
- To impart knowledge on the design and testing of voltage regulator circuits and timing circuits using voltage regulator ICs and IC 555 Timer.

Practical Exercises: **Periods: 30**

LIST OF EXPERIMENTS

(A minimum of TEN experiments to be conducted in the following Topics)

1. Obtain various characteristic parameters of IC 741
2. Design and analysis of Inverting, non-inverting amplifiers, Voltage follower.
3. Design and analysis of Adder and subtractor using OPAMP 741.
4. Design and analysis of Integrator, Differentiator using OPAMP 741.
5. Design and analysis of comparator circuits and instrumentation amplifier using OPAMP 741.
6. Design and analysis of D/A and A/D converters using OPAMP 741(Any one type).
7. Design and analysis of Schmitt trigger Using OPAMP 741.
8. Design and analysis of filter circuit (I order and II order) using OPAMP 741.
9. Design and analysis of Wein-bridge and RC phase shift oscillator.
10. Design and verification of waveform generator using OPAMP 741
11. Design and analysis of voltage regulators using IC 78XX/79XX.
12. Design and analysis of variable voltage regulator using IC LM317.
13. Design and test regulator circuits for power supplies using voltage regulator ICs.
14. Design and verification of Monostable and Astable, multivibrator using IC 555 Timer
15. Design of Schmitt Trigger by using IC 555 Timer.

Course Outcomes:

After Successful completion of this course, the student should be able to

1. Determine and evaluate the characteristic parameters of the IC 741 operational amplifier and interpret its practical limitations.
2. Design and analyze amplifier and linear application circuits, including inverting, non-inverting, adder, subtractor, integrator, and differentiator configurations using IC 741.
3. Design and analyze comparator, Schmitt trigger, first- and second-order filter, oscillator, waveform generator, and A/D–D/A converter circuits using IC 741 operational amplifier.
4. Design, implement, and test fixed and variable voltage regulator circuits using ICs 78XX, 79XX, and LM317 for regulated power supply applications.
5. Design and verify timing and waveform generation circuits such as monostable and astable multivibrators, and Schmitt trigger using IC 555 Timer.

Textbooks:

T1: Ramakant A. Gayakward, “Op-amps and Linear Integrated Circuits”, Pearson Education, 5th Edition, 2015.

T2: Roy Choudhary, Sheil. B. Jani, "Linear Integrated Circuits", New Age Publication, 5th Edition, 2018

T3: Muhammad H. Rashid, "Microelectronic Circuits: Analysis and Design", Cengage learning Inc, 2nd Edition, 2011.

Web links and Video Lectures (e-Resources):

1. **https://ade2-iitr.vlabs.ac.in/List%20of%20experiments.html**
2. **https://ae-iitr.vlabs.ac.in/List%20of%20experiments.html**
3. **https://be-iitkgp.vlabs.ac.in/List%20of%20experiments.html**

CO–PO & PSO Mapping

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	1	1	-	1	1	1
CO2	3	2	2	2	2	-	-	1	1	-	1	1	1
CO3	3	2	2	2	2	-	-	1	1	-	1	1	1
CO4	3	2	2	2	2	-	-	1	1	-	1	1	1
CO5	3	2	2	2	2	-	-	1	1	-	1	1	1
AVG	3	2	2	2	2	-	-	1	1	-	1	1	1

1–Low, 2–Medium, 3–High, '-' –No correlation

PROFESSIONALISM AND BASIC APTITUDE			
EEE, ECE, CSE, IT and ME			
Course Code:	25UPCE41	**Course Type:**	EEC
Teaching Periods / Week (L: T:P:SL)	2:0:0:1	**Credits:**	NIL
Total Teaching Periods:	48	**CAT Marks:**	50
Teaching Department:	Placement cell		

Course Objectives:

To impart knowledge on:

1. This course helps students improve communication, teamwork, and time management.
2. It teaches how to behave professionally and work well with others.
3. Students will learn problem-solving and leadership skills

Unit 1	**ATTITUDE, ADAPTABILITY, VALUES, AND LEARNING IN PROFESSIONAL LIFE**	**10 Periods**

Attitude: Positive thinking and optimism - Growth mindset vs. fixed mindset - Self-motivation and initiative - Managing negative attitudes and stress

Adaptability: Change management - Cognitive flexibility - Continuous learning - Workplace diversity adjustment

Values: Personal vs. professional values - Integrity and honesty - Respect and empathy - Ethical decision-making

Perception and learning: Sensory perception and attention - Factors affecting perception - Types of learning - Learning styles and strategies

Teaching Learning Process	**Pedagogy:** Interactive lectures combined with case studies, role plays, group discussions, self-reflection, and activity-based learning to develop positive attitude, adaptability, values, and effective learning strategies.
	RBT Level: Theory: L3 & L4 (Apply & Analyze)

Unit 2	**LEADERSHIP, CREATIVITY, AND PERSONAL EXCELLENCE**	**10 Periods**

Leadership: Leadership Styles-Effective Communication-Decision-making-Team motivation

Creativity: Brainstorming-Innovation-Problem-solving-Imagination

Reaching your potential: Self-awareness - Goal setting - Time management - Continuous improvement

Teaching Learning Process	**Pedagogy:** Interactive lectures supported by brainstorming sessions, case studies, role plays, group activities, goal-setting exercises, and reflective learning to develop leadership, creativity, and self-improvement skills.
	RBT Level: Theory: L3–L5(Apply, Analyze, Evaluate)

Unit 3	**FUNDAMENTALS OF NUMBER SYSTEM AND FACTORIAL-BASED PROBLEM SOLVING**	**10 Periods**

General Aptitude

Number System: Types of Numbers - Prime and Composite Numbers -Place Value and Face Value - Conversions between Number Bases

HCF & LCM: Prime Factorization Method - Division Method - Relationship between HCF and LCM - Word Problems on HCF and LCM

Factorial Concepts: Definition and Notation of Factorial - Factorial Identities - Factorial in Permutations and Combinations - Trailing Zeros in Factorials

Teaching Learning Process	**Pedagogy:** Concept explanation through interactive lectures followed by worked examples, step-by-step problem solving, tutorial practice, and application-oriented exercises on number systems, HCF–LCM, and factorial concepts.
	RBT Level: Theory: L2–L4 (Understand, Apply, Analyze)

Unit 4	**FUNDAMENTALS OF QUANTITATIVE APTITUDE: PERCENTAGES, PROFIT–LOSS, AND INTEREST CALCULATIONS**	**10 Periods**

Quantitative Aptitude – 1

Profit and Loss: Cost Price and Selling Price - Profit and Loss Percentage - Marked Price and Discount - Successive Transactions

Percentage, Ratio and Proportion: Percentage Basics and Calculations - Ratio Simplification and Comparison - Direct and Inverse Proportion - Percentage to Ratio Conversions

Simple Interest and Compound Interest: Simple Interest Formula and Calculation - Compound Interest Basics - Difference between SI and CI - Time and Rate-Based Problems

Teaching Learning Process	**Pedagogy:** Interactive lectures with formula derivation, step-by-step numerical problem solving, tutorial practice, real-life application examples, and short quizzes to strengthen calculation speed and accuracy.
	RBT Level: Theory: L2–L4 (Understand, Apply, Analyze)

Unit 5	PROBABILITY, COUNTING TECHNIQUES, AND WORK–TIME APPLICATIONS	8 Periods

Probability: Basic Probability - Sample Space - Independent and Dependent Events - Complementary Events

Permutation and Combination: Fundamental Principle of Counting - Permutations - Combinations - Circular Permutations

Pipe and Cistern: Inlet and Outlet Pipes - Filling and Emptying Time - Pipes Working Together - Alternate Inlet–Outlet Problems

Teaching Learning Process	**Pedagogy:** Concept-oriented lectures supported by solved examples, diagrammatic explanations, step-by-step numerical problem solving, tutorial practice, and application-based exercises to develop logical and analytical skills.
	RBT Level: Theory: L2–L4 (Understand, Apply, Analyze)

Total	48 Periods

Suggested Activities and Evaluation Methods:

Group Discussions, Aptitude Practice Sessions, Case Study Analysis Online Quizzes & Practice Tests
Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After successful completion of this course, the student should be able to:

CO1: Apply positive attitude, adaptability, ethical values, and effective perception and learning strategies for personal and professional development.

CO2: Build leadership, creativity, and self-awareness to communicate effectively, solve problems, and achieve continuous growth.

CO3: Apply number system concepts, HCF & LCM methods, and factorial principles to solve quantitative problems efficiently.

CO4: Calculate profit/loss, percentage, ratio, proportion, and interest problems to make informed financial and quantitative decisions.

CO5: Solve problems on probability, permutations, combinations, and pipe-cistern scenarios using logical and mathematical reasoning.

Textbooks:

T1: Quantitative aptitude for competitive exams by S. Chand, Dr.R.S. Aggarwal.

T2: Quantitative aptitude for CAT by Arun Sharma, Tata McGrew Hill.

References:

R1: Rapid Quantitative Aptitude by Er. Deepak Agarwal and Mr.D. P. Gupta.

R2: Numerical Ability and Quantitative aptitude for Competitive examinations by P.K. Mittal.

Web Links and Video Lectures (e-Resources):

1. https://www.teachbritannica.com/lesson-minis/professional-skills-in-action-lib/

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1		3				3	2	2	2	2	2		
CO2	2	1	1	1	1	1	1	1					
CO3	2	2	2								2		
CO4	2		2					2			2		
CO5	2	2	2						2		2		
AVG	1.6	1.6	1.4	0.2	0.2	0.8	0.6	1	0.8	0.4	1.6		

1–Low, 2–Medium, 3–High, '-' –No correlation

ENTREPRENEURIAL SKILLS AND CONCEPTS			
(Common to all Branches)			
Course Code:	25UMCC41	**Course Type:**	**MCC**
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	0
Total Teaching Periods:	30	**CAT+ ESE Marks:**	
Teaching Department:			

Course Objectives:

To learn the basic knowledge of Entrepreneurship, Digital Technology, Management, Start-Up Environment and Strategy Management.

Unit 1	**INTRODUCTION TO ENTREPRENEURSHIP**	**06 Periods**

Strategy from Ideation to Exit, Identifying the Trade-offs, Intellectual Activity & Knowledge Economy, sharing Economy, Approach to construct Social, Economic Models.

Unit 2	**DIGITAL TECHNOLOGIES AS AN OPEN INNOVATION'S ENVIRONMENT**	**06 Periods**

Transaction costs, Trust and Reviewing system (personification), Hardware & Software - Robotics and Intelligence, Computing Recognition and Decision Making, Infrastructure Building - Cyberphysical Systems as a Product and as an Infrastructure**.**

Unit 3	**ORGANIZATION AND MANAGEMENT OF OPEN INNOVATION PROJECTS**	**06 Periods**

History the Emergence of Open Innovation - Analysis of Elements of Open Innovation in the Traditional Management - Agile, Flexible Project Management - Methodologies within Agile Approach, From Project to Product, Steps of converting Ideas into Goods - Stakeholders of Open Innovation Project, Customers, Investors, Employees. Indicators of Effectiveness for the various Groups of Stakeholders.

Unit 4	**START-UP ENVIRONMENT**	**06 Periods**

Institutions support and finance innovation projects-Types of Financing - Infrastructure supporting Small Innovative Enterprises and Start-Ups.

Unit 5	**OPERATIONAL AND STRATEGY MANAGEMENT**	**06 Periods**

Operations Analysis, Coordination and Planning, Quality Management, Project Management, and Logistics and Supply Chain Management, Strategy Management, Technological Strategy

Teaching Learning Process	**Pedagogy:**
	RBT Level: Theory: Practical:
Total	**Periods:45**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study
Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to CO1:
To understand the concept of Entrepreneurship.
CO2: To understand the Digital Technologies as an Open Innovation's Environment.
CO3: To understand the Organization and Management of Open Innovation Projects.
CO4: To understand and create Start-Up Environment
CO5: To understand the concept of Operational and Strategy Management.

Textbooks:

T1: Peter F. Drucker, "Innovation and Entrepreneurship", Classic Drucker Collection, 2007
T2: Vasant Desai, "Entrepreneurship: Development and Management", Himalaya Publishing House, 2015.

References:

R1: Greg Caldwell , "Lean Startup: How to Apply the Lean Startup Methodology to Innovate, Accelerate, and Create Successful Businesses", Alakai Publishing LLC, 2020
R2: RIES ERIC,"The Lean Startup: How Constant Innovation Creates Radically Successful Businesses", Portfolio Penguin, 2011.

Web links and Video Lectures (e-Resources):

1. https://archive.nptel.ac.in/course.html

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	2	2	1	1	1	1	2	2	1	2	2	1	1
CO2	2	3	2	2	3	1	1	1	2	2	2	2	1
CO3	2	3	3	2	2	1	1	1	3	2	2	2	2
CO4	1	2	2	2	1	2	2	2	2	2	3	1	2
CO5	2	3	3	2	2	1	1	1	3	3	3	2	2
AVG	1.8	2.6	2.2	1.8	1.8	1.2	1.4	1.4	2.2	2.2	2.4	1.6	1.6

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

Honor Course

Renewable Energy

RENEWABLE ENERGY SYSTEMS			
Course Code:	25UEEH01	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:0:0:1	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

- To develop understanding of various renewable energy resources and their availability.
- To study the principles, operation, and applications of renewable energy conversion systems.
- To analyze renewable energy systems and select suitable technologies based on technical and economic considerations.

Unit 1	**INTRODUCTION TO RENEWABLE ENERGY SYSTEMS**	**9 Periods**

Energy scenario – Environmental impacts of conventional energy sources – Need for renewable energy – Classification of renewable and non-renewable energy sources – Renewable energy potential in India – Role of renewable energy in sustainable development.

Teaching Learning Process	**Pedagogy: Chalk-and-talk, schematic analysis, discussion-based learning**
	RBT Level:K1 (Remember), K2 (Understand)

Unit 2	**SOLAR ENERGY SYSTEMS**	**9 Periods**

Solar radiation fundamentals – Measurement of solar radiation – Solar thermal systems: flat plate and concentrating collectors – Solar photovoltaic principle – PV cell characteristics – PV modules and arrays – Applications of solar energy systems.

Teaching Learning Process	**Pedagogy:** Interactive lecture, numerical problem solving, simulation-based learning
	RBT Level: K2 (Understand), K3 (Apply),K4(Analyze)

Unit 3	**WIND ENERGY SYSTEMS**	**9 Periods**

Wind characteristics and resource assessment – Aerodynamics of wind turbines – Types of wind turbines – Wind turbine generators – Power control methods – Applications and grid integration of wind energy systems.

Teaching Learning Process	**Pedagogy: Chalk-and-talk, problem-based learning, case study discussion**
	RBT Level: K2 (Understand), K3 (Apply), K4 (Analyze)

Unit 4	**BIOENERGY AND SMALL HYDRO SYSTEMS**	**9 Periods**

Biomass resources and classification – Biogas generation and plant design – Biofuels and waste-to-energy systems – Small, mini, and micro hydropower plants – Environmental and economic aspects of bioenergy and hydropower systems.

Teaching Learning Process	**Pedagogy: Analytical discussion, schematic explanation, demonstration using models and charts**
	RBT Level: K2 (Understand), K3 (Apply)

Unit 5	**EMERGING RENEWABLE ENERGY TECHNOLOGIES**	**9 Periods**

Geothermal energy systems – Ocean energy: tidal, wave, and OTEC – Hybrid renewable energy systems – Basics of grid integration – Overview of energy storage and smart grid concepts.

Teaching Learning Process	**Pedagogy: Discussion-based learning, student seminars, chalk-and-talk, interactive lecture**
	RBT Level: K1 (Remember),K2 (Understand)

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Understand various renewable energy resources and their role in sustainable development.

CO2: Analyse the performance of solar energy conversion systems.

CO3: Examine wind energy systems and their operational characteristics.

CO4: Evaluate bioenergy and small hydropower systems.

CO5: Understand emerging renewable energy technologies and grid integration issues.

Textbooks:

T1: Godfrey Boyle, "Renewable Energy: Power for a Sustainable Future", Oxford University Press.

T2: Gilbert M. Masters, "Renewable and Efficient Electric Power Systems", Wiley Publications

References:

R1: Twidell J. and Weir T., "Renewable Energy Resources", Taylor & Francis.

R2: B. H. Khan, "Non-Conventional Energy Resources", McGraw-Hill Education.

R3: S. Kalogirou, "Solar Energy Engineering: Processes and Systems", Academic Press.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/108103002
2. https://nptel.ac.in/courses/108105050
3. https://nptel.ac.in/courses/108104011

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	–	–	–	–	–	–	–	1	–	2
CO2	3	3	2	2	1	–	–	–	–	–	1	–	3
CO3	3	3	2	2	1	1	–	–	–	–	1	–	3
CO4	3	2	2	2	1	1	–	–	–	–	1	–	2
CO5	2	2	2	1	2	1	1	–	–	1	2	2	3
AVG	**2.8**	**2.4**	**1.8**	**1.4**	**1.0**	**0.6**	**0.2**	–	–	**0.2**	**1.2**	**0.4**	**2.6**

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

ENERGY STORAGE SYSTEMS

Course Code:	25UEEH02	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	3:0:0:1	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

- To develop the ability to understand / analyze the various types of energy storage.
- To study the various applications of energy storage systems.
- To analyze various types of energy storage devices and perform the selection based on techno-economic view point.

Unit 1	**FUNDAMENTALS OF ENERGY STORAGE**	**9 Periods**

Necessity of energy storage – types of energy storage – comparison of energy storage technologies – Applications.

Teaching Learning Process	**Pedagogy: Chalk-and-talk, schematic analysis**
	RBT Level:K3

Unit 2	**ELECTRICAL ENERGY STORAGE**	**9 Periods**

Fundamental concept of batteries – measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide and modern batteries for example zinc-Air, Nickel Hydride, Lithium Battery

Teaching Learning Process	**Pedagogy: Interactive Lecture, Simulation-Based Learning**
	RBT Level: K4

Unit 3	**FUEL CELL**	**9 Periods**

Fuel Cell – History of Fuel cell, Principles of Electrochemical storage – Types – Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis – advantage and drawback of each type

Teaching Learning Process	**Pedagogy: Problem-Based Learning, chalk and talk**
	RBT Level:K4

Unit 4	**THERMAL STORAGE SYSTEM**	**9 Periods**

Thermal storage – Types – Modelling of thermal storage units – Simple water and rock bed storage system – pressurized water storage system – Modelling of phase change storage system – Simple units, packed bed storage units - Modelling using porous medium approach.

Teaching Learning Process	**Pedagogy: Analytical problem solving, and demonstration using models/charts**
	RBT Level:K3

Unit 5	**ALTERNATE ENERGY STORAGE TECHNOLOGIES**	**9 Periods**

Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications.

Teaching Learning Process	**Pedagogy: Discussion-based learning, student seminars, Chalk and talk, Interactive Lecture**
	RBT Level: K2

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Understand the different energy storage technology

CO2: Analyze the technical aspects of battery storage system

CO3: Examine the performance of fuel cell storage system.

CO4: Evaluate the performance of different thermal storage system

CO5: Criticize the different alternate energy storage technology

Textbooks:

T1: Ibrahim Dincer and Mark A. Rosen, "Thermal Energy Storage Systems and Applications", John Wiley & Sons 2002.

T2: James Larminie and Andrew Dicks,"Fuel cell systems Explained", Wiley publications, 2003.

References:

R1: Lunardini.V.J, Heat Transfer in Cold Climates, John Wiley and Sons 1981.

R2: Ru-shiliu, Leizhang and Xueliang sun, "Electrochemical technologies for energy storage and conversion", Wiley publications, 2012.

R3: Schmidt.F.W and Willmott.A.J, Thermal Storage and Regeneration, Hemisphere Publishing Corporation, 1981.

Web links and Video Lectures (e-Resources):

1. nptel.ac.in/courses/112105221/56
2. nptel.ac.in/courses/108108036/9
3. https://nptel.ac.in/courses/108102047/7
4. https://nptel.ac.in/courses/108105058/37

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	–	–	–	–	–	–	–	1	–	2
CO2	3	3	2	2	1	–	–	–	–	–	1	–	3
CO3	3	3	2	2	1	1	–	–	–	–	1	–	3
CO4	3	2	2	2	1	1	–	–	–	–	1	–	2
CO5	2	2	2	1	2	1	1	–	–	1	2	2	3
AVG	**2.8**	**2.4**	**1.8**	**1.4**	**1.0**	**0.6**	**0.2**	–	–	**0.2**	**1.2**	**0.4**	**2.6**

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

Minor Course

Electric Vehicle Technology

INTRODUCTION TO ELECTRIC VEHICLE			
Course Code:	25UEEM01	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	4:0:0:1	**Credits:**	4
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

- Provide fundamental knowledge of electric vehicle technology and its advantages over conventional vehicles.
- Explain the working principles of EV components including batteries, motors, and power electronics.
- Introduce charging methods, infrastructure, and safety practices.
- Discuss current applications and future trends in electric vehicle technology.
- Prepare students for further study or careers in EV design, manufacturing, or maintenance.

Unit 1	**BASICS OF ELECTRIC VEHICLES**	**9Periods**

Introduction to electric vehicles, their need, advantages and comparison with conventional vehicles. different types of EVs and their basic components.

Teaching Learning Process	**Pedagogy: Chalk and talk, Interactive Lecture**
	RBT Level: K2

Unit 2	**BATTERIES AND ENERGY STORAGE**	**9 Periods**

Basic concepts of batteries used in electric vehicles and their working principles. Introduction to battery charging, discharging and safety aspects

Teaching Learning Process	**Pedagogy: Chalk and talk, Interactive Lecture**
	RBT Level: K2

UNIT 3	**CHARGING SYSTEMS AND POWER ELECTRONICS**	**9 Periods**

EV charging methods and simple power electronic converters used in EVs. Introduction to charging infrastructure and fast charging basics.

Teaching Learning Process	**Pedagogy: Chalk and talk, Interactive Lecture**
	RBT Level: K2

Unit 4	**ELECTRIC MOTORS AND DRIVES**	**9 Periods**

Electric motors (Brushless DC Motor and Induction Motor) used in EVs and their operating principles. Basic motor control and regenerative braking concepts.

Teaching Learning Process	**Pedagogy: Chalk and talk, Interactive Lecture**
	RBT Level: K2

Unit 5	**EV Applications and Future Trends**	**9 Periods**

Applications of electric vehicles and their environmental benefits. Introduction to future developments and challenges in EV technology.

Teaching Learning Process	**Pedagogy: Chalk and talk, Interactive Lecture**
	RBT Level: K2

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: To explain the key advantages of EVs over conventional vehicles and identify major EV components.

CO2: To describe different EV battery types, charging/discharging behavior, and key safety considerations.

CO3: To explain the working principles of EV motors and the concept of regenerative braking for energy efficiency.

CO4: To describe EV charging systems and the role of power electronics in efficient energy transfer and conversion.

CO5: To evaluate EV applications, environmental benefits, and anticipate future trends in EV technology.

Textbooks:

T1: Bent Sørensen, Renewable Energy: Physics, Engineering, Environmental Impacts, 4th Edition, Academic Press, 2011

T2: Ramesh Bansal (Ed.), Handbook of Distributed Generation: Electric Power Technologies, Economics and Environmental Impacts, Springer, 2017

T3: Ali Keyhani, Design of Smart Power Grid Renewable Energy Systems, Wiley–IEEE Press, 2017

References:

R1: Frede Blaabjerg, Control of Power Electronic Converters and Systems, Academic Press, 2018

R2: S. Chowdhury and P. Crossley, Microgrids and Active Distribution Networks, IET, 2009

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=KOLBGKMo3zQ
2. https://www.youtube.com/watch?v=30pt8C-wbaM
3. https://www.youtube.com/watch?v=30pt8C-wbaM

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	2	1										
CO2	3	2	1										
CO3	3	2	1										
CO4	3	2	1									1	
CO5	3	2	1								1		
AVG	3	2	1										

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

ELECTRIC AND HYBRID VEHICLE SYSTEMS			
Course Code:	25UEEM02	**Course Type:**	Theory
Teaching Periods / Week (L: T:P:SL)	4:0:0:1	**Credits:**	4
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40+60
Teaching Department:	EEE		

Course Objectives:

- Introduce students to the fundamentals of electric and hybrid vehicles and their role in sustainable mobility.
- Cover major EV/HEV components including propulsion, energy storage, power electronics, and control systems.
- Provide knowledge on energy management strategies and system integration challenges.
- Explain current trends such as vehicle-to-grid systems and autonomous EV technologies.
- Prepare students for careers in EV/HEV design, analysis, and implementation.

Unit 1	**INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES**	**9Periods**

Introduction to electric and hybrid vehicles, classification of HEVs, PHEVs and BEVs and comparison with conventional vehicles. Basic architecture of electric and hybrid powertrains. Role of EVs and HEVs in sustainable transportation.

Teaching Learning Process	**Pedagogy: Chalk and talk, Interactive Lecture**
	RBT Level: K2

Unit 2	**POWER ELECTRONICS AND CONTROL**	**9Periods**

Power electronic converters including DC–DC converters and inverters for EV and HEV systems. Control of electric drives and power flow. Introduction to on-board and off-board charging systems

Teaching Learning Process	**Pedagogy: Chalk and talk, Interactive Lecture**
	RBT Level: K2

UNIT 3	**ENERGY STORAGE AND ENERGY MANAGEMENT**	**9Periods**

Battery technologies, ultracapacitors and fuel cells used in EVs and HEVs. Charging–discharging characteristics and performance parameters. Energy management strategies in hybrid vehicles

Teaching Learning Process	**Pedagogy: Chalk and talk, Interactive Lecture**
	RBT Level: K2

Unit 4	**ELECTRIC PROPULSION SYSTEMS**	**9 Periods**

Electric motors used in EV and HEV applications such as DC, BLDC, PMSM and induction motors. Motor operating characteristics and selection criteria. Basics of traction drives and regenerative braking.

Teaching Learning Process	**Pedagogy: Chalk and talk, Interactive Lecture**
	RBT Level: K2

Unit 5	**SYSTEM INTEGRATION AND FUTURE TRENDS**	**9 Periods**

Integration of propulsion, energy storage and control systems in EVs and HEVs. Thermal management, safety standards and testing. Future trends such as autonomous vehicles and vehicle-to-grid systems.

Teaching Learning Process	**Pedagogy: Chalk and talk, Interactive Lecture**
	RBT Level:K2

Total	**45 Periods**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: To Compare and classify different types of electric and hybrid vehicles.

CO2: Explain electric propulsion technologies and their applications.

CO3: To Describe energy storage systems and energy management strategies.

CO4: Apply power electronics and control principles in EV/HEV systems.

CO5: Analyze system integration issues and future trends in electric mobility.

Textbooks:

T1: Mehrdad Ehsani, Yimin Gao, and Stefano Longo, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, 2nd Edition, CRC Press, 2010

T2: Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003

T3: Chris Mi, M. Abul Masrur, and David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications, Wiley, 2011

References:

R1: James Larminie and John Lowry, Electric Vehicle Technology Explained, 2nd Edition, Wiley, 2012

R2: Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=iQ2tRtepVtE
2. https://www.youtube.com/watch?v=9HZlLtw_9Oc
3. https://www.youtube.com/watch?v=Q3qt4N2NVZ0
4. https://www.youtube.com/watch?v=QjguVYV-EAQ
5. https://www.youtube.com/watch?v=S-p6vRhwDlU

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CO3	3	2	1										
CO4	3	2	1									1	
CO5	3	2	1								1		
AVG	3	2	1										

1 – Low, 2 – Medium, 3 – High, '-' – No correlation