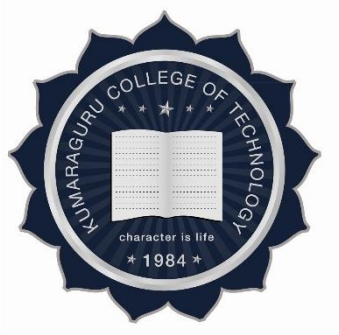
KUMARAGURU COLLEGE OF TECHNOLOGY,

An autonomous Institution affiliated to Anna University, Chennai

COIMBATORE – 641 049

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATION 2024



I to VIII Semesters

Department of
Electrical and Electronics Engineering

VISION

To be a Centre of Excellence in Globalizing Education and Research in the field of Electrical and Electronics Engineering

MISSION

The Mission of the department is to

- Empower the students with state-of-art knowledge to excel as eminent electrical engineers with multi-disciplinary skills.
- Emphasize social values and leadership qualities to meet the industrial needs, societal problems and global challenges.
- Enable the technocrats to accomplish impactful research and innovations

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Our graduates will be able to

PEO 1: Pursue a diverse range of careers in engineering, consultancy, and entrepreneurship.

PEO 2: Contribute to continuous professional development through higher studies and life-long learning.

PEO 3: Demonstrate their technical proficiency with ethical values and social responsibility.

PEO 4: Innovate and provide solutions for ever-changing global environments with familiarity in computational platforms in electrical engineering.

PROGRAM OUTCOMES (POs)

Our Graduates will be able to:

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, modelling, 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 modelling 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 and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

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)

KNOWLEDGE AND ATTITUDE PROFILE (WK)

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

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

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

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

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

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

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

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

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

.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Our Graduates will be able to:

PSO 1: Apply the knowledge of Electrical Electronics and computer Engineering concepts to design, develop and analyze renewable and sustainable Energy systems.

PSO 2: Implement application-oriented engineering systems with the concepts of Electronic circuits, Embedded and Control systems

KUMARAGURU COLLEGE OF TECHNOLOGY

B.E ELECTRICAL AND ELECTRONICS ENGINEERING
REGULATION AND CURRICULUM R2024
From 2024 Batch Onwards

Semester I

S.No	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24HST101	Heritage of Tamils	Theory	HS	1	0	0	0	1
2	24MAI113	Linear Algebra and Multivariant Calculus	Embedded	BS	3	0	2	0	4
3	24CYI101	Electronic Materials Chemistry	Embedded	BS	3	0	2	0	4
4	24MEI103	Computer Aided Engineering Graphics	Embedded	ES	2	0	2	0	3
5	24EEI101	Electric Circuits and Networks	Embedded	ES	3	0	2	0	4
6	24INP102	Innovation Practicum-1	Practical	ES	0	0	2	0	1
7	24ADP001	Basics of Artificial Intelligence	Practical	ES	0	0	2	0	1
8	24HSP111	Holistic Wellness – 1	Practical	HS	0	0	2	0	1
9	24INP101	Design Thinking	Practical	ES	0	0	2	0	1
10	24INO1--	FCLF General Stack - 1	Practical	OE	0	0	2	0	1
								Total Credits	**21**
								Total Contact Hours/week	**30**

Semester II

S.No	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24HST102	Tamils and Technology	Theory	HS	1	0	0	0	1
2	24HST103	Effective Communication	Theory	HS	2	0	0	0	2
	24HST104	Professional Communication	Theory	HS	2	0	0	0	
	24HSJ102	Fluency through Practice	Project	HS	0	0	0	4	
3	24MAI123	Computational Differential Equations	Embedded	BS	3	0	2	0	4
4	24PHI102	Applied Physics for Circuit Engineering	Embedded	BS	3	0	2	0	4
5	24CSI101	Logical Thinking and Problem Solving	Embedded	ES	3	0	2	0	4
6	24EET102	Electromagnetic Fields	Theory	ES	3	0	0	0	3
7	24ECI102	Electron Devices and Circuits	Embedded	PC	3	0	2	0	4
8	24INP103	Innovation Practicum - 2	Practical	ES	0	0	2	0	1
9	24HSP112	Holistic Wellness - 2	Practical	HS	0	0	2	0	1
10	24INO1--	FCLF General Stack - 2	Practical	OE	0	0	2	0	1
								Total Credits	**25**
								Total Contact Hours/week	**32**

SEMESTER III									
S. No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
1.	24HSP005	Mastering Conversations	Practical	HS	0	0	2	0	1
2.	24MAI233	Probability and Applied Statistics	Embedded	BS	3	0	2	0	4
3.	24EEI201	DC Machines and Transformers	Embedded	PC	2	0	2	0	3
4.	24EEI202	Instrumentation Systems	Embedded	PC	2	0	2	0	3
5.	24ECI203	Linear Integrated Circuits	Embedded	PC	3	0	2	0	4
6.	24EEI203	Digital System Design	Embedded	PC	3	0	2	0	4
7.	24INP201	Innovation Practicum - 3	Practical	ES	0	0	2	0	1
8.	24INO___	FCLF General Stack - 3	Practical	OE	0	0	2	0	1
9.	24INM201	Universal Human Values -II: Understanding Harmony	Theory	HS	1	0	0	0	1
10.	24EEJ204	Internship – I	Internship	PRJ	0	0	0	0	1
Total Credits									**23**
Total Contact Hours/week									**30**

SEMESTER IV									
S. No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
1.	24HSP006	Mastering Group Discussion and Presentation Skills	Practical	HS	0	0	2	0	1
2.	24EET205	Generation Transmission and Distribution	Theory	PC	3	0	0	0	3
3.	24EEI206	Induction and Synchronous Machines	Embedded	PC	3	0	2	0	4
4.	24EEI207	Embedded Systems	Embedded	PC	2	0	4	0	4
5.	24EII204	Signal Processing Techniques	Embedded	PC	3	0	2	0	4
6.	24INO___	FCLF Technical Stack - 1	Practical	OE	0	0	2	0	1
7.	24INO___	FCLF Emerging Stack - 1	Practical	OE	0	0	2	0	1
8.	24INP202	Innovation Practicum - 4	Practical	ES	0	0	2	0	1
9.	24INM202	Environmental Science and Sustainability	Embedded	BS	1	0	2	0	2
10.	24INM102	Indian Knowledge systems in science and Engineering	Theory	HS	1	0	0	0	1
Total Credits									**22**
Total Contact Hours/week									**31**

SEMESTER V									
S. No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
1.	24HSP007	Building Professional Readiness	Practical	HS	0	0	2	0	1
2.	24EEI301	Control Systems	Embedded	PC	3	0	2	0	4
3.	24EEI302	Power Electronics	Embedded	PC	3	0	2	0	4
4.	24EEI303	Power System Analysis and Protection	Embedded	PC	3	0	2	0	4
5.	24EEI304	Data Structures and Algorithms	Embedded	ES	2	0	2	0	3
6.	24EEE___	Professional Elective - I	Theory /Embedded	PE	3	0	0	0	3
7.	24INO__	FCLF Technical Stack – 2	Practical	OE	0	0	2	0	1
8.	24INO__	FCLF Emerging Stack - 2	Practical	OE	0	0	2	0	1
9.	24EEJ304	Internship -II	Project	PRJ	0	0	0	0	2
10.	24INM301	Constitution of India	Theory	MC	1	0	0	0	0
Total Credits									**23**
Total Contact Hours/week									**28**

SEMESTER VI									
S. No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
1.	24EEI305	Solid State Drives and Controls	Embedded	PC	3	0	2	0	4
2.	24EEI306	Electric Vehicle Technology	Embedded	PC	3	0	2	0	4
3.	24EEI307	VLSI Design	Embedded	PC	2	0	2	0	3
4.	24EEI308	AI for Energy Management systems	Embedded	PC	2	0	0	2	3
5.	24EEE___	Professional Elective –II	Theory	PE	3	0	0	0	3
6.	24EEE___	Professional Elective –III	Theory	PE	3	0	0	0	3
7.		Indian/Foreign Languages	Practical	HS	0	0	4	0	2
8.		FCLF Technical Stack – 3	Practical	OE	0	0	2	0	1
9.		FCLF Emerging Stack - 3	Practical	OE	0	0	2	0	1
Total Credits									**24**
Total Contact Hours/week									**32**

SEMESTER VII									
S. No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
1		Project Management and Finance	Theory	HS	3	0	0	0	3
2	24EEE___	Professional Elective- IV	Theory/Embedded	PE	3	0	0	0	3
3	24EEE___	Professional Elective - V	Theory/Embedded	PE	3	0	0	0	3
4	24EEE___	Professional Elective - VI	Theory/Embedded	PE	3	0	0	0	3
5	24EEJ401	Project Phase I	Project	PW	0	0	0	6	3
6	24XXXX	Disaster Management	Theory	MC	1	0	0	0	0
								Total Credits	**15**
								Total Contact Hours/week	**21**

SEMESTER VIII										
S. No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	**Pre-requisite**
1	24EEJ402	Project Phase II	Project	PW	0	0	0	24	12	-
								Total Credits	**12**	
								Total Contact Hours/week	**24**	
								Total Credits	**165**	

Elective Tracks

- Sustainable Energy & Smart Grids
- Electric Mobility & Smart Transportation
- Embedded systems and Computational Techniques
- Intelligent Automation and Control

Sustainable Energy & Smart Grids

S. No		Course Title	Course Mode	CT	L	T	P	J	C
1	24EEE001	Energy Storage systems	Theory	PE	3	0	0	0	3
2	24EEC002	Power Electronics for solar and wind Energy conversion system	Embedded	PE	2	0	2	0	3
3	24EEE003	Electrical safety and Energy auditing	Theory	PE	3	0	0	0	3
4	24EEE004	Distributed Energy Resources and Micro Grid	Theory	PE	3	0	0	0	3
5	24EEE005	Smart Grid Technologies and Architecture	Theory	PE	3	0	0	0	3
6	24EEE006	Energy Conservation and Green Building	Theory	PE	3	0	0	0	3
7	24EEE007	Power Quality and custom power Devices	Theory	PE	3	0	0	0	3
8	24EEE008	Digital protection of Power system	Theory	PE	3	0	0	0	3
9	24EEE009	High voltage Engineering	Theory	PE	3	0	0	0	3

Electric Mobility & Smart Transportation

S. No	Course Code	Course Title	Course Mode	CT	L	T	P	J	C
1	24EEE016	Automotive Electronics	Theory	PE	3	0	0	0	3
2	24EEC017	Advanced power Converters	Embedded	PE	2	0	2	0	3
3	24EEE018	Electric Drives and Motor Control for Electric Vehicles	Theory	PE	3	0	0	0	3
4	24EEC019	Battery Technologies and Management systems	Embedded	PE	2	0	2	0	3
5	24EEE020	EV Charging Infrastructure and Grid Integration	Theory	PE	3	0	0	0	3
6	24EEC021	Autonomous and Connected Vehicles	Embedded	PE	2	0	2	0	3
7	24EEE022	Intelligent and sustainable Transportation System	Theory	PE	3	0	0	0	3
8	24EEE023	CAD for Electrical Machines	Embedded	PE	2	0	2	0	3

Embedded systems and Computational Techniques

S. No	Course Code	Course Title	Course Mode	CT	L	T	P	J	C
1.	24EEC031	Real-Time Operating System	Embedded	PE	2	0	2	0	3
2.	24EEE032	Internet of Things	Theory	PE	3	0	0	0	3
3.	24EEE033	Data Communication and Networks	Theory	PE	3	0	0	0	3

4.	24EEC034	Machine Learning and Deep Learning	Embedded	PE	2	0	2	0	3
5.	24EEC035	Embedded AI and Edge AI Systems	Embedded	PE	2	0	2	0	3
6.	24EEE036	Low power VLSI	Theory	PE	3	0	0	0	0
7.	24EEC037	Linux Programming Essentials	Embedded	PE	2	0	2	0	3
8.	24EEC038	Computer Vision	Embedded	PE	2	0	2	0	3
9.	24EEC039	Object Oriented Programming	Embedded	PE	2	0	2	0	3
10.	24EEC040	Data Analytics and Visualization	Embedded	PE	2	0	2	0	3
11.	24EEE040	Quantum Computing	Theory	PE	2	0	2	0	3

Intelligent Automation and Control

S.No	Course Title	Course Mode	Course Mode	CT	L	T	P	J	C
1	24EEE046	Biomedical Instrumentation	Theory	PE	3	0	0	0	3
2	24EEE047	Advanced Control Systems	Theory	PE	3	0	0	0	3
3	24EEC048	PLC Automation and SCADA	Embedded	PE	2	0	2	0	3
4	24EEE049	Digital Twin for Industrial systems	Theory	PE	3	0	0	0	3
5	24EEE050	Robotics and Automation	Theory	PE	3	0	0	0	3
6	24EEE051	Industry 4.0	Theory	PE	3	0	0	0	3
7	24EEE052	Smart sensors and intelligent Instrumentation	Theory	PE	3	0	0	0	3
8	24EEE053	Cyber-Physical Systems	Theory	PE	3	0	0	0	3
9	24EEE054	Machine monitoring and predictive maintenance	Theory	PE	3	0	0	0	3

24HST101	தமிழர் மரபு / HERITAGE OF TAMILS (Common to all Departments)	L	T	P	J	C
		1	0	0	0	1
HS		SDG	4, 11, 16			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	தமிழ் மொழி மற்றும் இலக்கியத்தின் அடிப்படை அம்சங்களை அறிமுகப்படுத்துதல், அதன் தொன்மைக்காலம் முதல் நவீனகாலம் வரையிலான வளர்ச்சியை விளக்கம் செய்யுதல். Introduce students to the foundational aspects of Tamil language and literature, tracing its evolution from ancient to modern times.
2	தமிழகத்தின் செழுமையான கலாச்சார பாரம்பரியத்தை அறிமுகப்படுத்துதல், பாறை ஓவியக் கலையிலிருந்து நவீன சிற்ப கலையின்படி அதன் கலை வெளிப்பாடுகளை ஆராய்தல். Familiarize students with the rich cultural heritage of Tamil Nadu, exploring its artistic expressions from rock art paintings to contemporary sculptures.
3	தமிழகத்தின் நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகளை அறிதல்- தினணக்கோட்பாடுகளை ஆராய்தல்- இந்திய தேசிய இயக்கத்தில் தமிழர்களின் பங்கினை அறிதல். To know the folk arts and heroic ames of Tamilnadu-explore the concept of thinai -to know the role of Tamils in Indian National movement.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	தமிழ் மொழி மற்றும் இலக்கியத்தின் அடிப்படை அறிவை மேம்படுத்துதல். மொழி பண்பாட்டில் எவ்வாறு இணைந்துள்ளது என்பதை உணர்தல். Enhance the fundamental knowledge of Tamil language and literature	U
CO2	பழங்கால பாறை ஓவியங்கள், சிற்பம் என கலைகள் நவீன காலம்வரை எவ்வாறு பயணிக்கிறது என்பதை புரிந்துகொள்ளுதல். Understand the heritage, rock art paintings to modern art sculpture	U
CO3	நாட்டுப்புறக் கலைகள் தற்காப்புக் கலைகளாகவும், உடல் ஆரோக்கியத்தை மேம்படுத்தும் விதமாகவும் அமைவதை அறிந்து கலைகள் மீதான ஆர்வத்தை அதிகரிக்கச் செய்தல்- தமிழர்களின் அகத்திணை, புறத்திணை கோட்பாட்டினை புரிந்து கொள்ளுதல். இந்திய பண்பாட்டில் தமிழர்களின் பங்களிப்பை அறிதல். Acquire essential knowledge in the folk and martial arts-understanding the Agam and puram concept- to know the contribution of Tamils in Indian culture.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1							3	2	2		2			

2							3	3	2		2			
3							3	2	2		2			

Course Content	
மொழி மற்றும் இலக்கியம் இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தொடக்கம் -பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு. **LANGUAGE AND LITERATURE** Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.	**3 Hours**
மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புற தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு. **HERITAGE – ROCK ART PAINTINGS TO MODERN ART SCULPTURES** Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.	**3 Hours**
நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள். **FOLK AND MARTIAL ARTS** Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Ciabatta, Valari, Tiger dance - Sports and Games of Tami	**3 Hours**
தமிழர்களின் திணைக்கோட்பாடுகள் தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பொடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் தமிழர்களின் வெற்றி. **THINAI CONCEPTS OF TAMIL** Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.	**3 Hours**
இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு. **CONTRIBUTIONS OF TAMIL TO INDIAN NATIONAL MOMENT AND INDIAN CULTURE** Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.	**3 Hours**

Theory Hours: 15	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 15

Learning Resources

Reference books:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Textbook and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

Online Educational Resources:

1. https://www.youtube.com/watch?v=IKPwEmsmuZc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e
2. https://www.youtube.com/watch?v=j6_ddjn_gLc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e&index=2
3. https://docs.google.com/presentation/d/1pf0jbyuDTNdvlcKMnOfoPjbqha7JqdOc/edit#slide=id.p1
4. https://www.youtube.com/watch?v=IKPwEmsmuZc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e&index=1

Assessment (Theory course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Assignments, Quiz, Library Record

Course Curated by

Expert from Industry	Expert(s) from Higher Education Institutions	Internal Expert

Mr.Vijayan Ramanathan , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore		Suriya Prakash Department of Language
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24MAI113	LINEAR ALGEBRA AND MULTIVARIATE CALCULUS (Common to EC, EE, EI)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	7, 9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	provide a solid foundation in linear algebra, focusing on eigenvalues, eigenvectors, matrix transformations, and quadratic forms for practical applications.
2	develop skills in multivariate calculus for solving optimization problems and computing derivatives, integrals, and volumes using double and triple integrals.
3	teach key concepts in vector calculus, including operations like gradient, divergence, curl, and the application of Green's, Gauss's, and Stokes' theorems.
4	introduce fundamental principles of complex analysis, covering analytic functions, Cauchy's theorems, and residue calculus for evaluating integrals through contour integration.
5	equip students with MATLAB proficiency to perform matrix operations, solve optimization problems, compute integrals and verify complex mathematical theorems.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	apply the concepts of eigenvalues, eigenvectors, and the Cayley-Hamilton theorem to diagonalize matrices and perform orthogonal transformations of symmetric matrices using matrix operations and eigenvalue computations.	Ap
CO2	apply orthogonal transformations to reduce quadratic forms to their canonical forms and solve related matrix problems, leveraging to compute transformations and quadratic forms.	Ap
CO3	analyze and solve unconstrained and constrained optimization problems using the Lagrange multiplier method and determine the maxima and minima of functions with two or more variables relevant to engineering applications.	An
CO4	apply double and triple integrals in Cartesian coordinates by computing and using them to determine areas and volumes in engineering applications, including changing the order of integration.	Ap
CO5	apply vector calculus operations like gradient, divergence, curl, and directional derivatives to verify Green's theorem, Gauss's divergence theorem, and Stokes' theorem used for computational verification.	Ap
CO6	apply Cauchy-Riemann equations, Cauchy's integral theorem, and Cauchy's integral formula to solve complex analysis problems and evaluate integrals using the residue theorem for performing contour integration.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2			2									
2		3	2		2									

3	2				2		1							
4	3			2	2									
5		2			2			2						
6					2									

Course Content:

MATRICES Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley Hamilton theorem (excluding proof) - Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation. **Practical Component** Introduction to MATLAB - Matrix Operations - Addition, Multiplication, Transpose, Inverse and eigenvalues and eigenvectors of higher order matrices. Characteristic equation of a Matrix and Cayley-Hamilton Theorem.	**9 Hours** **6 Hours**
FUNCTIONS OF SEVERAL VARIABLES Total derivative – Taylor's series expansion – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraints – Jacobians. **Practical Component** Determining Maxima and Minima of a function of one variable. Determining Maxima and Minima of a function of two variables	**9 Hours** **6 Hours**
MULTIPLE INTEGRALS Double integration in Cartesian coordinates – Change of order of integration - Triple integration in Cartesian coordinates – Applications: Area as double integral and Volume as triple integral. **Practical Component** Double Integral and Area as double integral Triple Integral and Volume as triple integral	**9 Hours** **6 Hours**
VECTOR CALCULUS Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Verification of theorem and simple applications. **Practical Component** Evaluating gradient, divergence and curl. Verifying Green's theorem in the plane	**9 Hours** **6 Hours**
ANALYTIC FUNCTIONS Functions of a complex variable – Analytic functions – Necessary and sufficient conditions in Cartesian coordinates, Cauchy- Riemann equations (excluding proofs). **Practical Component** Check analyticity using Cauchy-Riemann equations	**4 Hours** **3 Hours**
COMPLEX INTEGRATION Cauchy's integral theorem – Cauchy's integral formula –Singularities –Residues – Residue theorem –Application of residue theorem for evaluation of real integrals – Contour Integration (excluding poles on the real axis). **Practical Component** Perform contour integration around a circular contour	**5 Hours** **3 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 30	Total Hours: 75

Learning Resources

Textbooks

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45thEdition, 2020.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2018.
3. Kreyszig E., "Advanced Engineering Mathematics" International students' version, 10th Edition, John Wiley and sons, 2023.

Reference books

1. Veerarajan T., "Engineering Mathematics (for First Year)", Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2008.
2. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics", S. Chand & Co., New Delhi, (Reprint) 2014.
3. Venkataraman M.K., "Engineering Mathematics", The National Publising Co., Chennai, 2003.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.

Online Resources (Web Links)

1. Linear Algebra by MIT Open Courseware (Free) https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/
2. Multivariable Calculus by MIT Open Courseware (Free) https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/
3. Khan Academy: Multivariable Calculus (Free) https://www.khanacademy.org/math/multivariable-calculus
4. Coursera: Introduction to MATLAB Programming by Vanderbilt University https://www.coursera.org/learn/matlab

Assessment (Embedded course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore. Mr.Jayakumar Venkatesan, Valles Marineris International Private Limited- Chennai. Mr. Imran Khan, GE Transportation Company, Bangalore.	Dr.T.Govindan, Government College of Engineering, Srirangam, Trichy. Dr.C.Porkodi, PSG College of Technology, Coimbatore. Dr.P.Paramanathan, Amrita Vishwa Vidyapeetham, Coimbatore.	Dr. K.Maheswari Dr. J.Rajasingh Dr. K.Meena, Department of Mathematics

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24CYI101	ELECTRONIC MATERIALS CHEMISTRY (Common to EC, EE, EI and MR)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	7, 9, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	acquire knowledge of advanced electrochemical energy systems, organic materials, insulating, and high-resistivity materials in electronics to understand their role in modern electronic applications.
2	develop skills to synthesize, analyze, and characterize various electronic materials such as conducting polymers, nanomaterials, and green electronic materials through theoretical and practical approaches.
3	gain competency in evaluating the environmental impact of electronic materials and promote sustainable practices, including green chemistry principles, recycling, and e-waste management.
4	apply advanced concepts of electronic materials to solve real-world engineering problems in the field of energy storage, flexible electronics, and nanoelectronics.
5	enhance analytical and problem-solving abilities through hands-on laboratory experiments, bridging theoretical concepts with practical applications in the electronic materials domain.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	apply electrochemical principles to solve challenges in advanced battery and hybrid energy systems.	Ap
CO2	analyse the properties and synthesis of conducting polymers to compare their applications in flexible electronics and OLEDs.	An
CO3	analyse the applications in electronic components by integrating the properties of insulating and high-resistivity materials.	An
CO4	apply the concepts of nanomaterials to demonstrate their significance in nanoelectronics and electronic sensing technologies.	Ap
CO5	analyse the environmental impact of electronic materials to prioritize the adoption of green chemistry and sustainable electronic practices.	An
CO6	evaluate and recommend innovative eco-friendly electronic materials and recycling strategies to address future environmental challenges.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2												
2	2		2								2			
3	2	2		2										

4			2		2								
5						3	2						
6		1	1				1				1		

Course Content

ADVANCED ELECTROCHEMICAL ENERGY SYSTEMS Introduction to electrochemistry for energy systems - Advanced battery technologies (Li-ion batteries, Sodium-ion batteries, Al – air Battery, Zn - air batteries) - Comparison of battery technologies and its challenges. Hybrid energy storage systems: Super-capacitors: Electric double-layer capacitors (EDLCs) - Pseudo capacitors - Hybrid supercapacitors Fuel cells: Principles and recent advancements of Proton exchange membrane fuel cells (PEMFCs) - Solid oxide fuel cells (SOFCs) - Microbial fuel cells - Regenerative fuel cells. **Practical Component:** • Compare the Conductivity of different electrolytes in battery systems. • Determination of electrical conductivity in electroplated metal coating on substrate. • Determination of electrode potentials of the cell and construct feasible cell. • Estimation of mixture of acids using strong base by Conductometric titrations.	**9 Hours** **12 Hours**
ORGANIC MATERIALS FOR ELECTRONIC APPLICATIONS Introduction to polymers - Classification - Functionality - Degree of Polymerization. Polymerization: Addition polymerization and its Mechanism (Free Radical, Cationic, and Anionic) - Condensation polymerization – Copolymerization Conducting materials: Small molecule conductors (Pentacenes and their derivatives) - Engineered Pentacenes and Reversible functionalization - Synthesis and doping of conducting polymers (Polyacetylene and Polythiophene) - Applications of conducting materials in devices (Organic light-emitting diodes (OLEDs), Organic photovoltaics, Flexible and printed electronics) **Practical Component:** • Determination of molecular weight of polymer using Viscometric method.	**9 Hours** **3 Hours**
INSULATING AND HIGH-RESISTIVITY MATERIALS IN ELECTRONICS Insulating materials in electronics: Introduction (Importance and Key properties) - Classification (Solid, liquid, and gas insulators) - Properties (Dielectric properties and breakdown) - Preparation, properties, and uses of Solid inorganic (Mica and Porcelain) and organic insulators (Bakelite and Rubber) - Liquid insulators (Epoxy resin and Transformer oil) – Gas Insulator (Sulfur hexafluoride) High Electrical resistivity materials: Factors influencing electrical resistivity - High resistivity materials (Composition, properties, and applications of Manganin and Molybdenum disilicide) - Nanocomposite insulators **Practical Component:** • Determination of pH and Conductivity in different Transformer Oils	**9 Hours** **3 Hours**
NANOMATERIALS AND NANOELECTRONICS Introduction to nano chemistry - Distinction between molecules, nanoparticles, and bulk materials - Size-dependent properties of nanomaterials - Quantum confinement effects - Carbon nanotubes and graphene (Preparation by Chemical Vapor Deposition and Laser Ablation, Properties and Applications in electronics) - Nanowires (Preparation by Electrochemical Deposition and Electrospinning, Properties and Applications in electronics) – Nanoparticles, nanoclusters, and nanorods (Preparation by Sol-gel, Solvothermal, Properties and Applications in electronics) - Nanotubes and nanowires in sensing applications.	**9 Hours**

Practical Component: • Synthesis of Nanoparticle using Solvo-Thermal Method	**3 Hours**
GREEN CHEMISTRY AND SUSTAINABLE ELECTRONICS Introduction to sustainable electronics (Importance and Environmental challenges in the electronics industry) - Environmental impact (Conductors, semiconductors, and polymers), Toxicity and persistence of electronic materials - Green chemistry principles in electronics manufacturing (12 principles of green chemistry applied to electronics and Eco-friendly materials and processes) - Life cycle assessment of electronic products - Recycling and e-waste management strategies (Recovery, Challenges and innovations in electronics recycling) - Future trends in eco-friendly electronic materials. **Practical Component:** • Determination of Copper from electronic waste by Complexometric method. • Estimation of copper ion by spectrophotometry. • Estimation of strength of sulphuric acid in spent Battery Electrolytes by pH metry	**9 Hours** **9 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources

References:

1. Singh, G. (2019). Advanced battery technology for energy storage applications (1st ed.). New Age International Publishers.
2. Beguin, F., & Frackowiak, E. (2013). Supercapacitors: Materials, systems, and applications (1st ed.). Wiley-VCH.
3. Kumar, V., & Kumar, A. (2015). Conducting polymers: Synthesis, properties, and applications (1st ed.). Narosa Publishing House.
4. Chandrasekhar, S. (2014). Organic electronics: Concepts and applications (1st ed.). Springer.
5. Sharma, R. K. (2022). Electrochemistry for energy systems (1st ed.). Narosa Publishing House.
6. Hironis, N. P., & Pal, M. (2004). Electrical insulating materials (1st ed.). S. Chand & Company Ltd.
7. Kulkarni, S. K. (2014). Nanotechnology: Principles and practices (3rd ed.). Capital Publishing Company.
8. Ahluwalia, V. K. (2009). Green chemistry: Environmentally benign reactions (1st ed.). Ane Books Pvt. Ltd.
9. Shina, S. G. (2008). Green electronics design and manufacturing (1st ed.). McGraw-Hill.

Online Resources (Weblinks)

1. https://www.coursera.org/learn/lithium-based-batteries
2. https://www.youtube.com/watch?v=Gbltx4IXLzQ&list=PLbMVogVj5nJT0slH3tuas5BIp1DG8ZpMj&index=2
3. https://www.coursera.org/learn/applied-sustainability-engineering
4. https://www.youtube.com/watch?v=nSAvyQajVzE

Assessment (Embedded course)

CAT, Activity and Learning Task(s) (Concept Map, Think-Pair-Share, Jigsaw), MCQ, End Semester Examination (ESE), Lab Workbook, Model Exam, Viva-Voce.

Course Curated by

Expert from Industry	Expert from Higher Education Institution	Internal Expert(s)
Dr. Muthuraja Perumal	Dr. Venkatakrishnan Professor,	Dr K Rathidevi, Dr. K Sampath,

General Manager - Research & Development Rohith Industries, APIIC Industrial Park, Andhra Pradesh	School of Chemical Sciences Indian Institute of Technology (Mandi) Himachal Pradesh India		Dr S Jyothi, Dr R Ashokkumar, Department of Chemistry
Recommended by BoS on	16.08.2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24MEI103	COMPUTER AIDED – ENGINEERING GRAPHICS (Common to EE, EC, EI, BT)	L	T	P	J	C
		2	0	2	0	3
ES		SDG	9, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	understand the fundamental principles of engineering graphics and their significance.
2	develop proficiency in freehand sketching, usage of drawing instruments, and lettering.
3	gain competency in using computer graphics technologies for graphical communication, including isometric views and various coordinate systems (absolute, relative, polar)

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	apply the principles of engineering graphics to create accurate orthographic and isometric projections	Ap
CO2	design free-hand sketches of orthographic views from pictorial representations to improve spatial understanding and communication of engineering concepts	C
CO3	apply CAD software tools to create, edit, and annotate technical drawings and analyse them using ISO and ANSI standards	Ap
CO4	analyse the parametric and non-parametric CAD models, producing detailed two-dimensional documentation, including sectional views and annotations.	An
CO5	apply geometric and topological concepts to design 3D models for additive manufacturing.	Ap
CO6	apply the principles of engineering graphics to create accurate orthographic and isometric projections	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	2	2		2							2			
2		1	2								1			
3	2	3	2	2							2			
4		1	1						2		1			
5				2	2			1			1			
6				2	2			1			1			

Course Content

Introduction to Engineering Drawing Principles of Engineering Graphics and their significance, Freehand sketching, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute.	**6 Hours** **6 Hours**
Orthographic and Isometric Projections	**6 Hours**

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.	**6 Hours**
Overview of Computer Graphics Listing the computer technologies that impact on graphical communication, Isometric Views of lines, Planes, Simple and compound Solids, Coordinates system - Absolute Coordinates, Relative Coordinates, Polar Coordinates.	**6 Hours** **6 Hours**
Customization & CAD Drawing Setting up modules and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Isometric Projections and Solids.	**6 Hours** **6 Hours**
Annotations, layering & other functions Layers to create drawings, create, edit and use customized layers; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and projecting the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Part editing and two-dimensional documentation of models, Shape extractions (Freeform modelling). Planar projection theory includes sketching of perspective, isometric, Multiview, auxiliary, and section views. Spatial visualization exercises – Transformation, Rendering and Lighting. Geometry and topology of engineered components: Introduction to Additive manufacturing (AM); Exporting the 3D model.	**4 Hours** **8 Hours**

Theory	Tutorial	Practical	Project	Total
Hours: 30	**Hours: 0**	**Hours: 30**	**Hours: 0**	**Hours: 60**

Learning Resources

Textbooks

1. Dhawan, R. K. *A Textbook of Engineering Drawing*. S. Chand Publishing (2019).
2. Bhatt N.D., Panchal V.M. & Ingle P.R., Engineering Drawing, Charotar Publishing House (2014).
3. Shah, M.B. & Rana B.C. Engineering Drawing and Computer Graphics, Pearson Education (2008).

Reference books

1. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
2. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publishers.

Online Resources (Weblinks)

1. https://www.youtube.com/watch?v=8UKg928M4C0
2. https://www.youtube.com/watch?v=JvsJf1huMXQ
3. https://www.youtube.com/watch?v=8lHEizPf-wY

Assessment (Embedded course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. G. Vergin Vino Design Engineer TANCAM, Chennai	Dr. V. Prabhuraja Professor, Department of Mechanical Engineering PSG College of Technology, Coimbatore	Dr. Samuel Ratna Kumaar Assistant Professor – III Department of Mechanical Engineering

Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24EEI101	ELECTRIC CIRCUITS AND NETWORKS	L	T	P	J	C
		3	0	2	0	4
ES		SDG	7, 9, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	equip students with essential knowledge of electric circuits and networks, focusing on their principles, analysis techniques, and design methodologies.
2	establish a robust foundation in circuit analysis that is essential for learning advanced Electrical and Electronics courses.
3	provide students with the necessary skills to design and implement electrical networks and enhance their problem-solving and design skills.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	analyse and interpret the behaviour of electric circuits by applying circuit laws	An
CO2	apply mesh analysis/ nodal analysis / network theorems to analyse the behaviour of the given Electric circuit	Ap
CO3	analyse the transient response of first order and second order systems to step and sinusoidal input	An
CO4	apply phasor diagram techniques to represent and analyse the voltages and currents in three-phase systems.	Ap
CO5	analyse the frequency response of series and parallel RLC circuits and explain the behaviour of magnetically coupled circuits.	An
CO6	simulate, demonstrate and analyse various electrical circuits using fundamental laws, theorems, and design techniques.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3												
2	3	2		1	2								1
3	3	2		1	2							2	1
4	3	2		1	1							2	
5	3	2		1	2							1	1
6	3	2		1	2							2	2

Course Content

BASIC CIRCUIT ANALYSIS Fundamentals concepts of R, L and C Elements-Energy Sources - Ohm's Law - Kirchhoff 's Laws - DC Circuits - Resistors in series and parallel circuits - A.C Circuits	**9 Hours**

- Average and RMS Values - Complex Impedance - Phasor diagram - Analysis of Series and Parallel Circuits: Real Power, Apparent Power Reactive Power and Power Factor. **Practical Component** • Experimental verification of series and parallel electric circuits using fundamental laws. • Measurement of Real and Reactive power in AC circuits.	**6 Hours**
NETWORK REDUCTION AND THEOREMS Source transformation - star delta conversion - Mesh and Nodal analysis - Network Theorems: Superposition, Thevenin's and Norton's Theorem - Maximum power transfer theorem - Duality Principle. **Practical Component** • Simulation and Experimental Verification of Mesh Analysis. • Simulation and Experimental Verification of Thevenin's theorem. • Simulation and Experimental Verification of Superposition theorem. • Simulation and Experimental Verification of Maximum Power transfer theorem.	**9 Hours** **12 Hours**
TRANSIENT RESPONSE ANALYSIS Introduction - Transient response of RL, RC and RLC circuits using Laplace transform for Source free, Step input and Sinusoidal input. **Practical Component** • Simulation of RL, RC and RLC Circuit Transients.	**9 Hours** **3 Hours**
RESONANCE AND COUPLED CIRCUITS Series and parallel resonance - Frequency response - Quality factor and Bandwidth - Introduction to Magnetic circuits - Comparison of Magnetic and Electric circuits – Self and Mutual inductance - Coefficient of coupling - Dot convention - Analysis of coupled circuits. **Practical Component** • Design and Implementation of Series and Parallel Resonance Circuit.	**9 Hours** **6 Hours**
THREE PHASE CIRCUITS Phase Sequence - Line and Phase Quantities - Three Phase Star and Delta Connections - Phasor diagram of voltages and currents - Analysis of Three Phase Circuits with Star and Delta Connected Balanced and Unbalanced Loads - Power Measurement in Three Phase Circuits using Two Wattmeter Method - Power Factor Calculations. **Practical Component** • Measurement of Power and Power factor in Three Phase Balanced Circuit.	**9 Hours** **3 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources

Textbooks

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9th Edition, New Delhi (2020).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis", McGraw Hill, 5th Edition, (2017).

Reference books

1. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc. 2018.
2. Chakrabarti A, "Circuits Theory (Analysis and synthesis)", Dhanpat Rai & Sons, New Delhi, 7th Edition, 2020.
3. Joseph A. Edminister, Mahmood Nahvi, "Electric circuits", Schaum's series, McGraw-Hill, 1st Edition, 2019.
4. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 2nd Edition, McGraw Hill, 2019.

5. Allan H. Robbins, Wilhelm C. Miller, “Circuit Analysis Theory and Practice”, 5th Edition Cengage Learning India, 2013.

Online Resources (Web Links)

1. https://nptel.ac.in/courses/108/108/108108076/
2. https://www.coursera.org/courses?query=electric%20circuits

Assessment (Embedded course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert
Dr K Vetrivel Deputy Director National Power Training Institute, Bengalure Mr. K. Anburaja, Project Manager, Bosch Global Software Technologies, Coimbatore	Dr.R.Rajeswari, Professor/ EEE, Government College of Technology, Coimbatore Dr. G. Saravana Ilango Professor/EEE, NIT, Trichy	Dr. K.Premalatha, Associate Professor Department of EEE

Recommended by BoS on	14.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24ADP001	BASICS OF ARTIFICIAL INTELLIGENCE (Common to all Departments except CS, IT, AD)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	8, 9, 16			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	introduce students to the fundamentals of Artificial Intelligence (AI) and Generative AI, and its key concepts
2	enable students to explore and experiment with common generative AI models and tools for generating text, images, audio, video, and code
3	equip students with the techniques and best practices for crafting effective prompts for AI models

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	understand the fundamentals of AI and generative AI, including its potential impact, issues, limitations, and ethical concerns and its practical use cases in real-world scenarios.	U
CO 2	explore common generative AI models and tools for text, code, image, audio, and video generation.	E
CO 3	apply common prompt engineering techniques and approaches for writing effective prompts.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	2						2							
2	2		2											
3					2					2				

Course Content

Introduction to Artificial Intelligence (AI) **Practical Component** Introduction to Artificial Intelligence (AI) - Generative AI Overview and Use Cases - Impact and Examples of AI - Application Domains for AI - Generative AI Applications. AI Concepts, Terminology - Cognitive Computing (Perception, Learning, Reasoning) - Terminology and Related Concepts of AI- Machine Learning Techniques and Training - Deep Learning - Neural Networks - Natural Language Processing, Speech, Computer Vision - Self Driving Cars. AI: Issues, Concerns and Ethical Considerations - AI Ethics, Regulations, Governance, and ESG. The evolution and future of AI - The AI Ladder - The Journey for Adopting AI Successfully - Hotbeds of AI Innovation.	**8 Hours**
Generative AI: Introduction and Applications	

Practical Component Introduction and Capabilities of Generative AI - Applications of Generative AI - Tools for Text Generation - Tools for Image Generation - Tools for Audio and Video Generation - Tools for Code Generation	**6 Hours**
Generative AI: Prompt Engineering Basics **Practical Component** Introduction to Prompt and Prompt Engineering - Best Practices for Prompt Creation - Common Prompt Engineering Tools - Hands on Lab: Getting to Know Our AI Prompting - Experimenting with Prompts - Naive Prompting and Persona Pattern. Prompt Engineering Techniques and Approaches - Text-to-Text Prompt Techniques - Interview Pattern Approach - Chain-of-Thought Approach - Tree-of-Thought Approach - Future of Human-Crafted Prompts - Text-to-Image Prompt Techniques - Hands-on Lab: Effective Text Prompts for Image Generation.	**7 Hours**
Project and Wrap Up **Practical Component** Graded Quiz Final Project: Generating Text, Images, and Code.	**9 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**30**

Learning Resources

Textbooks:

1. George F. Luger "Artificial Intelligence: Structures and Strategies for Complex Problem Solving" (6th Edition), Pearson, 2021.
2. Anna Jordan, Robert S. Menzies, Kristine P. Schwab, "AI-Powered Creativity: Generative AI and the Future of Content Creation" Routledge, 2023.

References:

1. https://platform.openai.com/docs/overview
2. https://towardsdatascience.com/
3. https://gemini.google.com/

Online Resource (Weblinks)

1. Introduction to Artificial Intelligence (AI) | Coursera
2. Generative AI: Introduction and Applications | Coursera
3. Generative AI: Prompt Engineering Basics | Coursera

Assessment (Practical course)

MCQ, Mini project and viva-voce

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
-	-	Dr. S. Sangeetha, Associate Professor Department of AI&DS

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24INP102	INNOVATION PRACTICUM – 1 (Common to all Departments)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	9, 11, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	analyse the effectiveness of systems thinking and problem-solving methodologies in applying data-driven insights for innovative solution design.
2	evaluate the impact of transdisciplinary collaboration on creating functional hardware prototypes through fabrication techniques.
3	understand the future trends and implications of technology in developing innovative products.

Course Outcomes:

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	recall the fundamental principles of custom hardware design.	R
CO2	understand the appropriate tools and their applications for solving hardware-related problems.	U
CO3	apply systems engineering concepts to real-world hardware design challenges.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	2		1											
2	2				1									
3		2	2	1										

Course Content

Engineering Fundamentals and Innovation Why engineering? The concept of street fight engineering - Real-world design process and problem-solving methodology - Data-driven insights and concept generation - Case studies of successful engineering innovations.	**3 Hours**
Transdisciplinary Systems and Manu'Futuring Transdisciplinary systems to accelerate innovation - Manu'Futuring: Technology in hardware manufacturing and manufacturing of hardware technologies - Future scopes with product case studies.	**6 Hours**

Building Custom Hardware How to build a basic custom hardware - Electronics fundamentals and components - Software for hardware control - Fabrication techniques.	**6 Hours**
System Thinking and Engineering Introduction to system thinking - Real world as a system - Concept of system engineering and its application – iLenSys.	**7 Hours**
Creativity Time and Tech Teardown Creativity exercise: Apply system thinking to a real-world problem - Tech teardown: Analyse a product or system to understand its engineering principles - Presentation: Present your creative project and tech teardown with an engaging title	**8 Hours**

Theory Hours:	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:
0	0	30	0	30

Learning Resources

Textbooks:

1. Sanjoy Mahajan - Street Fighting Mathematics
2. Donald Knuth - The Art of Computer Programming
3. Think like a programmer: An introduction to creative problem solving
4. Thinking in Systems: A Primer

References:

1. Learning to code: How to think like a programmer
2. How to find innovative ideas: Ramesh Raskar's note
3. Case study: How Tesla changed the auto industry
4. Ultimate Guide: How to develop a new electronic hardware product

Online Resources (Weblinks)

1. https://www.ifixit.com/Teardown?srsltid=AfmBOorwzDG9RhJoL3L5tlZ_Dr4sVcey-vPC-pkKTj2E0mWJWtFYlikY
2. https://www.symmetryelectronics.com/technology-teardowns/

Assessment (Practical course)

Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert from Industry	Expert from Higher Education Institutions	Internal Expert
Dr. Mahesh Veezhinathan Director - Innovation Practicum Associate VP - Forge. Innovation	-	Dr. Samuel Ratna Kumar P S Assistant Professor – III Department Mechanical Engineering

Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24HSP111	HOLISTIC WELLNESS-1 (Common to all Department)	L	T	P	J	C
		0	0	2	0	1
HS		SDG	2, 3			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	introduce first-year students to the foundational concepts of holistic wellness, emphasizing the integration of physical, mental, emotional, and Internal well-being.
2	create a balanced lifestyle that promotes overall health and happiness through practical activities.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	understand the basic principles of holistic wellness.	U
CO 2	apply strategies for maintaining physical health, including nutrition and exercise	Ap
CO 3	practice mindfulness techniques to enhance mental and emotional well-being.	Ap
CO 4	develop a personal wellness plan incorporating various aspects of holistic health.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1						2		1						
2						2								
3						1					3			
4						2					3			

Course Content

INTRODUCTION TO HOLISTIC WELLNESS: • Overview of holistic wellness: physical, mental, emotional, and internal health. • The importance of balance in overall well-being. • Hands-on activity: Self-assessment of current wellness status.	**4 Hour**
PHYSICAL WELLNESS: • Importance of physical activity and exercise. • Understanding nutrition and its role in health. • Sleep hygiene and its impact on well-being. • Hands-on activity: Designing a personalized fitness and nutrition plan.	**14 Hours**
MENTAL AND EMOTIONAL WELLNESS: • Stress management techniques. • The role of Yoga, mindfulness and meditation in mental health. • Emotional intelligence and its impact on relationships.	**6 Hours**

• Hands-on activity: Practicing Yoga, mindfulness and emotional regulation exercises.	
INTERNAL WELLNESS: • Exploring the concept of Internal wellness. • The role of purpose and meaning in life. • Introduction to meditation and reflective practices. • Hands-on activity: Developing a personal reflection, Yoga and meditation routine.	**4 Hours**
INTEGRATING WELLNESS PRACTICES: • Combining physical, mental, emotional, and Internal wellness practices into daily life. • Developing a balanced wellness plan. • Hands-on activity: Creating a comprehensive personal wellness plan.	**2 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**30**

Learning Resources

Textbooks:

1. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
2. Rosenberg, Marshall Bertram., Nonviolent Communication: A Language of Life., Puddle Dancer Press, Encinitas, CA (2015).

References:

1. B.K.S Iyengar., Yoga: The Path to Holistic Health., Dorling Kindersley Limited, City of Publication (2001)
2. Goleman Daniel., Emotional Intelligence., Bloomsbury India, India, (2021).
3. James Allen., As a Man Thinketh., Maple Press, Noida, (2010)
4. Swami Budhanandha., Will power and its development., Advaita Ashrama Mayavati, Pithoragarh, Himalayas from its Publication Department, Calcutta. (2001)
5. Kalderdon Adizes Ichak., What Matters in Life: Lessons I Learned from Opening My Heart ., WS Press, Newtown, PA (2023)

Online Resources (Weblinks)

1. Learning Suryanamskar
2. Yoga for well-being
3. Nutritional Educational contents
4. Introduction to Psychology
5. Guided Meditation
6. Simplified physical exercises instructions
7. Simplified Physical Exercises
8. Life skills and value education
9. James Allen Library

Assessment (Practical course)

Participation, Practical activities and assignments, personal wellness plan and reflection.

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Dr. Ezhilarasi Principal- KCT
Recommended by BoS on	16.08.2024	

Academic Council Approval	No: 27	**Date**	24.08.2024

24INP101	DESIGN THINKING (Common to all Department)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	introduces first-year engineering students to Design Thinking, focusing on practical, user-centered problem-solving techniques
2	empathize with users, generate ideas, and create models to test and refine their solutions
3	understand iteration, empathy, and critical reflection to cultivate a creative mindset

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	apply problem-solving techniques and the Design Thinking process to engineering problems using simple models	Ap
CO 2	understand user needs through various empathy techniques and develop/refine models iteratively based on user insights.	U
CO 3	reflect critically on their learning journeys and the emotional demands of problem-solving. Collaborate effectively in teams to develop innovative solutions	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	1		2			2		2			1			
2	1							2			1			
3	1		2			2		1			1			

Course Content

Introduction to Problem Solving and Ground Rules Introduction to problem-solving strategies without mentioning Design Thinking-Emphasize problem-solving attitudes, mindsets, and behaviours necessary for iterative problem solving (e.g., openness to failure, patience, empathy)-Set ground rules for the course, including incentives for creative risk-taking and penalties for non-participation or lack of reflection-Overview of the Design Thinking process and its importance.	**6 Hours**
Empathy and Problem Definition	

Techniques for understanding user needs, including observation, interviews, **surveys** and **focus groups-**Importance of secondary research as a complement for the above-mentioned methods-Introduction to empathy cycles: involve students in two empathy cycles before and after problem definition-Finetuning problem definition based on user insights.	**6 Hours**
Ideation and Concept Modelling Brainstorming ideas and selecting feasible solution-Creating concept modelling to visualize ideas-Include an empathy cycle after students propose solutions, allowing them to revisit and reshape their solutions based on further insights from users.	**6 Hours**
Prototyping and Testing with Models Building basic prototypes using simple materials (e.g., cardboard, clay)- Introduction to different prototyping methods (e.g., **low-fidelity** vs **high-fidelity models**) for different contexts: product design, space design, policy, and digital/e-commerce solutions-Conduct an empathy cycle after the prototype is developed to gather user feedback and refine the prototype.	**6 Hours**
Iteration and Final Modelling Project Students refine their prototypes based on feedback from the empathy cycle-Finalize prototypes for presentation based on consistent feedback loops.	**6 Hours**
Presentation, Reflection, and Learning Summaries Students present their final projects and reflect on their learning journeys, including how their understanding of problem-solving and empathy evolved during the course-**Learning Summary Activity:** Each student presents their individual journey and learning outcomes from the empathy cycles and iterations-Peer review and group discussions.	**6 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**30**

Learning Resources

Textbooks:

1. Handbook of Design Thinking, Christian Muller – Roterberg, Kindly Direct Publishing
2. The Art of Innovation, Tom Kalley
3. E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company

Online Resources (Weblinks)

1. Survey and focus group design guides
2. Guidance on Designing, Administering and Analyzing Focus Groups and Interviews
3. Empathy mapping tools
4. How to Make a Concept Model
5. Brainstorming Techniques: 15 Creative Activities
6. 10 Brainstorming Techniques for Developing New Ideas
7. Brainstorming templates
8. 5 Common Low-Fidelity Prototypes and Their Best Practices
9. UX Prototypes: Low Fidelity vs. High Fidelity
10. Low-fidelity vs. High-fidelity Design Prototypes (and when to use which)

Case study 1: Iterative Design and Prototype Testing of the NN/g Homepage

Case study 2: Using iterative design to optimise the user flow of a product

11. Reflective practice toolkit

Assessment

Formative: Assignments, Mini project

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**	
		Dr. Padhmanand Sudhagar R Department of Bio-Tech Dr. Arul H Department of Physics	
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24HST102	தமிழரும் தொழில்நுட்பமும்/ TAMILS AND TECHNOLOGY	L	T	P	J	C
		1	0	0	0	1
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பத்தை அறிமுகப்படுத்துதல், சங்க கால கட்டிட தொழில்நுட்பத்தை விளக்குதல், கோயில்கள் மற்றும் சிற்பக்கலைகளை ஆராய்தல். introducing weaving and pottery technology of Tamils -Explaining the building technology of the Sangam Period-Explore temples and sculptures.
2	கப்பல், இரும்பு, நாணயங்கள், மணி உருவாக்கும் தொழிற்சாலைகள், ஆகியவற்றை விளக்கம் செய்தல், தமிழகத்தின் தொல்லியல் சான்றுகளின் பழமையை உணர்த்துதல். explain Ship, Iron, Coins, Beads Making Factories. Realizing the Antiquity of Archaeological Evidence of Tamil Nadu
3	வேளாண்மை மற்றும் அறிவியல் தமிழைப் பற்றி அறிதல், இணையத்தில் தமிழின் தேவையை உணர்த்துதல்,தமிழ் மென்பொருள்களை அறிமுகம் செய்தல். knowledge of Agricultural and Scientific Tamil, Realizing the need for Tamil on the Internet, Introducing Tamil software.

Course Outcomes:

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பத்தின் முக்கியத்துவத்தினை அறிந்து கொள்ளுதல். சங்ககால தமிழர் வளர்த்த அழகுக் கலைகளைத் தெரிந்து கொள்ளுதல். know the importance of weaving and pottery technology of Tamils-To know the Aesthetics arts developed by Sangam Tamils	U
CO 2	கப்பல் கட்டும் கலை, இரும்புத் தொழிற்சாலை, நாணயங்கள் அச்சடித்தல்,மணி உருவாக்கும் தொழிற்சாலைகள், சிலப்பதிகாரத்தில் உள்ள மணிகளின் வகையை அறிதல். knowledge of ship building, ironworks, coinage, minting, and beads making factories,Knowing the types of beads in Silapathikaram.	U
CO 3	வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தை அறிந்து கொள்ளல். அறிவியல் தமிழ் மற்றும் கணினித் தமிழைப் புரிந்து கொள்ளுதல். know agriculture and irrigation technology. Understanding Scientific Tamil and Computer Tamil.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)
	1	2	3	4	5	6	7	8	9	10	11	

Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	2		2				3	2	2		2			
2	2		2				3	2	2		2			
3	2		2				3	2	2		2			

Course Content

நெசவு மற்றும் பானைத் தொழில்நுட்பம்: சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள். Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW)-Graffiti on Potteries.	**3 Hours**
வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் ரூ சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் -சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை. Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.	**3 Hours**
உற்பத்தித் தொழில் நுட்பம்: கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள்- நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள். Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel- Copper and gold- Coins as source of history - Minting of Coins - Beads making- industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidence - Gem stone types described in Silappathikaram.	**3 Hours**
வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம்- கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள்- வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம். Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries - Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.	**3 Hours**
அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:	

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள்- சொற்குவைத் திட்டம். Development of Scientific Tamil - Tamil computing- Digitalization of Tamil Books- Development of Tamil Software - Tamil Virtual Academy - Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project.	**3 Hours**

Theory Hours: 15	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 15

Reference books

1. தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL- (in print)
6. Social Life of the Tamils the Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tarnils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Textbook and Educational Services Corporation> Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation> Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) - Reference Book.

Online Resources

1. https://www.youtube.com/watch?v=Gp1ratX2sOE&list=PLtyn2o7hocf40PtPibRqJTf_dQL3eOtLl
2. https://www.youtube.com/watch?v=jteRvnNiD6w

Assessment (Theory course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
-	-	-

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24HSJ102	FLUENCY THROUGH PRACTICE (Common to all Departments)	L	T	P	J	C
		0	0	0	4	2
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	develop professional communication skills, including technical writing, public speaking, and collaborative discourse.
2	foster creativity and critical thinking by producing real-world academic and professional outputs such as book chapters, journal articles, and intellectual property.
3	instil awareness of global and ethical communication practices, contributing to sustainability and social impact.
4	enhance students' language fluency through project-based learning relevant to engineering

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	analyse and apply effective communication techniques in professional contexts.	An
CO2	collaborate in teams to design and execute language-based projects with real-world applications.	Ap
CO3	develop critical thinking and problem-solving skills through research, analysis, and presentation of technical content.	An
CO4	produce publishable-quality written and spoken outputs, such as book chapters, journal articles, and copyrighted content.	C

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1		2	2	1			3	2	2	1	2			
2		3	2	1			3	2	2	1	2			
3		2	2	2			3	2	2	1	2			
4		3	1	1			3	2	2	1	1			

Course Content

- Introduction to Activity Based Learning
- Research and Initial Project Planning
- Technical Writing and Documentation
- Creative Writing
- Drafting and Editing Techniques
- Teamwork and Peer Collaboration
- Public Speaking and Presentation Skills
- Challenges to Opportunities

60 Hours

• Cross-Cultural Communication and Global Ethics Intellectual Property and Copyrighting Publication – English for research Writing Digital Communication & Social Responsibility	

Theory Hours: 0	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 60	Total Hours: 60

Learning Resources

Reference books

1. Mahesh Kumar, Dr.Soma. Soft Skills: Enhancing Personal and Professional Success, McGraw Hill,2023.
2. Maxwell, John C. Developing the leader within you, Harper Collins, 2018.
3. Ansarian, Loughman, and Teoh, Mei Lin. Problem-based Language Learning and Teaching: An Innovative Approach to Learn a New Language. Singapore, Springer Nature Singapore, 2018.
4. Savin Baden, M., Major, C. H. (2004). Foundations of Problem Based Learning. United Kingdom: McGraw-Hill Companies, Incorporated.

Online Resources (Weblinks)

1. https://www.sciencedirect.com/science/article/pii/S2590291123002735
2. https://www.cal.org/adultesl/pdfs/problem-based-learning-and-adult-english-language-learners.pdf
3. https://www.apu.ac.jp/rcaps/uploads/fckeditor/publications/polyglossia/Polyglossia_V16_Ng.pdf

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr.Vijayan Ramanathan , Project Manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University Chennai Dr. E. Justin Ruben, CIT, Coimbatore	Dr. Arokia Lawrence Vijay Dr. SG Mohanraj Department of English

Recommended by BoS on	16.08.2024		
Academic Council Approval	No:27	**Date**	24.08.2024

24HST103	EFFECTIVE COMMUNICATION	L	T	P	J	C
		2	0	0	0	2
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to

1	enhance students' abilities to communicate ideas effectively, both orally and in writing, by developing skills in organizing thoughts clearly and logically and expressing them through well-structured paragraphs and concise summaries.
2	enable students to critically evaluate and synthesize information from multiple sources and utilize suitable writing techniques and formats to produce professional-quality content tailored to various contexts.
3	foster active listening, critical reading, and reflective thinking, empowering students to create engaging, relevant, and informative content by applying effective communication strategies across diverse platforms.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	demonstrate proficiency in delivering ideas effectively, both in speaking and writing, with a deeper understanding of the content and the ability to convey complex ideas through well-structured paragraphs and summaries.	Ap
CO2	create and present original content by evaluating information from multiple sources and employing appropriate formats and writing strategies across various professional contexts.	C
CO3	produce engaging and informative content through active listening, reading, reflection, and effective communication skills.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1							2	2	3		3			
2							2	2	3		3			
3							2	2	3		3			

Course Content

Text Analysis Composition of Coherent Paragraphs (Expository, Descriptive, Narrative, Evaluative) - Loud Reading (Reading Extracts will be given were students identify the main idea of paragraphs or sections and debrief)	**6 Hours**
Visual & Written Analysis Process writing (Drafting effective introduction, process and conclusion using	

appropriate transition words and phrases) - Describing Visuals (Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram) - Note Making & Summarizing	**6 Hours**
Professional Correspondence Crafting Professional Emails - Writing Instruction for Manuals - Reading technical documents (Reading extracts will be given to construct sentences from the new words found in the document)	**6 Hours**
Research and Documentation Library Reading (Identify at least three sources and extract information, Summarize the main ideas and key findings from each source, compile them findings into a brief report that includes the main points, sources, and relevance to the topic)- Report Writing (Title Page, Abstract, Introduction, Methodology, Results, Discussion, Conclusion and recommendation)	**6 Hours**
Talk Analysis and Podcast Skills Listening to and analyzing TED talks – Preparing Podcast-PRISM (Professional Rhetoric Improvement and Speech Mastery) to share facts, opinions and experiences - Writing Reviews on products.	**6 Hours**

Theory Hours: 30	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 30

Learning Resources

References:

1. Swamy, V. R. Narayana. Strengthen Your Writing. Orient Longman, 2003.
2. Sasikumar, V., and P. V. Dhamija. Spoken English: A Self-Learning Guide to Conversation Practice. Tata McGraw Hill, New Delhi (1993).
3. Maison, Margaret M. Examine Your English. Orient Longman, 1999.
4. Rizwi, Ashraf. Effective Technical Communication. Tata McGraw Hill, 2005.
5. Pickett, Nell Ann, and Ann A. Laster. Technical English: Writing, Reading, and Speaking.
6. Harpercollins College Div, 1993.

Online Resources (Weblinks)

1. https://owl.purdue.edu/owl/general_writing/academic_writing/paragraphs_and_paragraphing/index.html
2. https://learnenglish.britishcouncil.org/skills/writing/upper-intermediate b2/describing-trends
3. https://hbr.org/2016/07/how-to-write-email-with-military-precision
4. https://owl.purdue.edu/owl/subject_specific_writing/professional_technical_writing/reports and_memos/index.html

Assessment (Theory course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by

Expert from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr.Vijayan Ramanathan , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore	Dr. Arokia Lawrence Vijay Dr. Sreejana Dr. Tissaa Department of English

Recommended by BoS on	16.08.2024		
Academic Council Approval	No:27	**Date**	24.08.2024

24HST104	PROFESSIONAL COMMUNICATION (Common to all Departments)	L	T	P	J	C
		2	0	0	0	2
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to

1	develop students' abilities to craft clear, concise, and well-structured technical content and professional communications
2	enhance students' communication skills in team settings
3	equip students with cross-cultural communication skills and effective listening techniques

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	demonstrate proficiency in crafting clear, concise, and well-structured technical content and professional communications, including emails that meet industry standards.	Ap
CO2	communicate effectively in team settings, showcasing collaboration, conflict resolution, and leadership skills, while employing creative writing techniques to convey complex ideas.	An
CO3	apply principles of cross-cultural communication and effective listening techniques to engage successfully in diverse, globalized professional environments.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1						2	1	3	1		3			
2						2	3	3	2		3			
3						1	1	3	1		3			

Course Content

Mastering Professional Communication Industry-specific terminology (Business / Technical Register) - Crafting professional emails - Essential elements of an effective email (subject line, salutation, body, closing) - reading and responding to email communication – Networking Emails - Analyzing and interpreting technical texts (Loud Reading).	**6 Hours**
Navigating Digital Media Introduction to Digital media and online communication tools (instant messaging, video conferencing, social media, blogs, forums) - Listening and analyzing advanced audio materials - Creative & Blog Writing (General & Technical).	**6 Hours**

Technical Writing Techniques Writing Reflective Essays / Experience Sharing, Process writing, Transcoding graphics (interpreting technical texts), Writing Reviews (Research Articles & Books).	**6 Hours**
Building a Professional Digital Presence Creating Digital Profile - Overview of different digital platforms (LinkedIn, GitHub, personal websites) - Setting Up a LinkedIn Profile – Crafting a Video Resume – Digital Etiquette and Professionalism - Cross-cultural communication and diversity awareness.	**6 Hours**
Social Responsibility in Practice Environmental and social responsibilities - Case studies and real-world applications - Project Work - Writing Project reports.	**6 Hours**

Theory Hours: 30	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 30

Learning Resources

Reference books

1. Baker, W., & Ishikawa, T. Transcultural Communication Through Global Englishes: An Advanced Textbook for Students. Routledge, 2021.
2. Bodnar, O., Fedak, S., Hinsirovska, I., Denysiuk, N., Perenchuk, O., Plavutska, I., ... & Shchur, N. English for Study and Work: A Coursebook In-class Activities. 2017.
3. Doff, A., Thaine, C., Puchta, H., Stranks, J., & Lewis-Jones, P. Cambridge English Empower Advanced Student's Book. Cambridge University Press, 2016.
4. Hewings, M., Thaine, C., & McCarthy, M. Cambridge Academic English C1 Advanced Student's Book: An Integrated Skills Course for EAP. Cambridge University Press, 2012.
5. Beer, D. F., & McMurrey, D. A. A Guide to Writing as an Engineer. John Wiley & Sons, 2019.

Online Resources (Web Links)

1. https://hbr.org/2016/07/how-to-write-email-with-military-precision
2. https://ocw.mit.edu/courses/comparative-media-studies-writing/21w-732-scientific-and-technical-communication-spring-2015/
3. https://www.coursera.org/learn/digital-media
4. https://owl.purdue.edu/owl/subject_specific_writing/professional_technical_writing/reports_and_memos/index.html

Assessment (Theory course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by

Expert from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr.Vijayan Ramanathan , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore	Dr. Arokia Lawrence Vijay Dr. Hema Department of English

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24MAI123	COMPUTATIONAL DIFFERENTIAL EQUATIONS (Common to EC, EE, EI)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	7, 9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	understand the fundamental concepts and methods for solving linear ordinary differential equations (ODEs) of second and higher order, and apply them to real-world engineering problems such as electric circuits.
2	develop proficiency in using Laplace Transform techniques to solve ODEs, particularly in scenarios involving constant coefficients, and apply these methods to practical engineering systems.
3	gain expertise in the application of various numerical methods, including Taylor's series, Euler, Improved Euler, and Runge-Kutta methods, to solve initial value problems for ODEs with a focus on accuracy and efficiency.
4	master the methods of solving partial differential equations (PDEs), including separation of variables and standard techniques for first-order and higher-order PDEs, and understand their application in modeling physical phenomena.
5	apply and evaluate finite difference and other numerical techniques for solving complex engineering problems involving PDEs, such as two-dimensional Laplace's and Poisson's equations, as well as one-dimensional heat and wave equations.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	solve linear ordinary differential equations (ODEs) of second and higher order, including applications in electric circuits.	Ap
CO 2	apply Laplace Transform techniques to solve linear ODEs.	Ap
CO 3	apply numerical methods, including Taylor's series, Euler, Improved Euler, and Runge-Kutta methods, to solve initial value problems for ODEs.	Ap
CO 4	analyse and solve partial differential equations (PDEs) using separation of variables and standard methods for first-order PDEs and higher-order linear homogeneous PDEs.	An
CO 5	apply finite difference techniques to solve two-dimensional Laplace's and Poisson's equations and use numerical schemes to solve one-dimensional heat and wave equations.	Ap
CO 6	analyze and solve complex real-world engineering problems using a variety of analytical and numerical methods for ordinary and partial differential equations.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3

1	3	2		2										
2	3				2									
3		2			2						2			
4		3		2										
5		2			3									
6	2	2			2						2			

Course Content

ORDINARY DIFFERENTIAL EQUATIONS Linear equations of second and higher order with constant coefficients – Euler's and Legendre's linear equations – Method of variation of parameters – First order Simultaneous linear equations with constant coefficients – Applications: Electric Circuits.	**9 Hours**
Practical Component: • Solving Second-Order Linear ODEs with Constant Coefficients • Solving First-Order Simultaneous Linear Equations	**7 Hours**
SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS USING LAPLACE TRANSFORMS: Laplace Transform – Properties – Inverse Laplace transforms – Properties – Solution of linear ordinary differential equations with constant coefficients.	**9 Hours**
Practical Component: • Using Laplace Transforms to Solve Linear ODEs	**4 Hours**
NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS Initial value problems - Single step methods: Taylor's series method – Truncation error – Euler and Improved Euler methods – Fourth order Runge–Kutta method – Multistep method: Milne's predictor - corrector method.	**9 Hours**
Practical Component: • Numerical Solution Using Taylor's Series Method • Numerical Solution Using Euler and Improved Euler Methods • Numerical Solution Using Fourth Order Runge-Kutta Method	**9 Hours**
PARTIAL DIFFERENTIAL EQUATIONS: Solution of PDE by variable separable method - solution of standard types of first order partial differential equations (excluding reducible to standard types) - Lagrange's linear equation – Linear homogeneous partial differential equations of second and higher order with constant coefficients.	**9 Hours**
Practical Component: • Solution of PDE by Variable Separable Method	**4 Hours**
NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: Finite difference techniques for the solution of two-dimensional Laplace's and Poisson's equations on rectangular domain–Solution of one-dimensional heat equation using Bender Schmidt and Crank Nicholson difference schemes –Solution of one-dimensional wave equation by explicit scheme.	**9 Hours**
Practical Component: • Numerical Solution of Two-Dimensional Laplace's and Poisson's Equations • Numerical Solution of Heat Equation Using Bender-Schmidt and Crank-Nicholson Methods.	**6 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources

Textbooks:

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44th Edition, 2021.
2. Sastry S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.
3. Thomas, G.B., Weir, M.D., Hass, J., "Thomas' Calculus", Pearson Education, 15th Edition, 2023.

References:

1. Kreyzig E., “Advanced Engineering Mathematics”, 10th Edition, John Wiley and sons, 2023.
2. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2018.
3. Zill, D.G., Wright, W.S., "Advanced Engineering Mathematics", Jones & Bartlett Learning, 7th Edition, 2020.
4. O'Neil, P.V., "Advanced Engineering Mathematics", Cengage Learning, 7th Edition, 2017.
5. "Numerical Methods for Engineers" by Steven C. Chapra and Raymond P. Canale,Mc Graw Hill, 8th Edition,2021.

Online Resources (Weblinks)

1. MIT OpenCourseWare: Differential Equations
   https://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010
2. Khan Academy: Differential Equations
   https://www.khanacademy.org/math/differential-equations
3. Paul’s Online Math Notes: Differential Equations
   http://tutorial.math.lamar.edu/Classes/DE/DE.aspx
4. Coursera: Introduction to Differential Equations
   https://www.coursera.org/learn/differential-equations
5. Wolfram MathWorld: Differential Equations
   https://mathworld.wolfram.com/topics/DifferentialEquations.html

Assessment

CAT, Activity and Learning Task(s), MCQ, Open Book Assignment, Worksheet assignment, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by

Expert from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr.Pradeep.C, Paerless Validation Software for Life Sciences Companies.	Dr. C. Porkodi, PSG College of Technology, Coimbatore. Dr. P. Paramanathan, Amrita Vishwa Vidyapeetham, Coimbatore.	Dr. K. Meena Dr. Vijeta Iyer Dr. R. Krishnamoorthy Department of Mathematics

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24PHI102	APPLIED PHYSICS FOR CIRCUIT ENGINEERING (Common to EC, EE, EI an MR)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	9			

Pre-requisite courses	Higher Secondary	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	discover the fundamental concepts of light-matter interactions, including emission, absorption, and Einstein's theory's presentation of stimulated emission's quantum mechanical foundations.
2	comprehend the principles of quantum mechanics, including wave-particle duality, the significance of the wave function, and quantum tunnelling.
3	examine various sources of green energy, including solar, wind, and ocean energy, and assess their efficiency and practical applications.
4	study the properties of semiconductors, magnetic materials, including carrier concentration, transport phenomena, and applications of the Hall effect in sensors.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	apply the principles of applied optics to demonstrate the operation of laser systems and their applications.	Ap
CO 2	apply quantum mechanical concepts to solve problems related to wave-particle duality and quantum tunnelling.	Ap
CO 3	apply principles of green energy technologies to assess their efficiency and practical applications.	Ap
CO 4	0075nderstanding semiconductor physics concepts to analyze carrier transport phenomena and properties of semiconductor devices.	U
CO 5	apply knowledge of magnetic materials to evaluate their properties and uses in modern applications like spintronics.	Ap
CO 6	apply optics, quantum physics, green energy, and semiconductor physics methods to design practical solutions in experimental setups.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	1												
2	3	1												
3	3	1												
4	3	1									2			
5	3	1												
6	3	1									2			

Course Content

APPLIED OPTICS	9 Hours

Interaction of light and matter - Quantization of electromagnetic radiation – Absorption, Spontaneous emission and Stimulated emission - Einstein's theory of stimulated emission- Population inversion - Sources of excitation - Active medium -Laser beam output- Nd-YAG laser - CO_2 laser - Applications – Laser Imaging, Holography and Laser gyroscopes. **Practical Component** 1. Semiconductor laser: a. Determination of wavelength of laser b. Determination acceptance angle and numerical aperture of an optical fibre. c. Determination of particle size 2. Spectrometer – Determination of wavelength of mercury source using grating	**6 hours**
QUANTUM PHYSICS Necessity of quantum mechanical picture - Planck's concept (hypothesis) - Wave-particle duality - de-Broglie waves - Physical significance of wave function - Schrodinger equation (Time independent and time-dependent) - Particle in a box- Eigen values and Eigen function- Superposition Principle - Quantum mechanical tunnelling through a barrier **Practical Component** 1. Compound pendulum – Determination of acceleration due to gravity 2. Determination of Planck's constant–electroluminescence method.	**9 Hours** **6 hours**
GREEN ENERGY Introduction to Green energy – Solar energy: Energy conversion by photovoltaic principle – Solar cells – Efficiency measurements – Types (First, Second and Third Generation) - Wind energy: Basic components and principle of wind energy conversion systems – Ocean energy: Wave energy – Wave energy conversion devices. Futuristic Energy: Hydrogen – Methane Hydrates – Carbon capture and storage (CCS). **Practical Component** 1. Determination of efficiency of solar cell **2.** Melde's string – Determination of frequency of a tuning fork	**9 Hours** **6 hours**
SEMICONDUCTOR PHYSICS Semiconductors - Intrinsic and extrinsic semiconductors - Variation of carrier concentration with temperature and impurity concentration - Carrier transport in Semiconductors: Drift, mobility and diffusion – Hall Effect in Semiconductors – Applications of Hall Effect - Magnetic field sensor, current sensor, and position sensor - Ohmic contacts: concept and importance - Schottky diode – construction and working - energy band diagram, I-V characteristics. **Practical Component** 1. Determination of band gap of a semiconductor 2. Determination of thermal conductivity of a bad conductor – Lee's Disc method 3. Non-uniform bending – Determination of Young's modulus	**9 Hours** **6 hours**
MAGNETIC MATERIALS Introduction – Bohr magnetron - types of magnetic material – Hysteresis behaviour – Energy product - Hard and soft magnetic materials - Magnetic Anisotropy- Spintronics and Magnetic Semiconductors- Applications – GMR - MRAM (Magneto resistive Random Access Memory) - Nanomagnetic Materials - Magnetocaloric Materials – Magnetic Materials in Renewable Energy – Magnetic levitation. **Practical Component** 1. Determination of magnetic susceptibility of a solid material – B-H curve apparatus	**9 Hours** **6 hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources

Textbooks

1. Avadhanulu, M. N., Kshirsagar, P. G., & Arun Murthy, T. V. S., A Textbook of Engineering Physics, S. Chand Publications, New Delhi (2018).
2. Gaur, R. K., & Gupta, S. L., Engineering Physics, Dhanpat Rai Publishing Co Pvt Ltd, New Delhi (Year not provided).
3. Beiser, A., Mahajan, S., & Choudhury, S. R., Concepts of Modern Physics, McGraw Hill Education, New Delhi (2017).
4. Rajendran, V., Applied Physics, Tata McGraw Hill Publishing, New Delhi (2017).

Reference books

1. Lal, Brij, & Subrahmanyam, Properties of Matter, S. Chand & Co Ltd., New Delhi (2014).
2. Prakash, Satya, Quantum Mechanics, Pragati Prakashan Publishers (2015).
3. Thiagarajan, K., & Ghatak, Ajoy, Lasers: Fundamentals and Applications, Springer Science & Business Media (2010)
4. Hill, William Silfvast, Laser Fundamentals, Cambridge University Press, New York (2018).
5. Ultrasonics: Fundamentals, Technology, Applications, 2nd Edition, Marcel Dekker, New York (1988).
6. Sze, S. M., & Ng, K. K., Physics of Semiconductor Devices, Wiley (2020), ISBN: 978-1119090240.
7. Sellmyer, David J., & Skomski, Robert, Permanent Magnetic Materials and Devices,
8. Springer (2017), ISBN: 978-3319315828.

Online Resources (Weblinks)

1. National Institute of Standards and Technology (NIST) - Laser Fundamentals
2. Optics.org - Laser Applications
3. IEEE Xplore - Semiconductor Devices
4. Semiconductor Industry Association - Semiconductor Technology
5. Global Wind Energy Council (GWEC) - Wind Energy
6. Ocean Energy Europe
7. Magnetics - Magnetic Materials

Assessment (Embedded course)

CAT, Mini project, Qualitative assignments (PrBL/Activity based), MCQ, End Semester Examination (ESE), Lab Workbook, Model exam and viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Dr. R. Balamurugan Dr. K. Sugandhi Department of Physics

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24CSI101	LOGICAL THINKING AND PROBLEM SOLVING (Common to all Programmes)	L	T	P	J	C
		3	0	2	0	4
ES		SDG	8, 9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	gain a comprehensive understanding of computing systems, including their classification, processing units, memory structures, storage hierarchies, and the essential functions and types of operating systems
2	develop strong logical and analytical thinking skills, enabling the systematic analysis and solution of computational problems using reasoning techniques, algorithms, and flowcharts.
3	acquire a solid foundation in C programming, mastering the use of data types, operators, control structures, and input/output operations to create efficient and effective programs.
4	apply advanced programming techniques, including the use of arrays, structures, pointers, and functions, to solve complex real-world problems with a focus on modular and efficient coding practices.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	understand the basic concepts of hardware, software, Operating systems, and the logic behind the functioning of the Computing systems.	U
CO2	apply logical thinking and reasoning to solve computing problems using tools like algorithms and flowcharts.	Ap
CO3	understand the structured programming paradigms, memory organization and how the language can be used as a tool to solve problems.	U
CO4	develop simple programs using data types, operators, control structures, pointers, and functions as appropriate in real world applications.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2												
2	3	2	1									3	
3		1										2	
4	3	2	1									3	

Course Content

FUNDAMENTALS OF COMPUTERS AND COMPUTING Generations of computers, and classification of computers (supercomputers, mainframes, minicomputers, microcomputers). Processing Units (CPU, GPU, TPU), memory (RAM, ROM), storage devices and hierarchy, input / output and peripheral devices. System software, application software. Operating Systems - Functions (process	**6 Hours**

management, memory management, file system management, device management, security), types of operating systems (desktop, mobile, networking, distributed, real-time, embedded). **Number Systems**: Introduction to different number systems (binary, octal, decimal, hexadecimal), conversions between number systems, and binary arithmetic (addition, subtraction, multiplication, division). **Practical Component** Exploring hardware and software components	 **4 Hours**
LOGICAL THINKING, REASONING AND TOOLS Problem Analysis – Logical Thinking vs Critical Thinking vs Design Thinking - Inference – Inductive Reasoning – Deductive Reasoning – **Logical Thinking Tools: Algorithms**: Definition and importance, characteristics of algorithms (finite, clear and unambiguous, well-defined inputs and outputs, feasible). Algorithm representation Techniques: Pseudocode, stepwise refinement, and top-down design. **Flowcharts**: Symbols used in flowcharts, creating flowcharts, and examples of flowchart-based problem-solving. **Practical Component** Algorithm writing and Flowcharts,	**8 Hours** **4 Hours**
PROGRAMMING PARADIGMS AND INTRODUCTION TO C PROGRAMMING **Programming Paradigms**: Structured programming - functional programming - object-oriented programming. **Introduction to C Programming**: History of C - features of C - structure of a C program – input / output statements. **Data Types**: Primitive data types (int, char, float, double) - derived data types, typecast. **Operators**: Arithmetic operators - relational operators - logical operators - bitwise operators - assignment operators - operator precedence. **Conditional Statements**: If - if-else - nested if - switch-case. **Looping Statements**: For loop - while loop - do-while loop. Pre-processor Directives and Command line arguments, Storage Classes. **Practical Component** Programs on Operator precedence, Decision Making, Iterations	**11 Hours** **10 Hours**
ARRAYS AND STRUCTURES **Collections**: Arrays – 2D Arrays – String Manipulation. **Structures and Unions**: Definition - declaration - accessing members - differences between structures and unions - applications. **Practical Component** Programs on Arrays, Structures, Union,	**10 Hours** **6 Hours**
POINTERS AND FUNCTIONS **Pointers**: Definition - declaration - pointer arithmetic - pointers and arrays. **Functions**: Definition - declaration - types of functions (user-defined, library functions) - parameter passing (by value, by reference) pointers and functions, recursion. **Practical Component** Pointers and Functions. Additional programs on Files to be discussed.	**10 Hours** **6 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**75**

Learning Resources
Textbooks:
1. Kanetkar, Yashavant. Let Us C. BPB Publications, New Delhi (2023). 2. Rajaraman, V. Fundamentals of Computers. PHI Learning, New Delhi (2020). 3. Dromey, R.G. How to Solve it by Computer. Prentice Hall International, New York (2008).
Reference

1. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. Introduction to Algorithms. MIT Press, Cambridge (2022).
2. Balagurusamy, E. Programming in ANSI C. McGraw Hill Education, New York (2021).
3. Kernighan, Brian W., and Dennis M. Ritchie. The C Programming Language. Prentice Hall, New York (2017).
4. Patterson, David A., and John L. Hennessy. Computer Organization and Design: The Hardware/Software Interface. Morgan Kaufmann, San Francisco (2017).

Online Resources (Weblinks)

1. https://nptel.ac.in/courses/106105214
2. https://www.coursera.org/learn/computer-fundamentals
3. https://www.khanacademy.org/computing/computer-science/algorithms
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/
5. https://www.geeksforgeeks.org/c-programming-language/

Assessment (Embedded course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert
-	-	Dr. S. Kavitha, Department of Information Technology

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24EET102	ELECTROMAGNETIC FIELDS	L	T	P	J	C
		3	0	0	0	3
ES		SDG	7, 9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	foster a comprehensive understanding of the implications of electrostatics and magnetostatics in engineering applications.
2	develop the ability to analyze the properties of conductors and dielectrics, focusing on current density and boundary conditions.
3	impart analytical skills to investigate the principles of electrostatics, magnetostatics and electromagnetic wave propagation.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	evaluate the electric field intensity for various types of charges using basic electrostatic laws and to recognize different co-ordinate systems.	An
CO 2	analyze the electrostatic boundary conditions and evaluate capacitance of various configurations.	An
CO 3	apply basic laws of magnetostatics to determine magnetic field intensity and magnetic flux density.	Ap
CO 4	apply the knowledge of magnetic fields and inductance to calculate inductances of solenoids, toroidal cores and analyze the magnetic boundary condition.	Ap
CO 5	analyze the concepts of electrodynamics & electromagnetic waves and to derive the Maxwell's equations.	An

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	1										
2	3	2	1									1	
3	3	2	1									1	
4	3	2	1									2	2
5	2	2			2							2	2

Course Content

ELECTROSTATICS Static Electricity - Electric field – Charge density: line, surface and volume, Coulomb's law, – Coordinate systems and vector fields: rectangular, cylindrical and spherical coordinates, Divergence and curl of Electric field, Electric Field Intensity, Electrical	**9 Hours**

Field due to point charges, line, surface and volume charge distributions, Gauss's law and its applications, Absolute Electric Potential, Potential Gradient, Electric Dipole, applications.	
CONDUCTORS, DIELECTRICS AND CAPACITANCE Current and current density, Ohm's Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials, Permittivity of dielectric materials, Capacitance – Determination of Capacitance for cylindrical and parallel plate configurations.	**9 Hours**
MAGNETOSTATIC FIELDS Biot-Savart Law, Magnetic Field Intensity due to long straight conductor, Ampere's Circuit Law and its applications, Magnetic Flux and Magnetic Flux Density, applications	**9 Hours**
MAGNETIC FORCES AND INDUCTANCE Steady magnetic fields produced by current carrying conductors, Lorentz' Law of Force, Magnetic Force and Torque, Magnetization, Magnetic boundary conditions, Inductances and Mutual inductances – Inductance due to solenoid and toroidal core, Magnetic Energy.	**9 Hours**
MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES Faraday's Law – Stationary and Motional EMFs – Maxwell's Equations in Differential and Integral forms, Electromagnetic Wave Equation – Propagation of Waves in free space and good conductor, Skin depth, Poynting theorem- Biological effects of electromagnetic waves, Introduction to Electromagnetic Simulation Software tool.	**9 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 45

Learning Resources

Textbooks

1. W. H. Hayt and John A. Buck, "Engineering Electromagnetics", 8th Edition, Tata McGraw Hill, New Delhi, 2018.
2. Matthew N.O. Sadiku, "Elements of Electromagnetics", 7th Edition, Oxford University Press, 2021.
3. Gangadhar K.A. and Ramanathan P.M., "Electromagnetic Field Theory", 5th Edition, Khanna Publishers, New Delhi, 2013.

Reference books

1. Pramanik, "Electromagnetism – Theory and applications", PHI Learning Pvt. Ltd., 3rd Edition New Delhi, 2018.
2. Pramanik, "Electromagnetism – Problems with solution", Prentice Hall India, 3rd Edition, New Delhi, 2015.
3. J.A. Buck and W. H. Hayt, "Problems and Solutions in Electromagnetics", 1st Edition, Tata McGraw Hill, New Delhi, 2010.
4. John D. Kraus and Daniel A. Fleisch, "Electromagnetics: With Applications", 6th Edition, Tata McGraw Hill, New Delhi, 2019.
5. Joseph A. Edminister, "Schaum's Outline of Theory and Problems of Electromagnetics", 5th Edition, Tata McGraw Hill, New Delhi, 2019.
6. N.N. Rao, "Elements of Engineering Electromagnetics", 7th Edition, Pearson Education, 2019.

Online Resources (Weblinks)

1. https://nptel.ac.in/courses/117103065
2. https://nptel.ac.in/courses/108106073
3. https://www.coursera.org/learn/electrodynamics-electric-magnetic-fields

Assessment (Theory course)

CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mrs. Rithika J C Titan Engineering and Automation	Dr. Mageshwari.S NIT, Trichy	Dr. T. Shanthi Department of EEE
Recommended by BoS on	14.08.2024	
Academic Council Approval	No: 27	**Date** 24.08.2024

24ECI102	ELECTRON DEVICES AND CIRCUITS (Common to EE, EC)	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	provide a solid foundation in the principles of semiconductor diodes and their applications.
2	equip students with the comprehensive knowledge on structure, operation, biasing and configurations of BJT and MOSFET.
3	develop analytical skills for applying small signal models of BJT and MOSFET amplifiers to determine gain and frequency response.
4	equip students with the ability to evaluate the performance of multistage, differential, and tuned amplifiers and predict their gain and frequency response.
5	foster an understanding of feedback, power amplifiers and oscillators and analyze their performance.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	apply the basics of semiconductor diodes to analyze the VI characteristics and operational behaviour.	Ap
CO 2	analyze the structure, operation, and biasing techniques of BJT and MOSFET devices.	An
CO 3	analyze the small signal models of BJT and MOSFET amplifiers to determine gain and frequency response.	An
CO 4	examine the performance of multistage, differential, and tuned amplifiers to predict their gain and frequency response	An
CO 5	distinguish between various feedback amplifiers and oscillator circuits and assess the efficiency of various power amplifier	An
CO 6	demonstrate the characteristics of semiconductor devices and frequency response of amplifiers.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2	1			1	1							
2	1	1	2		1	1							
3	1		2		1	1							
4	1		2		1	1							
5	1			1	1	1							

6	2				1	1							

Course Content

DIODES AND THEIR APPLICATIONS Structure, operation and VI Characteristics of PN junction diode, Zener diode - Diffusion and transition capacitances of PN junction diode - LEDs and Photo diodes - Applications of diodes: Clippers and Clampers - Half wave and Full wave rectifiers with filter - Zener voltage regulator.	**6 Hours**
Practical Component • Design of Clipper and Clamper circuit. • Half wave and full wave rectifiers with filter. • Design of Voltage regulator using Zener diode.	**9 Hours**
BJT AND MOSFET BJT - Structure, operation and VI characteristics - Load line, Quiescent point, CE, CB and CC configurations - Biasing: Fixed base bias, voltage divider bias, emitter bias - BJT as a switch. MOSFET - Structure, operation and VI characteristics - Enhancement and Depletion modes - Biasing of MOSFET: CS configuration - BJT vs MOSFET.	**10 Hours**
Practical Component • Characteristics of BJT under CE configuration. • Characteristics of MOSFET under CS configuration.	**6 Hours**
SMALL SIGNAL AMPLIFIERS USING BJT AND MOSFET BJT small signal model, Analysis of CE amplifier - Gain and frequency response - MOSFET small signal model: Analysis of CS Amplifier and Source follower, Gain and frequency response - High frequency analysis of BJT and MOSFET.	**10 Hours**
Practical Component • Frequency response of CE amplifier. • Frequency response of CS amplifier.	**6 Hours**
MULTISTAGE, DIFFERENTIAL AND TUNED AMPLIFIERS RC coupled amplifier, Differential amplifier - Common mode and Difference mode analysis, CMRR - Tuned amplifiers: Single tuned and double tuned - Gain and frequency response.	**9 Hours**
Practical Component • Analysis of RC coupled amplifier.	**3 Hours**
LARGE SIGNAL AMPLIFIERS AND OSCILLATORS Advantages of negative feedback - Voltage, Current, Series, Shunt feedback amplifiers - Power amplifiers: Class A, Class B and Class C amplifiers - Analysis of Class B push-pull power amplifier. Positive feedback - Conditions for oscillations, RC phase shift, Wien bridge Hartley, Colpitts and Crystal oscillators.	**10 Hours**
Practical Component • Analysis of Class B push-pull power amplifier. • Design of RC phase shift oscillator.	**6 Hours**

Theory Hours:	45	Tutorial Hours:	0	Practical Hours:	30	Project Hours:	0	Total Hours:	75

Learning Resources

Textbooks:
1. Jacob Millman, Christos C Halkias and Satyabrata Jit, Electron Devices and Circuits, Tata McGraw Hill, 4th Edition (2015). 2. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits-Theory and Applications, Oxford University Press, 7th Edition (2017).
References:
1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education,11th Edition (2015). 2. Thomas L. Floyd, Electronic Devices, Pearson Education, 9th Edition (2012). 3. David A. Bell, Fundamentals of Electronic Devices and Circuits, Oxford University Press, 5th Edition (2009).
Online Resources (Weblinks)
1. https://onlinecourses.nptel.ac.in/noc21_ee80/preview 2. https://onlinecourses.nptel.ac.in/noc20_ee89/preview

Assessment (Embedded course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Ms. T. Jeevaranjani, Bosch Global Software Technologies	Dr. I. S. Akila, Coimbatore Institute of Technology Dr. P. Palanisamy, NIT-Trichy	Dr. B. Gopinath, Ms. R. Dhivya Praba, Ms. A. Kalaiselvi, Mr. D. Allin Joe, Ms. T. Jaspar Vinitha Sundari, Dr. K. Paramasivam, Department of ECE	
Recommended by BoS on	13.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24INP103	INNOVATION PRACTICUM – II (Common to All branches)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	9, 11, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	equip students with essential tools and techniques for leveraging open-source technologies to develop proof-of-concepts and prototypes
2	provide hands-on experience and participants will gain a comprehensive understanding of the entire product development process
3	final prototyping, empowering them to transform their ideas into tangible outcomes

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	analyse the effectiveness of various electronic tools and techniques in product development processes	An
CO 2	develop and implement functional software prototypes using open-source tools	Ap
CO 3	design and fabricate 3D models using digital fabrication techniques	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	2	2	2									
2	2	2	2		2									
3	2	2	3	2	2									

Course Content

INTRODUCTION TO OPEN-SOURCE TOOLS AND TECHNIQUES Explore the concept of open-source, its underlying principles and its contrast with proprietary software, Discuss the advantages of using open-source tools, such as lower costs, increased innovation, educational value, and community support, walk through to the commonly used open-source tools for electronics design (KiCad, FreeCAD), software development (Python, Eclipse), and fabrication (Cura, LinuxCNC).	**3 Hours**
ELECTRONICS FUNDAMENTALS AND TOOLS Introduction to basic electronic components (resistors, capacitors, transistors, etc.), Understanding of electronic circuits and their functions, Hands-on practice with CircuitJS and Falstad, Simulating and analysing electronic circuits, Introduction to Arduino and Raspberry Pi, exploring their capabilities and applications, Designing PCBs using KiCad and EasyEDA, Understanding PCB fabrication processes	**6 Hours**
SOFTWARE PROTOTYPING AND TOOLS Benefits of rapid prototyping in product development, Iterative design and testing, Wireframing tools (Balsamiq, Figma), UI design tools (Sketch, Figma), Programming	**6 Hours**

languages (Python, JavaScript), Testing frameworks (Selenium), No-code platforms (Bubble, Adalo, Wix, AppGyver), Building functional prototypes without extensive coding	
FABRICATION AND PROTOTYPING Overview of fabrication techniques (3D printing, laser cutting, CNC machining), Prototyping methods for physical products, using tools like Blender, TinkerCAD, or Fusion 360, Creating 3D models for physical prototypes, Hands-on experience with laser cutting and engraving, Understanding their applications and limitations	**7 Hours**
SIMULATION & DEMONSTRATION Integrated project demonstration, explaining the design process, technical choices, and outcomes, simulation showcase to demonstrate their understanding of various technical tools and prototyping techniques	**8 Hours**

Theory Hours:	0	Tutorial Hours:	0	Practical Hours:	30	Project Hours:	0	Total Hours:	30

Learning Resources

Textbooks:

1. Damir Godec, Joamin Gonzalez-Gutierrez, Axel Nordin, Eujin Pei, Julia Ureña Alcázar, A guide to additive manufacturing, Springer – 2022. https://doi.org/10.1007/978-3-031-05863-9
2. Introducing SolidWorks, Dassault Systems.

References:

1. Insight into Electronics
2. Microcontroller Programming with Arduino and Python
3. Fundamentals of 3D modelling

Online Resources (Weblinks)

1. Google Play store apps:
   a. https://play.google.com/store/apps/details?id=com.electronicslab
   b. https://play.google.com/store/apps/details?id=it.android.demi.elettronica
2. https://engservices-ece.sites.olt.ubc.ca/files/2020/01/SolidWorks-3D-Printing-Tutorial-R2.pdf

Assessment (Practical course)

Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert from Industry	Expert(s) from Higher Education Institution	Internal Expert
Dr. Mahesh Veezhinathan Director - Innovation Practicum Associate VP - Forge. Innovation	-	Dr. Samuel Ratna Kumar P S Assistant Professor – III Department Mechanical Engineering

Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24HSP112	HOLISTIC WELLNESS-II (Common to all Department)	L	T	P	J	C
		0	0	2	0	1
HS		SDG	3, 4			

Pre-requisite courses	Holistic Wellness-I	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	build on the foundation laid in Holistic Wellness -I and deepening into the practices and principles of holistic wellness.
2	explore advanced techniques in mental, emotional, and spiritual well-being, with an emphasis on creating sustainable wellness habits.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	apply advanced techniques in mindfulness, meditation, and stress management.	Ap
CO 2	understand the role of community and social connections in wellness.	U
CO 3	develop resilience and adaptability in maintaining wellness.	E
CO 4	refine and sustain a personalized holistic wellness plan.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1						2		2						
2						2								
3						2					3			
4						2					3			

Course Content

ADVANCED MINDFULLNESS AND MEDITATION: • Deepening mindfulness practices for enhanced mental clarity. • Exploring different forms of meditation (e.g., guided, transcendental, movement-based). • Hands-on activity: Daily meditation practice and journaling reflections.	**6 Hours**
EMOTIONAL RESILIENCE AND MENTAL HEALTH: • Building emotional resilience through positive psychology practices. • Cognitive-behavioural strategies for managing stress and anxiety. • Hands-on activity: Developing and practicing a resilience toolkit.	**6 Hours**
SOCIAL AND ENVIRONMENTAL WELLNESS: • The impact of social connections and community on wellness. • Creating a supportive environment for personal growth. • Hands-on activity: Building a community wellness project or group activity.	**6 Hours**
INTERNAL GROWTH AND PURPOSE:	**6 Hours**

• Exploring the deeper aspects of internal wellness and self-actualization. • Reflective practices for discovering life purpose and meaning. • Hands-on activity: Creating a vision board or personal mission statement.	
SUSTAINING WELLNESS PRACTICES: • Strategies for maintaining wellness habits over the long term. • Adapting wellness plans to life changes and challenges. • Hands-on activity: Revising and finalizing a long-term personal wellness plan.	**6 Hours**

Theory Hours: 0	Tutorial Hours: 0	Practical Hours: 30	Project Hours:	Total Hours: 30

Learning Resources

Textbooks:

1. Hanh, Thich Nhat. The Miracle of Mindfulness: An Introduction to the Practice of Meditation. Beacon Press, Boston (1975).
2. Tolle, Eckhart. The Power of Now: A Guide to Spiritual Enlightenment. New World Library, Novato (1997).
3. Patel, Kamlesh. Heartfulness Way: Heart-Based Meditations for Spiritual Transformation, Kamlesh Patel, 2018.

References:

1. Goleman Daniel., Emotional Intelligence., Bloomsbury India, India, (2021).
2. James Allen., As a Man Thinketh., Maple Press, Noida, (2010)
3. Swami Budhanandha., Will power and its development., Advaita Ashrama Mayavati, Pithoragarh, Himalayas from its Publication Department, Calcutta. (2001)
4. Rosenberg, Marshall Bertram., Nonviolent Communication: A Language of Life., Puddle Dancer Press, Encinitas, CA (2015).
5. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
6. Lipton, Bruce., The Biology of Belief 10th Anniversary Edition: Unleashing the Power of Consciousness, Matter & Miracles, Hay House, Carlsbad (2015).
7. Kalderdon Adizes Ichak., What Matters in Life: Lessons I Learned from Opening My Heart
8. ., WS Press, Newtown, PA(2023).
9. Murphy, Joseph., The Power of Your Subconscious Mind [Original Edition (Complete)], Prentice-Hall, Englewood Cliffs (1963).
10. Kamlesh D. Patel., Designing Destiny: The Heartfulness Way, Heartfulness Institute, Chennai (2021)

Online Resources (Weblinks)

- Introduction to Psychology
- Guided Meditation
- Life skills and value education
- James Allen Library

Assessment (Practical course)

Participation, Practical activities and assignments, personal wellness plan and reflection.

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Dr. Ezhilarasi Principal- KCT

Recommended by BoS on			
Academic Council Approval	No: 27	**Date**	24.08.2024

24HSP005	Mastering Conversations	L	T	P	J	C
		0	0	2	0	1
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Demonstrate understanding of different perspectives by analyzing complex personal and professional situations.
2	Engage in thoughtful dialogue and discussions about complex, real-world issues, utilizing critical thinking to assess different viewpoints.
3	Apply role-playing as a tool to enhance understanding of workplace dynamics, conflict resolution, and team collaboration.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Empathize with and understand people in both professional and personal contexts, reflecting on situations from multiple perspectives and participating in activities that mirror career-related scenarios	Ap
CO 2	Analyse and converse critically on complex subjects, demonstrating the ability to approach and deal with various social contexts effectively	An
CO 3	Exhibit skills in role-playing and enacting given situations to navigate diverse social interactions and career-related contexts.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1		3						3	3		3			
2		3						3	3		3			
3		2						3	3		3			

Course Content

Roleplays Dynamics Introduction to Role play - Benefits of role plays - Importance of gesture, tone, and modulation-Skill development through role play activities - Types of role plays - Conversation Building through communicative functions-Initiating a dialogue- Framing questions- Receiving feedback	**6 Hours**
Roleplays on Social Skills Social Interactions: - (Ordering food at a restaurant- Making a reservation at a hotel-- Shopping at a store-- Attending a party or social gathering) Travel and Tourism:(Asking for directions- Booking a flight or hotel-- Exploring a new city- Interacting with local people) Community and Volunteering:(Participating in a charity event- Volunteering at a local organization- Discussing community issues- Organizing a community project)	**6 Hours**
Roleplays on Education and Technology	

Education and Personal Growth:(Setting goals-(Short term & Long term)- Creating a study plan- Participating in a workshop- Reflecting on personal growth) Technology and Online Interactions:(Participating in an online meeting Creating a social media post- Writing an email or text message- Making an online purchase) Technology and Science:(Explaining a scientific concept- Discussing emerging technologies- participating in Hackathons- Presenting a research paper)	**6 Hours**
Roleplays on Strategic Insights Critical Thinking :(Evaluating a news article-solving a moral dilemma-Decision with incomplete information-Assessing a historical event) Problem-Solving:(Resolving a conflict- Negotiating a deal - Making a complaint- Apologizing for a mistake) Business and Entrepreneurship:(Pitching an idea- Negotiating a contract Conducting a market Research- Presenting a product launch)	**6 Hours**
Roleplays on Cultural Exchange Cultural Exchange:(Sharing customs and traditions- Discussing cultural differences- Exploring historical events- Participating in a cultural festival) Media and Entertainment:(Event planning- Creating an advertisement-Digital Marketing-Conducting interviews- Creating news broadcast- Writing and Performing a script- Enacting one act plays) Arts and Culture:(Visiting an art gallery - Attending/ organizing a concert or play Discussing literature- Creating a piece of art)	**6 Hours**

Theory Hours:	0	Tutorial Hours:	0	Practical Hours:	30	Project Hours:	0	Total Hours:	30

Learning Resources

References:

1. Bonwell, C. C., & Eison, J. A. (1991). Active learning: Creating excitement in the classroom. Washington, DC: The George Washington University.
2. Harbour, E., & Connick, J. (2005). Role playing games and activities rules and tips. Retrieved from https://www.businessballs.com/roleplayinggames.htm
3. Lebaron, J., & Miller, D. (2005). The potential of jigsaw role playing to promote the social construction of knowledge in an online graduate education course. Retrieved from http://paws.wcu.edu/jlebaron/Jigsaw-FnlTCRpdf_050812.pdf
4. Davies, A. (2018). Teaching and learning through role-play: A practical guide. Maidenhead, UK: McGraw-Hill Education.
5. Young, K. C. (2016). The art of role play: Developing realistic scenarios for skill development. Boston, MA: Pearson.
6. Yardley-Matwiejczuk, K. M. (1997). Role play: Theory and practice. London, UK: SAGE Publications Ltd.

Assessment (Practical course)

Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr.Vijayan Ramanathan, Project manager, Toppan Merrill. Technologies, Coimbatore	1. Dr. Aninditha Sahoo, IIT, Madras 2. Dr.P.R.Sujatha Priyadharshini, Anna University Chennai 3. Dr. E.Justin Ruben, CIT, Coimbatore	1. Dr. Arokia Lawrence Vijay 2. Dr. Tissaa Tony Department of Languages and Communications

Recommended by BoS on	16.08.2024		
Academic Council Approval	No:27	**Date**	24.08.2024

24MAI233	PROBABILITY AND APPLIED STATISTICS (Common to EE, EI)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	3, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	Statistical Table

Course Objectives:

The purpose of taking this course is to:

1	introduce the concept of random variables and their probability theory.
2	provide knowledge on probability distributions, correlation, and regression analysis.
3	apply hypothesis testing for small and large sample data.
4	explain the principles of experimental design and analysis of variance.
5	expose students to statistical quality control tools and their applications in industrial processes.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	categorize and illustrate different types of random variables and the concepts of probability, conditional probability, and Bayes' theorem	An
CO 2	apply standard discrete and continuous distributions such as Binomial, Poisson, and Normal distributions to real-life statistical problems.	Ap
CO 3	analyze and interpret the correlation and regression relationships for discrete data.	An
CO 4	test the hypothesis using Z and Chi-square tests for large sample data and t and F tests for small sample data.	An
CO 5	make use of ANOVA techniques in experimental design and interpret the results.	Ap
CO 6	construct and interpret control charts for process monitoring.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2			2									
2	3	3			2									
3	3	3		2	2									
4	3	3		2	2				1					
5	3	3		2	2				1					
6	3	3		1	2				1					

Course Content

PROBABILITY AND RANDOM VARIABLES Axioms of probability – Conditional probability – Total probability – Bayes' theorem Random variable – Distribution function – properties – Probability mass function Probability density function **Practical Component** • Introduction to R programming • Application of descriptive statistics – Mean, Median, Mode and standard deviation	**10 Hours** **6 Hours**
CORRELATION AND STANDARD DISTRIBUTIONS Correlation (Discrete Data): Karl Pearson's Correlation coefficient - Regression lines (Discrete Data) - Binomial, Poisson and Normal distributions **Practical Component** • Applications of Correlation and Regression • Application of Normal distribution	**11 Hours** **8 Hours**
TESTING OF HYPOTHESIS Testing of hypothesis for large samples (single mean, difference of means) – Small sample tests based on t and F distributions (single mean, difference of means, paired t-test and variance ratio test) – Chi-square test for independence of attributes and goodness of fit **Practical Component** • Application of Student – t test • Application of F test • Application of Chi-square test	**9 Hours** **6 Hours**
DESIGN OF EXPERIMENTS Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – Randomized BlockDesign (RBD) – Latin Square Design (LSD). **Practical Component** • ANOVA – one way classification • ANOVA – two-way classification	**9 Hours** **6 Hours**
STATISTICAL QUALITY CONTROL Concept of process control - Control charts for variables: Mean and Range charts – Control charts forattributes: p, np, c – charts. **Practical Component** • Control charts for variables (mean and range chart)	**6 Hours** **4 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**75**

Learning Resources

Textbooks:

1. Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw Hill, third edition, 2017.
2. Gupta S. P, Statistical Methods, Sultan Chand & Sons Publishers, 2021.

References:

1. Johnson R. A., Miller & Freund's Probability and Statistics for Engineers, ninth Edition, Pearson Education, Delhi, 2017.
2. Gupta. S.C and Kapoor. V.K, Fundamentals of Mathematical Statistics, Eleventh extensively revised edition, Sultan Chand & Sons, 2020.
3. Montgomery D. C., Design and analysis of experiments, tenth Edition, Wiley, 2019.
4. Gupta S.C, and Kapur V.K Fundamentals of Applied Statistics, Sultan Chand, New Delhi, fourth Edition, 2014.
5. Grant, E. L., & Leavenworth, R. S. Statistical quality control, Seventh edition, McGraw-Hill, 2017.

Online Resources (Weblinks)

1. Probability and random variables:
https://www.coursera.org/learn/foundations-of-probability-and-random-variables
2. Testing of Hypothesis
https://archive.nptel.ac.in/courses/103/106/103106120/
3. Design of Experiments:
https://www.coursera.org/learn/anova-and-experimental-design
4. Control Charts:
https://www.coursera.org/learn/stability-and-capability-in-quality-improvement#modules

Assessment

SA I and SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
1. Dr. R Vasu Business Excellence and Management Systems Consultant Specialisation in Process Excellence, Six Sigma Quality, Health Safety & Environment Systems Vice President (Retired) Brakes India.	1. Dr. M. Sivakumar Assistant Professor Sr. Grade Vellore Institute of Technology, Vellore 2. Dr. Ramesh Babu Assistant Professor (SG) Amrita University Coimbatore, Tamil Nadu.	1. Dr. A. Ezhilarasi Assistant Professor III Department of Mathematics 2. Dr. R. Krishna Moorthy Assistant Professor III Department of Mathematics

Recommended by BoS on	25.4.2025		
Academic Council Approval No.	28	**Date**	26.06.2025

24EEI201	DC Machines and Transformers	L	T	P	J	C
		2	0	2	0	3
PC		SDG	7, 9, 12			

Pre-requisite courses	24EEI101	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	impart a strong theoretical foundation in the operating principles and construction of DC Machines and Transformers.
2	equip students with analytical and practical skills in conducting tests, evaluating performance, interpreting data, and diagnosing issues in machines and transformers.
3	familiarize students with modern and sustainable trends in DC machine operation and application areas like EVs and drones.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the fundamentals of Electromagnetic induction to examine the construction, working principle, and load behaviour of conventional and modern DC Machines.	Ap
CO 2	Analyze torque-speed behaviour, speed control methods, and braking techniques of DC motors for efficient motion control.	An
CO 3	Assess the steady-state and dynamic performance of single-phase transformers under various operating conditions.	Ap
CO 4	Apply selection criteria and control strategies for DC machines in applications such as electric mobility, renewable energy systems, and industrial automation.	Ap
CO 5	Examine the operational suitability and energy efficiency of transformer configurations through real-time case studies and smart grid applications.	An
CO 6	Conduct and interpret laboratory experiments and simulations on DC machines and transformers to validate theoretical concepts and performance parameters.	An

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO1	3		1									2	
CO2	3	2	1		1							3	
CO3	3	3			1							3	
CO4	2	2	2		2	1						3	3
CO5	2	2	2		2	1						3	2
CO6	3	3		2	3		2	3			2	2	3

Course Content	
DC MACHINES – EVOLUTION FROM CLASSICAL TO SUSTAINABLE MACHINES Fundamentals of DC Machines – DC Machine as Generator and Motor – Generated EMF and Back EMF – Torque Equation – Types of DC Machines: Shunt and Series – Characteristics – Speed Control of DC Motor - Types of Starters – Armature Reaction - Mechanical vs. Electronic Commutation – Introduction to Sustainable Materials in DC Machines – **Emerging Technologies:** Introduction to BLDC motors, Hybrid DC Generators and Coreless DC Motors. **Practical Component** • Energy Efficiency Assessment of a DC Shunt Motor using Brake Test • Dynamic Load Response Analysis of a DC Series Motor for Traction Applications • Loss Segmentation and Efficiency Benchmarking in a DC Shunt Motor	**10 Hours** **12 Hours**
TRANSFORMERS – FUNDAMENTALS TO FIELD APPLICATIONS Construction and Working Principle of Power Transformers – EMF Equation – Transformer on No Load and Load: Phasor Diagrams – Voltage Regulation – Equivalent Circuit - Parallel Operation of Transformers –Auto Transformers: Introduction and Applications **Practical Component** • Load Testing and Voltage Regulation of a Single-Phase Transformer • Open Circuit and Short Circuit Test on a Single-Phase Transformer	**10 Hours** **8 Hours**
CASE STUDIES IN DC MACHINES AND TRANSFORMERS IEEE & IEC Standards for Machines and Transformers – Performance-based Motor Selection for Paper Mills, Steel Plant, Rolling Mills and Drone Applications- Losses and Efficiency Calculations. **Case Study:** DC Motors in Indian Metro Traction – Regenerative Braking **Case Study:** Speed Control Techniques for DC Motors - Battery-operated Rickshaws **Case Study:** DC Generators in Renewable Energy Systems (Off-grid Solar & Wind) **Practical Component** • Performance Profiling of a DC Shunt Generator under Varying Load Dynamics • Speed Control of DC Shunt Motor • Study of Digital Twin and Smart Transformer monitoring using IoT/Simulation Tools	**10 Hours** **10 Hours**
Theory Hours: 30 **Tutorial Hours:** **Practical Hours: 30** **Project Hours:** **Total Hours: 60**	

Learning Resources

Textbooks

1. A.E. Fitzgerald, Charles Kingsley, and Stephen D. Umans, "Electrical Machinery", McGraw Hill Education, 2019.
2. I.J. Nagrath and D.P. Kothari, "Electric Machines", Tata McGraw-Hill Education, 2017.

Reference books

1. Ashfaq Husain, "Electric Machines", Dhanpat Rai & Co., New Delhi, 2018.
2. Nagsarkar, T.K., and Sukhija, M.S., "Electrical Machines", Oxford University Press, 2017.
3. Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw Hill Education, 2018.
4. M. Narayana, and T. S. Madhusudhan, "Electrical Machines: Theory and Practical Applications", PHI Learning Pvt. Ltd., 2016.
5. J.B. Gupta, "Theory and Performance of Electrical Machines", S.K. Kataria & Sons, 2017.

Online Resources (Weblinks)

1. **NPTEL**: https://nptel.ac.in/courses/108/104/108104121/
2. **MIT OpenCourseWare**: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-520j-electric-machines-fall-2006/
3. **Coursera - University of Michigan**: https://www.coursera.org/learn/control-of-electrical-drives
4. **EdX - University of Toronto**: https://www.edx.org/course/electric-motor-drives

Assessment (Embedded course)			
SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce			
Course Curated By			
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**		**Internal Expert(s)**
Mr. Mahesh Kumar D., Lead Initiatives, Janatics Global Solutions Ltd.	Dr Albert Alexander, Associate Professor Vellore Institute of Technology		Dr.K.Malarvizhi, Professor/EEE S.Arun Kumar, AP/EEE
Recommended by BoS on	**07.05.2025**		
Academic Council Approval	No: 28	**Date**	**26.06.2025**

24EEI202	INSTRUMENTATION SYSTEMS	L	T	P	J	C
		2	0	2	0	3
PC		SDG	9, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	impart a fundamental knowledge on principles and operation of various electrical measuring instruments used for quantifying electrical parameters.
2	provide students with analytical skills in solving various configuration of bridge circuits, for the precise measurement of resistance, inductance, and capacitance.
3	equip students with the knowledge and skills to design and implement basic data acquisition systems using transducers and sensors.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the principles of various electrical measuring instruments to quantify electrical parameters in different applications.	Ap
CO 2	Analyze different DC and AC bridges to determine unknown resistance, inductance, and capacitance	An
CO 3	Interpret the characteristics and applications of various transducers for specific applications	An
CO 4	Illustrate the operation of data acquisition systems and smart sensors.	Ap
CO 5	Demonstrate the use of digital instruments for real-time electrical measurements.	Ap
CO 6	Demonstrate the use of sensors in laboratory experiments and develop application-based projects	An

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO1	2				1								2
CO2	3	2											2
CO3	2	2	3		1			2	1			2	3
CO4	3	2	2		2			2	1			2	3
CO5	3	2	3		2			2	1			2	3
CO6	3	2	3		2			2	1			2	3

Course Content

MEASUREMENT OF ELECTRICAL QUANTITIES Functional elements of an instrument – Standards, errors and calibration - PMMC Ammeter: Working principle – Measurement of high voltage and high current using Instrument Transformers – Digital Instruments: Digital Voltmeter -Dual slope DVM, Digital Ammeter, Multimeter & Energy meter, DSO – Digital frequency meter - Power quality analyzers. **Case Study:** Analysing Energy Export and Import of a solar panel using net metering **Practical Component** • Measurement of voltage, frequency, power factor using DSO • Measurement of Energy.	**10 Hours** **6 Hours**
RESISTANCE, INDUCTANCE AND CAPACITANCE MEASUREMENT DC bridges: Kelvin double bridge, Wheat stone bridge, Megger - AC bridges: Maxwell's inductance bridge - Schering bridge - Wein bridge -LCR meter. **Practical Component** • Wheatstone Bridge for measurement of Resistance. • Schering Bridge for measurement of Capacitance.	**8 Hours** **6 Hours**
TRANSDUCERS AND APPLICATIONS Transducer: Classification and selection - Strain gauges - LVDT- Thermocouples – Thermistor - Piezo Electric Transducer - Ultrasonic Transducer -Speed measurement using Encoder - Hall effect sensor, Smart sensors – IOT based Data Acquisition Systems - Signal conditioning and telemetry -Basic concepts of MEMS and nano sensors. **Practical Component** • Temperature Transducer. • Measurement of displacement using LVDT. • Design Project: Applications of Sensor.	**12 Hours** **6 Hours** **12 Hours**

Theory Hours:	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:
30	0	30	0	60

Learning Resources

Textbooks

1. E. A. Doebelin, 'Measurement Systems - Applications and Design', 5th Edition, Tata McGraw Hill, New York, 2007.
2. K. Sawhney, 'A Course in Electrical & Electronic Measurement and Instrumentation', Dhanpat Rai and Co (P) Ltd., 2015.

Reference books

1. R.K. Rajput, 'Electrical and Electronic Measurements and Instrumentation', S Chand & Company, 2015.
2. D. V. S. Murty, 'Transducers and Instrumentation', 2nd Edition, PHI Learning Private Ltd (Prentice Hall India), 2022.
3. John G. Webster (Ed.), 'Measurement, Instrumentation, and Sensors Handbook', 2nd Edition, CRC Press, 2014.
4. David A.Bell, 'Electronic Instrumentation & Measurements', 3rd Edition, Oxford University Press India, 2013.

Online Resources (Weblinks)

1. https://onlinecourses.nptel.ac.in/noc24_ee117
2. https://elms-iitr.vlabs.ac.in/

Assessment (Embedded course)

SA I and SA II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
Rithika J C, Associate Lead, Titan Engineering and Automation Pvt. Ltd	Dr. Uma shankar S, Associate Professor Prince Sultan University, Riyadh	Dr. K. Premalatha, ASP/EEE Dr .R .Kavitha, ASP/EEE
Recommended by BoS on	**07.05.2025**	
Academic Council Approval	No: 28	26.06.2025

24ECI203	Linear Integrated Circuits (Common to ECE, EEE, E&I)	L	T	P	J	C
		3	0	2	0	4
PC		SDG	3, 9			

Pre-requisite courses	24ECI102, 24EII101	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Introduce operational amplifiers, their structure, configurations, and characteristics.
2	Enable the students to design and analysis of analog circuits using op-amps and special ICs.
3	Equip the students to use the filters and waveform generators in appropriate applications.
4	Provide the knowledge on Analog to Digital and Digital to Analog techniques.
5	Equip the students to acquire practical skills through hands-on experiments with linear integrated circuits.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Describe op-amp structure, stages, and characteristics through basic experiments.	U
CO 2	Analyze and implement inverting, non-inverting, and differential amplifiers using op-amps.	An
CO 3	Analyze op-amp circuits such as adders, subtractors, integrators, differentiators, clippers, and clampers.	An
CO 4	Design and evaluate filters and waveform generators using op-amps and IC 555.	C
CO 5	Apply DAC and ADC techniques using R-2R, weighted resistor, flash, SAR, and dual-slope converters.	Ap
CO 6	Evaluate voltage regulator ICs through experiments and analyse the working of PLLs and VCOs in frequency control and modulation.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2											
2	3	3	2										
3	3	3	2	2									
4	3	2	3	2	2				1				
5	3	2	2	2	2								
6	3	2	2	2	1				1				

Course Content	
BASICS OF OPERATIONAL AMPLIFIERS Basics of Operational Amplifiers – Ideal Operational Amplifier – General operational amplifier stages and internal circuit diagrams of IC 741, DC and AC performance characteristics, Open and closed loop configurations – Voltage follower, Inverting amplifier, Non-inverting amplifier, Differential amplifier. **PRACTICAL COMPONENT** • Inverting and non-inverting amplifiers	**9 Hours** **3 Hours**
APPLICATIONS OF OPERATIONAL AMPLIFIERS Adder and subtractor, Instrumentation amplifiers, V-to-I and I-to-V converters, Differentiators and Integrators, Precision rectifiers, Wave shaping circuits (Clipper and Clampers), Log and Antilog amplifiers, Analog voltage multiplier circuit and its applications, Comparators, Schmitt trigger. **PRACTICAL COMPONENT** • Adder and subtractor • Integrator and differentiator • Clipper and clamper	**9 Hours** **9 Hours**
FILTERS AND WAVEFORM GENERATORS Filters: Comparison between passive and active filters, Active filters: Low-pass, high-pass and band-pass filters – Waveform Generators: Sine, Square, Triangle, Sawtooth wave generators – IC 555 Timer: Monostable operation and its applications, Astable operation and its applications. **PRACTICAL COMPONENT** • Active filters • Waveform generation • Astable and Monostable multivibrators using IC 555 Timer	**9 Hours** **9 Hours**
DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS D/A converter: Specifications, Weighted resistor type, R-2R ladder type – Sample and hold circuit – A/D Converter: Specifications, Flash type, Successive Approximation type, Dual Slope type, Sigma-delta converter. **PRACTICAL COMPONENT** • Digital to Analog conversion • Analog to Digital conversion	**9 Hours** **6 Hours**
SPECIAL FUNCTION ICs IC Voltage regulators: Three terminal fixed and adjustable voltage regulators, IC 723 general purpose regulator, Monolithic switching regulator – Frequency to Voltage and Voltage to Frequency converters – PLL: Operation of PLL, Voltage Controlled Oscillator, PLL applications: AM and FM detection, FSK modulation and demodulation and frequency multiplier. **PRACTICAL COMPONENT** • IC Voltage regulator	**9 Hours** **3 Hours**

Theory Hours:	45	Tutorial Hours:	0	Practical Hours:	30	Project Hours:	0	Total Hours:	75

Learning Resources
Textbooks
1. D. Roy Choudhry and Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 6th Edition (2021). 2. Ramakant A. Gayakwad and Rekha S., Op-Amps and Linear Integrated Circuits, Pearson Education, 4th Edition (Revised) (2021).

Reference books
1. Jacob Millman, Christos Halkias and Chetan Parikh, Integrated Electronics, McGraw Hill Education, 2nd Edition (2018).
2. Coughlin Robert F. and Driscoll Frederick F., Operational Amplifiers and Linear Integrated Circuits, PHI, 6th Edition (2011). 3. S Salivahanan and V. S. Kanchana Bhaskaran, Linear Integrated Circuits and Applications, McGraw Hill Education, 1st Edition (2018).
Online Resources (Web Links)
1. https://onlinecourses.nptel.ac.in/noc24_ee73/preview 2. https://onlinecourses.nptel.ac.in/noc20_ee13/preview 3. https://training.ti.com/ti-precision-labs-op-amps Open source software tools 4. Falstad Circuit Simulator: https://www.falstad.com/circuit/

Assessment (Embedded course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated By			
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**		**Internal Expert(s)**
Mr. S. Chella Kumar, Staff CAD Engineer, Infinera India Pvt. Ltd., Bengaluru. Ms. Candida John, Sembcorp Energy India Limited.	Dr.V.P.Harigovindan, National Institute of Technology-Puducherry. Dr. Albert Alexander, VIT Vellore.		Dr. P. Thirumoorthi, Department of EEE, Dr. B. Gopinath, Department of ECE, Mr. M. V. Umesh, Department of E & I.
Recommended by BoS on	30.04.2025		
Academic Council Approval	No: 28	**Date**	26.06.2025

24EEI203	DIGITAL SYSTEM DESIGN (Common to ECE, EEE, E&I)	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9,12			

Pre-requisite courses	24ECI102 /24EII201	Data Book / Codes book (If any)	–

Course Objectives:

The purpose of taking this course is to:

1	Impart foundational knowledge of number systems, binary codes, Boolean algebra, and logic simplification techniques.
2	Develop analytical and practical skills in designing and implementing combinational and sequential circuits
3	Build competency in digital system design using state machine, programmable logic devices like FPGA and Verilog HDL programming.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply number systems and Boolean algebra to design basic digital circuits.	Ap
CO 2	Design and analyze the structure and functionality of various combinational circuits.	**An**
CO 3	Interpret the logic flow of sequential circuits and analyze their performance under different design constraints.	An
CO 4	Examine state transitions and circuit behaviour in synchronous sequential circuits using state diagrams and tables	An
CO 5	Apply Verilog HDL constructs with various modelling styles to simulate and test digital logic circuits.	Ap
CO 6	Develop, simulate and implement digital systems using logic gates and simulation tools	E

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO1	3	1	1										
CO2	3	2	1										
CO3	3	3	1										
CO4	2	2	2										
CO5	2	2	2		2								
CO6	3	3	2		3			2	2				

Course Content	
FUNDAMENTALS OF DIGITAL SYSTEMS Review of number systems, Logic gates, Binary codes and code converters - Boolean algebra and theorems - Sum of Product and Product of Sum simplification - Canonical forms - minterm and maxterm - Simplification of Boolean expressions - Karnaugh map (upto 4 variables). Basic IC Terminologies, Characteristics of Digital Logic families: TTL, ECL and CMOS logic. **Practical Component** • Implementation of Boolean Function using Gates. • Implementation of code converters using K-map	**9 Hours** **6 Hours**
DESIGN OF COMBINATIONAL LOGIC CIRCUITS Design of Combinational Circuits: Adders, Subtractors, Parallel Adder, Carry Look Ahead Adder, Digital Comparator, Parity Generator/Checker, Encoder, Decoder, Multiplexer, De-Multiplexer, Implementation of Boolean function using Multiplexer. **Practical Component** • Design and implementation of Adder / Subtractor circuits. • Design of combinational circuit using MUX/DEMUX.	**9 Hours** **6 Hours**
SEQUENTIAL LOGIC CIRCUITS Latches and Flip Flops: SR, JK, T and D , Characteristic Equation, Excitation Table, Types of Triggering, Master Slave Flip Flop - Counters: Synchronous, Asynchronous Counter, Modulo-N Counter, Ring Counter - Shift Registers and its types. **Practical Component** • Design and implementation of Synchronous Counter. • Design and implementation of Asynchronous Counter.	**9 Hours** **6 Hours**
STATE MACHINE DESIGN AND FPGA Classification of Sequential Circuits: Moore and Mealy Model, Design of Synchronous Sequential Circuit: State Diagram, State Table, State Reduction, State Assignment, Hazards in sequential circuits - Introduction to PLD and FPGA architectures. **Practical Component** • Design and implementation of synchronous sequential circuits	**9 Hours** **3 Hours**
VERILOG HDL PROGRAMMING Overview of Digital Design with Verilog HDL- Basic concepts- Modules and Ports- Gate-Level Modeling- Dataflow Modeling- Behavioral Modeling-Verilog HDL programming examples: gates, multiplexer, encoders, adders, flip flops, counters. **Practical Component** • Simulation of Combinational Logic using Verilog HDL • Simulation of Sequential Logic using Verilog HDL • Realization of simple digital module in FPGA	**9 Hours** **9 Hours**
Theory Hours: 45 **Tutorial Hours:** **Practical Hours: 30** **Project Hours:** **Total Hours: 75**	

Learning Resources
Textbooks
1. M. Morris Mano, "Digital Logic and Computer Design", Pearson India Education Services Pvt. Ltd., New Delhi, 2018. 2. Samir Palnitkar, "Verilog HDL A guide to Digital Design and Synthesis" 2nd edition, Pearson, 2003.

Reference books

1. M. Morris Mano and Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", Pearson India Education Services Pvt. Ltd., New Delhi, 2017.
2. Thomas L. Floyd, "Digital Fundamentals", 11th Edition, Pearson Education Limited, 2021.
3. Raj Kamal, "Digital Systems: Principles and Design", 3rd Edition, Pearson Education Limited, 2014.
4. John M. Yarbrough, "Digital Logic: Applications and Design", West Publishing Company, 2006.
5. David J. Comer, "Digital Logic & State Machine Design", Oxford University Press, 2012.

Online Resources (weblinks)

1. https://onlinecourses.nptel.ac.in/noc21_ee39/preview
2. https://www.coursera.org/learn/digital-systems
3. https://nptel.ac.in/courses/108106086

Open Source Software Tools

4. https://www.yosyshq.com/
5. https://circuitverse.org/simulator/
6. https://www.falstad.com/circuit/

Assessment (Embedded course)

SA I and SA II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions		Internal Expert(s)
Mr.S.P.Prasaanth, Senior Verification Engineer, Dyson Operations, Singapore Ms.Suganya M, Lead Sotware Engineer Bosch Global Software Technologies PVT Ltd	Dr..P.Palanisamy, Professor, National Institute of Technology, Trichy		Dr. K.Paramasivam, Professor/ EEE Dr. B. Gopinath, ASP/ECE Dr. I. Jeya Daisy, AP/ EIE
Recommended by BoS on	07.05.2025		
Academic Council Approval	No: 28	**Date**	26.06.2025

24INP201	Innovation Practicum - 3	L	T	P	J	C
		0	0	2	0	1
ES		SDG	4, 9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Develop a deep understanding of the innovation process and apply customer-centric thinking to innovation
2	Evaluate the feasibility and viability of innovation ideas.
3	Optimise innovation projects for efficiency and effectiveness and communicate the ideas effectively.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Analyse the various stages of innovation and their interdependencies	An
CO2	Create innovative solutions that address specific customer needs	C
CO3	Evaluate the potential impact and risks of different innovation concepts and present them clearly and persuasively.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	2	2	2									
2			3	2			2		2					
3									2	3				

Course Content

Idea Worth Prototyping Discuss potential risks and challenges associated with innovative ideas - Learn to refine and validate the initial concept - Develop a plan outlining key milestones and timelines for advancing from idea to prototype.	**3 Hours**
Framing the Challenge Define the specific problem or opportunity that the innovation aims to address, understand customer needs and preferences - Identify the gaps in the market and potential obstacles to adoption, assess the potential market size, competition, and feasibility.	**6 Hours**
Crafting High-Value Solutions Generate Minimum Usable Prototype (MUP) concepts that address the identified challenge that provide high value, evaluate the potential of each solution concept based on criteria like feasibility, viability, and desirability.	**6 Hours**

Optimization and Planning Create Bill of Quantities (BOQ) and Bill of Materials (BOM) to estimate costs and resources - Develop a comprehensive innovation proposal outlining the innovation concept, goals, and benefits - Implement Lean principles to improve efficiency and reduce waste in the innovation process - Reflect on the activities to identify areas for improvement and learning.	**7 Hours**
Project Presentation Develop and deliver a compelling presentation of your minimum usable prototype (MUP) and innovation solution to effectively communicate its value and impact to a broader audience - Create a visually engaging presentation that clearly outlines the problem, the proposed solution, and the value of your minimum usable prototype - Utilise tools such as slides, infographics, and videos to enhance the visual appeal - Craft a compelling story around your innovation - Highlight the journey from problem identification to solution development, emphasising key insights and milestones.	**8 Hours**

Theory Hours:	0	Tutorial Hours:	0	Practical Hours:	30	Project Hours:	0	Total Hours	30

Learning Resources

References:

1. Everything you need about value proposition: https://blog.forgeforward.in/everything-you-need-to-know-about-value-proposition-7247493c9 40c
2. Test your Value Proposition: http://businessmodelalchemist.com/2012/09/test-your-value-proposition-supercharge-lean-s tartup-and-custdev-principles.html
3. Valuation Risk versus Validation Risk in Product Innovations: https://blog.forgeforward.in/valuation-risk-versus-validation-risk-in-product-innovations-49f25 3ca8624
4. User Guide for Product Innovation Rubric: https://blog.forgeforward.in/user-guide-for-product-innovation-rubric-857181b253dd
5. Innovation Risk Diagnostic — Product Innovation Rubric: https://blog.forgeforward.in/product-innovation-rubric-adf5ebdfd356
6. Evaluating Product Innovations — proof, potential, & progress:https://blog.forgeforward.in/evaluating-product-innovations-e8178e58b86e

Online Resourse (Weblinks)

5. https://formlabs.com/blog/ultimate-guide-to-prototyping-tools-for-hardware-and-product-desi gn/
6. https://docs.kicad-pcb.org/
7. https://www.tinkercad.com/learn/circuits
8. https://docs.github.com/en/free-pro- team@latest/actions/guides

Assessment (Practical course)

Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Dr. Mahesh Veezhinathan Director - Director Forge. Academy	-	Dr. Samuel Ratna Kumar P S Assistant Professor – III Department Mechanical Engineering

Recommended by BoS on	07/05/2025		
Academic Council Approval	No: 28	**Date**	26/06/2025

24INM201	Universal Human Values II: Understanding Harmony (Common to All Branches)	L	T	P	J	C
		1	0	0	0	1
HS		SDG	3, 14, 15			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Introduce the concept and significance of value education in shaping a meaningful and fulfilling life.
2	Enable students to understand the human being as a co-existence of self and body and the harmony within.
3	Develop an understanding of harmony in relationships, family, and society.
4	Help students appreciate the interconnectedness and harmony in nature and existence.
5	Instill the importance of ethical behaviour in personal, professional, and social contexts.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Understand the foundational concepts of value education and human aspirations.	U
CO2	Analyze the human being as a holistic entity comprising self and body.	An
CO3	Evaluate and cultivate harmonious relationships within the family and society.	E
CO4	Interpret the interconnectedness in nature and recognize harmony in existence.	U
CO5	Apply holistic understanding to professional ethics and sustainable living.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1						3	3	3	3		3			
2						3	3	3	3		3			
3						3	3	3	3		3			
4						3	3	3	3		3			
5						3	3	3	3		3			

Course Content

Introduction to Value Education Value Education- Self-exploration as the Process for Value Education- Basic Human Aspirations and their Fulfilment- Right Understanding, Relationship and Physical Facility- Happiness and Prosperity – Current Scenario- Method to Fulfil the Basic Human Aspirations.	**3 Hours**
Harmony in the Human Being Human Being as Co-existence of the Self and the Body- Distinguishing between the Needs of the Self and the Body- The Body as an Instrument of the Self- Understanding Harmony in the Self- Harmony of the Self with the Body- Programs to Ensure Self-regulation and Health.	**3 Hours**

Harmony in the Family and Society Harmony in the Family –The Basic Unit of Human Interaction-'Trust' – The Foundational Value in Relationship-Respect – As the Right Evaluation- Other Values in Human-to-Human Relationship- Understanding Harmony in the Society Lecture Vision for the Universal Human Order.	**3 Hours**
Harmony in the Nature (Existence) Understanding Harmony in Nature- Interconnectedness, Self-regulation and Mutual Fulfilment among the Four Orders of Nature- Realizing Existence as Co-existence at All Levels- The Holistic Perception of Harmony in Existence.	**3 Hours**
Implications of the Holistic Understanding- A Look at Professional Ethics Basis for Universal Human Values-Definitiveness of (Ethical) Human Conduct - professional Ethics in the Light of Right Understanding-A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Holistic Technologies, Production Systems-and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession	**3 Hours**

Theory Hours: 15	**Tutorial Hours**	**Practical Hours:**	**Project Hours:**	**Total Hours: 15**

Learning Resources

Textbooks:

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

Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

References:

Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, Jeevan Vidya:Publishers, 1999.

Online Resources (Weblinks)

https://www.uhv.org.in/uhv-ii

Assessment (Theory course)

Presentation, MCQ, Assignment, Case Study and E Chart.

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
	Sh. Umesh Jadhav, NCCIP (National Co-oridnation Committee)-AICTE	Dr.S.Sivakumar, Associate Professor, SFS Dr.R.Prakasam, Assistant Professor, Department of Physics Mr.J.Sivaguru, Assistant Professor, Department of Mechatronics

Recommended by BoS on	03-05-2025		
Academic Council Approval		**Date**	26-06-2025

24EEJ204	Internship - I	L	T	P	J	C
		0	0	0	0	1
PRJ		SDG	7,9,12,13			

Pre-requisite courses	–	Data Book / Code book (If any)	–

Course Objectives:	
The purpose of taking this course is to:	
1	Provide awareness of current technologies, tools, and trends in electrical and electronics industries through hands-on exposure and interaction with industry professionals.
2	equip students with an understanding of industrial safety protocols, engineering standards, and professional ethics.
3	To enhance problem-solving abilities and innovation through observation, interaction with industry professionals.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the knowledge of electrical and electronics engineering to practical industrial task, projects and problem-solving scenarios	Ap
CO 2	Adhere to industrial safety norms, standards, and ethical practices relevant to engineering workplaces.	Ap
CO 3	Evaluate the functioning and performance of electrical equipment, control systems, and industrial processes.	E
CO 4	Prepare technical documentation and effectively communicate project findings in both written and verbal formats.	An
CO 5	Demonstrate teamwork, adaptability, and professional behaviour while working in a multidisciplinary industrial environment	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	2	2	3				1		2	3	3
2	2	2			2	2	3		1		2	2	2
3	3	3	2	2	3			2	1		2	3	3
4	2	1	1	1	2			2	3		2	2	2
5	2	2	1			2	2	3	2	3	2	2	2

Assessment
Presentation and Internship Report

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
-	-	[Dr. P. Thirumoorthi, Prof/EEE Dr. R. Kavitha, ASP/EEE]

24HSP006	Mastering Group Discussion and Presentation Skills	L	T	P	J	C
		0	0	2	0	1
Practical		SDG	4&8			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to:
1	To equip learners with techniques for organizing and presenting ideas effectively, ensuring logical flow and engaging delivery through appropriate visual and verbal strategies.
2	To enhance students' ability to evaluate diverse viewpoints and articulate reasoned arguments, fostering meaningful participation in collaborative discussions.
3	To strengthen students' ability to adapt their speaking style and content to different audiences and contexts, utilizing digital tools for enhanced presentation effectiveness.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Create and deliver structured presentations with a clear introduction, body, and conclusion, utilizing effective visual tools and appropriate pacing to enhance clarity and impact.	C
CO 2	Analyse issues from multiple perspectives, articulate ideas effectively within group discussions	An
CO 3	Deliver confident presentations and speeches in professional and social settings, leveraging digital tools and technologies to enhance quality and effectiveness.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1		2			1	2		3	3		3			
2		2			1	2		3	3		3			
3		2			1	2		3	3		3			

Course Content

MODULE 1 **Introduction to Group** Discussions - Key skills for effective participation - Phases in a GD - Conversational Phrases in GD. **Group Dynamics** - Understanding group roles and dynamics - Conflict resolution and management in groups - Techniques for fostering collaboration. **Presentations** - Introduction to Visual Aids and Technology in Presentations.	**6 Hours**

Delivery Techniques - Voice modulation and speech clarity - Body language and gestures – audience analysis. **Handling Q&A Sessions** - Preparing for audience questions - Techniques for handling difficult questions - Mock Presentation with Q&A sessions.	
MODULE 2 **Factual Group Discussions**: Focus on sharing and verifying accurate information on a given topic. Participants base their contributions on verifiable data and concrete evidence. **Opinion-based / Argumentative Group Discussion**: Encourages participants to express and defend their point of view on a topic. Evaluate different perspectives and build critical thinking skills.	**6 Hours**
MODULE 3 **Case Study Group Discussion**: Involves analyzing the complexities, identifying key issues, and developing insights or solutions based on the group's collective knowledge. **Abstract Discussion**: Deals with intangible concepts, ideas, or themes without concrete reference points. Encourages creative thinking and theoretical exploration.	**6 Hours**
MODULE 4 **Impromptu Presentations**: Participants speak on a given topic with little to no preparation. Helps develop quick thinking and effective communication skills. **Informative Presentation**: Aims to educate the audience on a specific topic by providing clear, factual information. The focus is on clarity, accuracy, and comprehensiveness. **Demonstrative Presentation**: Interactive sessions where participants engage in hands-on activities to learn practical skills. Often includes exercises, demonstrations, and collaborative tasks.	**6 Hours**
MODULE 5 **Training and Technical Presentation**: Designed to teach specific technical skills or procedures. Includes detailed instructions, demonstrations, and may involve technical jargon. **Academic Presentation**: Involves presenting research findings or theoretical concepts in an academic setting. Emphasizes clarity, evidence-based arguments, and adherence to scholarly standards. **Pitch Presentation:** A concise, persuasive presentation aimed at securing support, investment, or approval. Focuses on the value proposition, potential benefits, and unique selling points. **Persuasive Presentation**: Seeks to convince the audience to adopt a particular viewpoint or take a specific action. Utilizes logical arguments, emotional appeals, and credible evidence. **Multimedia Presentations**: Uses visual and auditory media to convey information and present arguments. Enhances engagement and aids in illustrating complex concepts.	**6 Hours**

Theory Hours:	-	**Tutorial Hours:**	-	**Practical Hours:**	2	**Project Hours:**	-	**Total Hours:**	30

Learning Resources*
Reference books/ Web Links
1. Powell, M. (2010). Dynamic presentations student's book with audio CDs (2). Cambridge University Press. 2. Reynolds, G. (2011). Presentation Zen: Simple ideas on presentation design and delivery. New Riders. 3. Galanes, G. J., Adams, K., & Brilhart, J. K. (2020). Effective group discussion: Theory and practice (15th ed.). McGraw-Hill Education. 4. Adams, K., & Galanes, G. (2018). Communicating in groups: Applications and skills, a practical guide (18th ed.). McGraw-Hill Education. 5. Ivy, D. K., & Backlund, P. (2018). Speak with confidence: A practical guide. Pearson. 6. Reynolds, G. (2019). Presentation Zen: Simple ideas on presentation design and delivery. New Riders.
Online Resources
1. https://www.coursera.org/learn/verbal-communications-and-presentation-skills 2. https://www.coursera.org/learn/present-with-purpose 3. https://www.coursera.org/learn/teamwork-skills-effective-communication

Assessment	
Formative	Summative
-----	1. Participation in group discussions (40%) 2. Individual presentations (40%) 3. Quizzes and written assignments (20%)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
Mr. Bhuvana Sundar Soorappaiah Program Manager Bosch, Coimbatore	Dr Kishore Selva Babu Head and Associate Professor Department of English and Cultural Studies Christ University Bangalore-560029	Dr. J Srikala- AP III Dr. C Tissaa Tony - AP III Dr. S G Mohanraj – AP III Dr. S Sreejan – AP III Dr. R Hema – AP II Dr. A S Mythili - AP II

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	**25.04.2025**

24EET205	GENERATION TRANSMISSION AND DISTRIBUTION	L	T	P	J	C
PC		3	0	0	0	3
		SDG	7, 9, 11,12			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil

Course Objectives:	The purpose of taking this course is to:
1	equip the students with the fundamental concepts, structure, and components of conventional and renewable electrical energy sources.
2	enable students to compute and analyze the performance parameters of transmission lines, insulators, and cables used in power systems.
3	Provide exposure to various distribution systems and power factor improvement methods in power system network.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Illustrate the working principles, merits, and demerits of conventional power plants in different power generation scenarios.	U
CO 2	Apply the concepts of renewable energy sources, and hybrid energy systems for sustainable power generation.	Ap
CO 3	Compute transmission line parameters, models, efficiency, regulation, and corona effects for assessing system performance.	Ap
CO 4	Analyze the characteristics of overhead line insulators, cables and compute mechanical parameters like sag and tension	An
CO 5	Apply the principles of AC/DC distribution systems and power factor improvement techniques to power system networks.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO1	3	1										3	
CO2	3	2	2			2					2	3	
CO3	3	3	2	1								3	1
CO4	3	3	1									2	1
CO5	3	2	1									3	1

Course Content

CONVENTIONAL POWER GENERATION Power system structure - Conventional sources of electrical energy: Working principles of thermal (coal, gas and diesel), Hydro-electric and Nuclear Power plants – Merits and Demerits.	**9 Hours**
RENEWABLE POWER GENERATION Need for renewable energy sources - Government initiatives and National Trends for renewable energy generation – Qualitative study of various renewable energy sources: Solar energy, Wind energy, Fuel cell, Hydrogen energy - Integration of solar energy system with grid.	**9 Hours**
TRANSMISSION LINES, MODELLING AND PERFORMANCE Types of Transmission - Transmission line parameters calculations: Inductance of a single phase two wire line and a three phase line with symmetrical spacing, Capacitance of a single phase line and a three phase line with equilateral spacing - Transmission line Models: Nominal T and π models – Performance Analysis of short and Medium transmission lines: Voltage Regulation, Transmission Efficiency - Bundled conductor - Transposition - Skin and proximity effects –- Ferranti effect - Corona: Critical Disruptive Voltage, Power loss - Comparison of HVDC and HVAC Transmission.	**9 Hours**
MECHANICAL DESIGN OF OVERHEAD LINES Types of Insulators - Voltage distribution in suspension insulators – String efficiency - Stress and sag calculation – Effect of line sag and remedial action - Effects of wind and ice loading, Underground cables: Types of cables – Grading of cables – Insulation resistance.	**9 Hours**
DISTRIBUTION SYSTEMS Types of Distribution systems – Connection Scheme of Distribution System: Radial, Ring main and Interconnected System- Kelvin's Law- DC and AC distributor with concentrated load - Techniques of power factor improvement.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**		**Practical Hours:**	**0**	**Project Hours:**		**Total Hours:**	**45**

Learning Resources

Textbooks

1. D.P. Kothari and I.J. Nagrath, 'Power System Engineering', Tata McGraw–Hill, 2ndEdition, 2008
2. J. Twidell, T. Weir, Renewable Energy Resources, Taylor and Francis, 4th Edition, 2021.
3. Dr. S.L. Uppal and Prof. Sunil S. Rao, Electrical Power Systems (Generation, Transmission, Distribution, Protection and Utilization of Electrical Energy), Khanna Publishers, 19th Reprint 2024.

Reference books/ Web Links

1. Turan Gonen, 'Electric Power Distribution System Engineering', CRC Press INC, 2nd Edition 2007.
2. C.L. Wadhwa, Electrical Power Systems, 7th Edition, New Age International, 2016.

Online Resources

https://nptel.ac.in/courses/108105067

Assessment (Theory)

SA-I, SA-II, Activity & Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
Er. P.G. Ravichandran, Assistant Executive Engineer, TANTRANSCO	Dr. S. Kumaravel National Institute of Technology, Calicut	Dr. T. Shanthi KCT
Recommended by BoS on	29.11.2025	
Academic Council Approval	No: 29	24.12.2025

24EEI206	INDUCTION AND SYNCHRONOUS MACHINES	L	T	P	J	C
		3	0	2	0	4
PC		SDG	7, 9 & 12			

Pre-requisite courses	24EEI201	Data Book / Codes / Standards (If any)	Nil

Course Objectives:	The purpose of taking this course is to:
1	Equip the students with comprehensive understanding of the construction, operation, and performance of induction motors and synchronous machines, including energy-efficient classifications.
2	Build knowledge and practical skills in starting, speed control, and braking methods of induction motors and excitation control in synchronous machines through laboratory experiments and practical scenarios.
3	Provide deeper insight into voltage regulation, power Factor improvement, and performance characteristics of synchronous generators and motors using case studies and practical tests.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Analyze the construction, operation and performance of synchronous generators	An
CO 2	Interpret core features, operating characteristics and energy-efficient classifications of three-phase induction motors.	Ap
CO 3	Apply suitable starting, control, and braking methods for induction motors across typical industrial scenarios.	Ap
CO 4	Outline key features, operating behaviour, and starting methods of single-phase induction motors.	U
CO 5	Apply the principles of synchronous motors to analyse performance and improve power factor in practical situations.	Ap
CO 6	Perform experiments on induction and synchronous machines to determine performance parameters and correlate with theoretical models.	An

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO1	3	2		2	2						2	3	1
CO2	3	2		2							1	3	1
CO3	3	2	2		2						1	3	1
CO4	3	2									1	2	1
CO5	2	2	2	1	3	2					2	3	1
CO6	3	3	2	3	2			2	2	1	2	3	2

Course Content	
SYNCHRONOUS GENERATORS Construction – Types – Excitation of Alternators - EMF Equation – Synchronous Reactance – Equivalent Circuit – Armature Reaction – Phasor Diagrams – Effect of Load Variation on Terminal Voltage, Power Factor and Voltage Regulation: ZPF Method – Parallel Operation of Synchronous Generators–Conditions, Load Sharing, Synchronization with Infinite Busbar – Brushless Alternators. **Practical Component** 1. Determination of Voltage Regulation of an Alternator using the Zero Power Factor (ZPF) Method. 2. Regulation of Three-Phase Salient Pole Alternator by Slip Test. **3.** Simulation and Testing of Automatic Voltage Regulator.	**12 Hours** **9 Hours**
THREE-PHASE INDUCTION MOTORS Construction – Principle of Operation – Types – Slip – Torque Characteristics – Condition for Maximum Torque – Equivalent Circuit – Introduction to Energy Efficient Motors: IE Classifications (IE1 to IE4). **Case Study:** Selection of Three-Phase Induction Motor for Industrial Scenarios. **Practical Components** 1. Functional Study on the parts of a Three-Phase Induction Motor. 2. Performance Characteristics of Three-Phase Induction Motors.	**9 Hours** **6 Hours**
STARTING AND SPEED CONTROL OF INDUCTION MOTORS Need for Starters – Conventional Starting Methods – Soft Starters – V/f Control – Slip Power Recovery – Braking Techniques. **Case Study**: Induction Motor Application in Electric Vehicles – Single Line Diagram, Control Methods, and Safety Considerations. **Practical Component** 1. Determination of Equivalent Circuit Parameters of a Three-Phase Induction Motor Using No-Load and Blocked-Rotor Tests.	**6 Hours** **3 Hours**
FRACTIONAL HP MOTORS Construction – Double Field Revolving Theory – Principle of Operation – Starting Methods –Types - Performance Characteristics – Electronic Starting Techniques. **Case Study:** Energy Efficiency Standards and Star Labelling of Fractional Horsepower (HP) motors in Domestic Appliances. **Practical Components** 1. Functional Study on the parts of a Single-Phase Induction Motor. 2. Performance Characteristics of Single-Phase Induction Motors.	**9 Hours** **6 Hours**

SYNCHRONOUS MOTORS Principle of Operation – Starting Methods – Torque and Power Characteristics- Effect of Field Current on Power Factor, Armature Current, Torque, and V–Curves /Inverted V–Curves – Digital Excitation Control – Synchronous Condensers. **Case Study:** Role of Synchronous Machines in Reactive power control and Power Generation **Practical Component** 1. V and Inverted V Curve Analysis of Synchronous Motors. 2. Study of Power Factor Improvement Techniques in Campus Utility Powerhouse.	**9 Hours** **6 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours: 30	Project Hours:	Total Hours: 75

Learning Resources

Textbooks

1. D.P. Kothari & I.J. Nagrath, Electric Machines, 5th Edition, McGraw Hill Education (India), 2017, ISBN: 9789352606405
2. Stephen D. Umans, Fitzgerald & Kingsley's Electric Machinery, 7th Edition, McGraw Hill Education, 2019, ISBN: 9780073380469
3. P.S. Bimbhra, Electrical Machinery, 7th Edition, Khanna Publishers, 2020, ISBN: 9788174091733

Reference books

1. Turan Gonen, Electrical Machines and Their Applications, 3rd Edition, Routledge, 2021, ISBN: 9780367655013
2. Mehdi Rahmani-Andebili, AC Electric Machines: Practice Problems, Methods, and Solutions, Springer, 2023, ISBN: 9783031393085
3. Stephen J. Chapman, Electric Machinery Fundamentals, McGraw-Hill, 2012, ISBN: 9780073529547

Online Resources/WebLinks

1. **NPTEL**: https://archive.nptel.ac.in/courses/108/105/108105131/
2. **MIT OpenCourseWare**: https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/
3. **Coursera - University of Colorado Boulder**: https://www.coursera.org/learn/motors-circuits-design
4. **Udemy**:https://www.udemy.com/course/electric-motor-drives-induction-motor/?srsltid=AfmBOorFbcmrsyvM4p5d-dmFONupoquuWUpu14Bh_tQC_4Aon8yo0Zy&couponCode=NVDINCTA35TRT

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
Mr. Mahesh Kumar D., Lead Initiatives, Janatics Global Solutions Ltd.	Dr Albert Alexander S., School of Electrical Engineering, VIT Vellore.	Dr.K.Malarvizhi,Professor/EEE Dr.N.VinothKumar,ASP/EEE Dr.N.Prakash,AP III/EEE Mr.N.Mohanasundaram,AP II/EEE Mr.M.Ravichandiran,AP I/EEE

24EEI207	EMBEDDED SYSTEMS (Common to ECE/EEE/EIE)	L	T	P	J	C
		2	0	4	0	4
PC		SDG		9, 12		

Pre-requisite courses	24EEI203 (Common to ECE/EEE/EIE)	Data Book / Code book (If any)	-

Course Objectives	
The purpose of taking this course is to:	
1	equip students with a foundational understanding of microcontroller fundamentals and embedded system architectures.
2	develop embedded C programming skills and build real-time and event-driven embedded applications
3	provide hands-on experience with microcontroller boards and tools, prepare students for embedded product development

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	interpret the fundamentals of embedded systems, basic micro controller/processor architectures used in modern applications.	U
CO2	examine the fundamentals of Embedded C programming by describing bare-metal program basics.	Ap
CO3	illustrate the CPU architecture, programmer model, operating modes, memory interface, and AMBA bus system of ARM Cortex.	U
CO4	apply the concepts of memory mapping and interface the GPIO and serial communication peripherals (UART, USART, I2C, SPI) in embedded system	Ap
CO5	collaborate and solve real-world problems to develop embedded system project case studies and evaluate the performance and effectiveness of the implemented prototypes.	C
CO6	demonstrate embedded system applications by implementing bare-metal programming in Embedded C, and peripheral interfacing using ARM Cortex-M4 processor through lab experiments.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO 1	3										2		
CO 2	3	2	2		3			2				2	2
CO 3	3	2			3								
CO 4	3	2	2	2	3			2				2	2
CO 5		3	3	3	3	2	3	3	3		3	3	3
CO 6		3			3		2	3			3	2	2

COURSE CONTENT	
EMBEDDED SYSTEMS – OVERVIEW Definition, characteristics, and classification - Embedded system vs general-purpose system - Building Blocks of Embedded System and Hardware Components - Embedded product development lifecycle - Hardware and software co-design - Overview of microcontrollers, microprocessors - Development toolchain: cross-compilers linkers. **Practical Components** • Datasheet reference-based activity – Feature Comparison (8051/PIC Controller) • Control word and Register Configuration (ADC, TIMER, CAPTURE INTERRUPT) • Configuration of port pins based on datasheet pin diagram-GPIO- LED Blinking. • Makefile for C, flashing tools, debugging basics • Application domains* *With respect to the concerned discipline	**6 Hours** **10 Hours**
EMBEDDED C PROGRAMMING Difference between C and Embedded C - Structure of an embedded C program - Header files - Data Types, Configuration files, startup files - Bare-metal programming – Device drivers, Bitwise Operations - Code, Data, BSS, Stack, Heap - Static vs global variables - Pointers and Arrays for Buffer Operations - Introduction to IDE. **Practical Components using IDE** • Write a simple delay loop program. (Bare Metal Programming Exercise) • Set/reset/toggle LED through bitwise operations and observe through watch window • Demonstrate pointer accesses and variables • Array access using indexing and pointer arithmetic • Role of Break points and static/global variables	**8 Hours** **10 Hours**
MICROPROCESSOR ARCHITECTURE CPU architectures: CISC vs RISC Overview -ARM Cortex Architecture: Components - Instruction level registers and Special Function Registers - General Purpose Registers-Programmer model-operating modes. ARM memory interface - Advanced Microcontroller Bus Architecture (AMBA), Advanced Peripheral Bus (APB), Advanced Serial Bus (ASB) **Practical Components** • Data sheet Comparison – ARM Versions • Common Microcontroller Software Interface Standard (CMSIS) • Configure GPIO pins using CMSIS • Use of Cortex-M system timer for accurate delays. • Low-Level Bit Manipulation Exercises	**10 Hours** **10 Hours**

INTERFACING & COMMUNICATION PROTOCOLS Memory Mapping – Registers involved and programming with GPIO – GPIO interfacing - UART, USART, Inter Integrated Circuit Bus (I2C), Serial Peripheral Interface (SPI). **Practical Components** • PWM Generation • ADC interfacing • UART interfacing • SPI and I2C based interfacing	**6 Hours** **10 Hours**
CASE STUDY ON EMBEDDED SYSTEMS* • IoT Enabled System Design • Automotive Domain • Industry Automation * Projects to be submitted based on their domain-based application	**20 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**60**	**Project Hours:**		**Total Hours:**	**90**

LEARNING RESOURCES

TEXTBOOKS:

1. Rajkamal, Embedded Systems – SoC, IoT, AI and Real-Time Systems, 4th Edition, MC Graw Hill Publication, 2020
2. Steve Furber, ARM System-on-Chip Architecture, Addison-Wesley Educational Publishers Inc., 2nd Edition, 2000.
3. Joseph Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, 3rd Edition, Elsevier / Newnes, 2013.
4. K.C.Wang, Embedded and Real-Time Operating Systems, (Softcover reprint of the original 1st Edition, 2017), Springer, 2018.

REFERENCES:

1. Umesh Dutta et. al, 8051 Microcontroller - Fundamentals and Programming: Project Based Learning Approach, 1st Edition, Clever Fox Publishing, 2022.
2. Tim Wilmshurst, Designing Embedded Systems with PIC Microcontrollers, 1st Edition, Newnes Publication, 2006.
3. Yifeng Zhu, Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C, 3rd Edition, E-Man Press LLC, 2017.
4. Israel Gbati, Bare-Metal Embedded C Programming: Develop high-performance embedded systems with C for ARM microcontrollers, Packt Publishing, 2024.
5. Muhammad Ali Mazidi, Shujen Chen, Eshragh Ghaemi, STM32 ARM Programming for Embedded Systems: Using C Language with STM32 Nucleo, MicroDigitalEd, 2018.
6. TI Tiva ARM Programming for Embedded Systems: Programming ARM Cortex-M4 TM4C123G with C, Mazidi & Naimi Arm, 1st Edition, 2017.
7. Israel Gbati, Bare-Metal Embedded C Programming: Develop high-performance embedded systems with C for ARM microcontrollers", Packt Publishing, 2024.

ONLINE EDUCATIONAL RESOURCES:

Coursera (Audit Free)

1. Embedded Systems – University of Colorado Boulder
    - Covers C programming, memory, interrupts, build systems, RTOS basics.
2. Introduction to Embedded Systems Software
    - Toolchains, debugging, firmware structure.

edX (Audit Free Courses)

1. Embedded Systems – Shape the World (UT Austin)
    - One of the best beginner courses; uses TI ARM microcontrollers.
2. Real-Time Bluetooth Networks – UT Austin
    - Intermediate, hands-on embedded networking & RTOS.
3. ARM Education – Embedded Systems Essentials with ARM

NPTEL (Free Courses)

1. Embedded Systems Design – IIT Kharagpur
2. Microprocessors & Microcontrollers – IIT Bombay
3. Real-Time Systems – IIT Madras
4. Embedded System Design with ARM – IIT Kharagpur

Suggested Video links:

- Basics of Embedded C: https://www.youtube.com/watch?v=6KVgKWnGqJA&t=3s
- STM32 Microcontroller Tutorial - https://www.youtube.com/watch?v=YJTF662ugVs
- Introduction to Bare Metal Programming Course in ARM Cortex-M Tutorial - https://www.youtube.com/watch?v=IS-k-2TyQ1Q&t=1s

Assessment (Embedded course)

SA-I, SA-II, Activity & Learning Task(s), MCQ, Mini Project, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
1. Mr. Charles Arokiaraj, Engineering Manager, RBEI, Coimbatore 2. Surendra Kumar Paulraj Principal Consultant. Pi Square Technologies, Bangalore. 3. Rohit Prajapati, MD, Digi Toad Technologies, Bangalore.	Dr.Albert Alexander, Professor, School of Electrical Engineering, VIT-Vellore.	Dr.R.S.Sandhya Devi, AP-III/EEE Dr.S.N.Shivappriya, Associate Professor/ECE

Recommended by BoS on	28.11.2025 & 29.11.2025		
Academic Council Approval	No.29	**Date**	24.12.2025

24EII204	SIGNAL PROCESSING TECHNIQUES Common EEE/EIE	L	T	P	J	C
		3	0	2	0	4
PC		SDG		9, 12		

Pre-requisite courses	24MAI113,24MAI233,24ECI102	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the fundamentals of signals, systems, and transforms used in signal analysis and processing.
2	Develop practical skills to model, analyse, and simulate signals and systems using modern computational tools.
3	Build competency to design and evaluate signal processing solutions with a focus on performance and sustainability.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Classify various signals and systems and formulate mathematical representation using differential and difference equations.	U
CO2	Analyze signal behaviour in time and frequency domains using the Fourier series, Fourier transforms and Z-transform.	An
CO3	Apply convolution and transformation techniques to model and simulate the response of continuous-time and discrete-time systems.	Ap
CO4	Apply DFT and FFT algorithms to perform frequency-domain analysis of discrete-time signals.	Ap
CO5	Design digital filters using appropriate techniques for performance and stability improvement.	An
CO6	Demonstrate signal processing methods by analysing their characteristics using analytical and simulation tools	An

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO1	3	2			1						1	3	1
CO2	3	3			2						1	3	2
CO3	2	3	2		1			2				3	3

CO4	2	2	2	1	2			2			1	2	3
CO5	3	3	3	1	2			2			2	3	3
CO6	2	2	2	3	3			3			3	2	3

COURSE CONTENT	
SIGNAL AND SYSTEMS Definition of Signals- Classification of Signals -Elementary Signals and Basic Operations –Introduction to Systems- Classification of Systems - Properties of Systems- Impulse Response Characterisation and Convolution **(**CT-LTI and DT-LTI)-System Representation Using Differential and Difference Equations – Applications: Smart home audio control systems. **PRACTICAL COMPONENTS:** • Standard signals, Mathematical operations on signals. • Convolution for CT and DT LTI systems and interpret outputs. • Simulation /modelling of LTI system using difference equations	**9 Hours** **6 Hours**
FOURIER ANALYSIS CT Fourier Series and CT Fourier Transform (CTFT)- Properties of CTFT and Frequency Response - DT Fourier Series and Discrete-Time Fourier Transform (DTFT) - Properties and Applications of DTFT **PRACTICAL COMPONENTS:** • Computation of CTFT and Fourier series synthesis • Fourier Series Representation of Musical Tones • Fault detection and Vibration analysis in Rotating Machines - Simulation	**9 Hours** **6 Hours**
Z-TRANSFORM Discrete-Time Complex Exponentials and Z-Transform - Region of Convergence and Properties - Inverse Z-Transform -Relationship between Z-Transform and Fourier Transform - Application to Solving Difference Equations **PRACTICAL COMPONENTS:** • Z-transform and inverse Z-transform computation • System analysis using Z-transform.	**5 Hours** **4 Hours**
DISCRETE FOURIER TRANSFORM Introduction to DFT and its Properties, and limitations- FFT Algorithms for Efficient Computation - Radix-2 FFT: DIT and DIF Algorithms - Butterfly Diagrams – Applications: FFT in speech recognition systems **PRACTICAL COMPONENTS:** • Power Quality analysis using FFT • FFT in speech recognition systems • ECG Heartbeat Frequency Detection -Simulation	**10 Hours** **6 Hours**
DESIGN OF DIGITAL FILTERS FIR Filter Design: Linear Phase and Windowing (Hamming, Hanning) - IIR Filter Design: Butterworth, Chebyshev - Impulse Invariant and Bilinear Transformation - FIR and IIR Structures: Direct Form I & II, Cascade, Parallel - Finite Precision Effects- Applications: Radar Signal Processing for Object Detection– Introduction to wavelet Transform.	**12 Hours**

PRACTICAL COMPONENTS:	8 Hours
• FIR filter Design • IIR filter design • Radar Signal Processing for Object Detection -Simulation • Precision effects on filter stability and response	

Theory Hours: 45	Tutorial Hours:	Practical Hours: 30	Project Hours:	Total Hours: 75

LEARNING RESOURCES

TEXTBOOKS:

1. Alan V. Oppenheim, Alan S. Willsky, *Signals and Systems*, 2nd Edition, Pearson Education,2015
2. John G. Proakis, Dimitris G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, 5th Edition, Pearson Education,2021

REFERENCES:

1. Simon Haykin & Barry Van Veen, *Signals and Systems*, Wiley, 2nd Edition, Wiley India, 2007.
2. Sanjit K. Mitra, *Digital Signal Processing: A Computer-Based Approach*, 4th Edition, McGraw-Hill Education, 2013
3. P. Ramesh Babu & R. Anandanatarajan, *Signals and Systems*, Vijay Nicole, 2022
4. P. Ramesh Babu, *Digital Signal Processing*, 7th Edition, Vijay Nicole, 2011

ONLINE EDUCATIONAL RESOURCES:

SIGNALS AND SYSTEMS

- **NPTEL**: Signals and Systems by Prof. Nagendra Krishnapura (IIT Madras) (https://nptel.ac.in/courses/117106084)
- **YouTube**: Signals & Systems - EC Academy
- **Interactive Tool**: Desmos Signal Explorer (for plotting signals)

FOURIER ANALYSIS OF CT AND DT SIGNALS

- **NPTEL**: Fourier Series and Transforms - IIT Kharagpur (https://nptel.ac.in/courses/117105144)
- **YouTube**: Fourier Series – MathTheBeautiful
- **Simulation Tool**: PhET Fourier: Making Waves

Z-TRANSFORM

- **MIT OCW**: Z-Transform Concepts (Video) (https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/)
- **YouTube**: Z-Transform Tutorials by Dr. Saeed Roosta
- **Tool**: Symbolab Z-Transform Calculator

DFT and FFT

- **Khan Academy**: Fourier Transform Intuition
- **YouTube**: Understanding FFT - Steve Brunton
- **Online Tool**: FFT Visualizer - Academo.org

DIGITAL FILTER DESIGN

- **Coursera**: Digital Signal Processing by EPFL

- **NPTEL**: Digital Signal Processing – Prof. T. K. Basu (IIT KGP) (https://nptel.ac.in/courses/117105130)
- **Online Tool**: T-filter (FIR Design Tool)
- **MATLAB Resource**: Filter Design Using FDAtool (Official MATLAB Guide)

General Tools and Platforms

- **MATLAB Online**: https://matlab.mathworks.com
- **Google Colab (Python + SciPy)**: https://colab.research.google.com
- **GNU Octave** (Free MATLAB alternative): https://www.gnu.org/software/octave/
- **Scilab**: https://www.scilab.org/

Assessment (Embedded Course)
SA-I, SA-II, Activity & Learning Task(s), MCQ, Mini Project, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Vinayaka Hegde Director Software Development, Visteon	Dr Suyampu Lingam A Assistant Professor (Sr. Gr.), Amrita Viswa Vidyapeetham	Umesh M V Associate Professor E& I Dr. Kavitha R Associate Professor EEE Dr. Kandasamy V Associate Professor EEE	
Recommended by BoS on	29.11.2025		
Academic Council Approval	No 29	Date	24.12.2025

24INM202	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to All Branches)	L	T	P	J	C
		1	0	2	0	2
HS		SDG	6, 13, 15			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	To introduce the importance, types, and conservation strategies of natural resources, with a focus on sustainable practices in water and food management.
2	To understand the structure and function of ecosystems and biodiversity, and explore the need for conservation through the study of hotspots and global environmental concerns.
3	To examine the causes and effects of environmental degradation, including pollution and waste management, and to promote mitigation strategies for sustainable development.
4	To provide knowledge of the legal and institutional frameworks for environmental protection in India and globally, including critical environmental acts and enforcement challenges.
5	To explore conventional and alternative energy resources, and to assess methods for energy conservation and carbon footprint reduction through audits and sustainability measures.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Apply the concept of natural resource conservation to demonstrate sustainable practices	Ap
CO2	Analyse the structure, function, and adaptive capacity of ecosystems to categorize threats and conservation strategies for biodiversity.	An
CO3	Analyse various forms of environmental degradation and propose management and preventive solutions.	An
CO4	Apply national environmental laws and frameworks in the personal and professional contexts	Ap
CO5	Design strategies using renewable energy principles to develop sustainable energy utilization plans through audits and footprint analysis to transfer a healthy environment for future generations.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	2	–	–	–	–	2	3	–	1	–	–	2	–	–
2	2	2	–	–	–	2	3	1	–	–	–	2	2	–
3	2	3	–	2	–	3	3	1	–	–	–	2	3	–

4	–	2	–	–	–	3	3	3	1	2	2	–	2	–
5	2	2	3	2	2	3	3	–	1	2	2	2	2	3

Course Content	
NATURAL RESOURCES **Introduction to Natural resources :** Types, significance, and conservation strategies **Water resources:** Utilization, management practices, and conservation strategies - rainwater harvesting methods.– Water distribution system audit **Food resources:** Challenges of food security in India - impact of modern agriculture, and environmental concerns related to fertilizers and pesticides. **Practical Component:** • Parameter Testing : Water / Effluent / Soil/Fertiliser • Simulation Experiments • Online Course	**3 Hours** **10 Hours**
ECOSYSTEM AND BIODIVERSITY **Ecosystem:** Structure and function of an ecosystem- ecosystem resilience and adaptive capacity **Biodiversity:** Values of biodiversity - Hot Spot of biodiversity (in the Himalayas, the Western Ghats, the Indo-Burma region, and the Gulf of Mannar) - Threats to biodiversity. **Conservation Strategies:** Emerging Issues in Biodiversity Conservation - Citizen science - In-situ and Ex-situ conservation of biodiversity. **Practical Component:** • Documentation of biodiversity in the campus	**3 Hours** **Hours**
ENVIRONMENTAL DEGRADATION AND MANAGEMENT **Pollution**: Causes, effects and control measures of Air pollution, Water pollution - Role of an individual in prevention of pollution **Waste management**: Circular Economy vs. Linear Economy - Disposal of solid wastes - Treatment of Liquid wastes **Disaster Management**: Mitigation strategies and Readiness **Practical Component:** • Waste Management and Resource recovery in Campus • Documentation of Environmental Data Resources and Monitoring Tools.	**3 Hours** **6 Hours**
LEGAL FRAMEWORK FOR ENVIRONMENTAL PROTECTION IN INDIA **Global and National Initiatives**: United Nations Sustainable Development Goals - Coastal Regulation Zone - Environmental impact assessment **Environmental Legislation in India**: Key Legal and Regulatory Terminology in India – Valuation of Ecosystem Services and integration of Acts in the workplace - Plastic Waste Management Rules - E-Waste Management Rules - Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act **Implementation Challenges**: Issues involved in enforcement of environmental legislation **Practical Component:** • Online Course	**3 Hours** **2 Hours**

ENERGY MANAGEMENT **Energy Resources:** Energy Demand and Urban energy Challenges - Necessity of alternate energy methods - Renewable and Non- renewable energy resources - Carbon footprint and carbon credit – Sustainable energy utilization – Case study **Energy Audits** – Purpose, methodology, and common instruments used **Practical Component**: • Documentation of Energy usage through Carbon footprint calculation - Personal as well as Institutional	**3 Hours** **6 Hours**

Theory Hours: 15	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 45

Learning Resources

References:

1. Bharucha, E. (2021). Textbook of environmental studies for undergraduate courses (3rd ed.). Orient BlackSwan / Universities Press - Hyderabad, India.
2. Miller, G. T., & Spoolman, S. E. (2014). Environmental science (14th ed.). Cengage India
3. Anubha Kaushik & C.P. Kaushik (2024). Perspectives in Environmental Studies (8th ed.). New Age International Publishers, New Delhi.
4. Masters, G. M., & Ela, W. P. (2013). Introduction to environmental engineering and science (3rd ed.). Pearson Education, New Delhi.
5. Leelakrishnan, P. (2018). Environmental law in India (3rd ed.). LexisNexis Butterworths, New Delhi.
6. Botkin, D. B., & Keller, E. A. (2014). Environmental science: Earth as a living planet (9th ed.). Wiley, Hoboken, NJ.
7. Armstrong, J. (2023). The future of energy: The 2023 guide to the energy transition. Independently published.
8. Easton, T. (Ed.). (2017). Taking sides: Clashing views on environmental issues (17th ed.). McGraw-Hill Education, New York, NY.
9. Ishwaran, N. (2022). Ecosystem services and economic valuation. New Delhi: TERI Press.

Online Resources (Weblinks)

https://www.youtube.com/watch?v=j4Z6WmTnhRQ How to Conduct a Water Audit in Institutions

- https://www.youtube.com/watch?v=_OKYio2Yk9U India's Food Security Challenge
- https://www.youtube.com/watch?v=IjNT9Z2OLf4 India's Biodiversity Hotspots
- https://www.youtube.com/watch?v=_c_sJIEJY4M What is Citizen Science?
- https://www.youtube.com/watch?v=1HZR3GyzFZc What is a Circular Economy
- https://www.youtube.com/watch?v=6_tLYyR_3Vo Environmental Law and Acts in India
- https://www.youtube.com/watch?v=kGcrYkHwE80 Introduction to SDGs
- https://www.youtube.com/watch?v=V__eNSHdChA Conducting an Energy Audit
- https://www.youtube.com/watch?v=dUqTt5Qrxn8 - What is Your Carbon Footprint?

Assessment (Embedded course)

CAT, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)
Lab Workbook, Report Submission

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. Muthuraja Perumal General Manager - Research & Development Rohith Industries, APIIC Industrial Park, Andhra Pradesh	Dr. Mathivanan Packiarajan University of Michigan Ann Arbor, MI USA Dr. Venkatakrishnan Professor, School of Chemical Sciences Indian Institute of Technology (Mandi) Himachal Pradesh India		Faculty Of Chemistry Department of Chemistry
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

BoS Chair

24INM102	Indian Knowledge Systems in Science and Engineering (Common to All branches)	L	T	P	J	C
		1	0	0	0	1
HS		SDG	5,16			

Pre-requisite courses	_	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Explore the Role of Traditional Knowledge in Basic Scientific Concepts
2	Know the science behind the establishment of traditional architecture
3	Revive ancient Indian aerospace, metallurgy and navigation technologies
4	Revitalize ancient textile traditions through sustainable practices, promoting eco- friendly materials
5	Explore and integrate ancient Indian medical systems like Ayurveda, Siddha & Rasa Shastra

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	understanding Indigenous Knowledge Systems (IKS) in Science and Technology	U
CO 2	apply Traditional Design Principles in Civil Engineering	Ap
CO 3	explore of Ancient Aerospace Technologies for Aeronautical Engineering	E
CO 4	know the sustainable traditional textile practices for ecofriendly atmosphere	R
CO 5	gain knowledge of Ancient Medical Practices for Biotechnologists	U

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	2	2	2	2	1	2	3	1	2	1	3			
2	2	2	2	2	1	2	2	1	2	1	3			
3	2	2	2	2	1	2	2	1	2	1	3			
4	2	2	2	2	1	2	2	1	2	1	3			
5	2	2	2	2	1	2	2	1	2	1	3			

Course Content

IKS in Basic Sciences Study of ancient Indian concepts such as atomism (paramāṇu)- the five elements (Panchabhūta)- Exploration of alchemical practices, metallurgy-development of zero, decimal systems, algebra, and trigonometry - works by scholars such as Brahmagupta and Aryabhata- detailing planetary motions and timekeeping systems.	**3 hours**
IKS in Civil Engineering Evolution from rock-cut caves to grand temples like Madurai Meenakshi and Brihadeeswarar.- Vastu Shastra- The Concept of "Mandala- Courtyard Design- Sacred Geometry- Panchabhuta- Chhatri- dome-shaped canopy- Prana Vayu- Shilpa Shastra- Sthapatya Veda- Kaalchakra- Brahmasthan.	**3 hours**

IKS in Mechanical Engineering Exploration of ancient metallurgical techniques-including ore extraction-alloying, furnace design-Vimana (Flying Machines) - Shakti (Energy Source) -Aerospace materials- Vimana Shapes -Ancient Navigation- Vedic Astronomy- Flight Principles in Nature- Matrika Systems-Indian shipbuilding techniques and navigation methods.	**3 hours**
IKS in Textile technology Introduction to Ancient Indian Textiles- Cultural and Historical Context -Traditional Dyeing Techniques-Weaving Techniques and Patterns-Khadi- -Natural Fibers and Materials-Cotton,Silk,Wool and Jute-Sustainable Practices and Eco-Friendly Technologies-Organic Cotton Farming-Recycling and Repurposing.	**3 hours**
IKS in medicine Ayurveda- Siddha Medicine- Rasa Shastra- Herbal Medicine- Nadi Pariksha- Chikitsa- Yoga and Pranayama- Surgical Techniques -Charaka Samhita - Sushruta Samhita— Panchagavya usage-Medicinal Plants and Herbal Remedies-Agricultural Practices and Crop Diversity-Sacred and Ritual Plants.	**3 hours**

Theory	Tutorial	Practical	Project	Total
Hours: 15	**Hours: 0**	**Hours: 0**	**Hours: 0**	**Hours: 15**

Learning Resources

Textbooks:

1. Indian Knowledge Systems: A Sustainable Approach: The Science of Self-Healing" by Vasant Lad, Excel India Publisher, 2024.
2. Indigenous Knowledge Systems: Towards a Holistic Inclusive Conservation, Satarupa Dutta Majumder, Manohar Publishers & Distributors, 2019.

References:

1. Indian Knowledge System: Integrating Heritage with Engineering, Gagan Bansal, Deep Science Publishing, 2025

Online Resources (Weblinks)

www.deepscienceresearch.com/dsr/catalog/book/70

Assessment (Theory course)

Presentation, MCQ, Assignment, Case Study and E Chart.

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
	Dr K Sangeetha, Professor and Head-Textile Department, IKS-Nodal officer, Bharathiar University,Coimbatore-46.	Dr.R.Prakasam, AssistantProfessor, Department of Physics. Capt-A.R.Arul, Assistant Professor, Department of Physics

Recommended by BoS on	25-04-2025		
Academic Council Approval		**Date**	26-06-2025

24HSP007	Building Professional Readiness	L	T	P	J	C
		0	0	2	0	1
Practical		SDG	4&8			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	

Course Objectives**:	The purpose of taking this course is to:
1	To familiarize students with various interview formats and equip them with essential techniques for effectively handling personal, behavioural, stress, and panel interviews.
2	To develop self-awareness and career readiness by guiding students in analysing job roles, articulating career goals, and confidently presenting their skills and experiences.
3	To enhance students' adaptability in diverse career pathways by exploring alternative job opportunities, entrepreneurial ventures, and global career options beyond traditional engineering roles.

Course Outcomes***:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Effectively navigate various interview formats by applying appropriate techniques for personal, behavioural, stress, and panel interviews, demonstrating confidence and professionalism in different interview scenarios.	Ap
CO 2	Exhibit career readiness and self-awareness by analysing job roles, articulating career aspirations, and presenting skills and experiences in alignment with employer expectations.	An
CO 3	Evaluate and explore diverse career pathways beyond traditional engineering roles, demonstrating adaptability in pursuing opportunities in entrepreneurship, global careers, public sector roles, and other emerging industries.	E

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1						2	2	3	3		3			
2						2	2	3	3		3			
3						2	2	3	3		3			

Course Content

Career Awareness and Goal Setting	6 Hours
• Exploring Varied Career Options Beyond Engineering • Industry Roles	

• Startups and Entrepreneurial Ventures • Research Opportunities and Higher Education • Public Sector and Non-Profit Careers • Self-Assessment and Personal Reflection • Identifying Strengths, Weaknesses, Skills, and Career Aspirations • Setting Short-Term and Long-Term Career Goals	
Fundamentals of Interview Preparation • Analysing Company Background and Understanding Job Roles • Aligning Career Goals with Job Opportunities • Professional Etiquette and Appearance • Interview Dress Code, Grooming, and First Impression • Resume and Digital Profile Readiness • Types of interviews: personal, behavioural, stress, virtual, and panel	**6 Hours**
Behavioural Interviews – Responding with Purpose • Introduction to behavioural interviews: What and Why? • Common behavioural interview questions • The STAR technique (Situation – Task – Action – Result) • Identifying and reflecting on past experiences • Mapping soft skills to behavioural questions • Practicing concise storytelling • Active listening and adapting responses	**6 Hours**
Stress Interviews – Performing Under Challenging Situations • Understanding stress interviews: Purpose and setting • Types of stress tactics (rapid-fire questions, silence, disagreement, interruptions) • Strategies to stay composed and confident • Emotional regulation and response control • Maintaining clarity, tone, and respect under pressure • Practicing assertive and professional body language • Turning pressure moments into strengths	**6 Hours**
Panel Interviews • What is a panel interview? Structure and expectations • Understanding panel roles (HR, technical, managerial) • Techniques for engaging with a diverse panel • Managing eye contact, addressing questions, and body posture • Preparing multi-perspective answers • Handling follow-up or cross-questions • Strategies for closing the interview with impact	**6 Hours**

Theory Hours:	**-**	**Tutorial Hours:**	**-**	**Practical Hours:**	**2**	**Project Hours:**	**-**	**Total Hours:**	**30**

Learning Resources*

Reference books/ Web Links

1. Amos, J. (2004). Handling Tough Job Interviews: Be Prepared, Perform Well, Get the Job. United Kingdom: How To Books.
2. Clark, A. (2019). Cracking the Behavioral Interview Code!!! How to Answer Behavioral Interview Questions and Answer with a Preparation Guide + 20 Most Popular Behavioral

Interview Questions and Answers.. (n.p.): Amazon Digital Services LLC - KDP Print US.
3. Collins, A. (2015). HR Interview Secrets: How to Ace Your Next Human Resources Interview, Dazzle Your Interviewers and LAND the JOB YOU WANT!. United States: Success in HR Publishing.
4. Downes, C. (2008). Cambridge English for Job-hunting Student's Book with Audio CDs (2). Germany: Cambridge University Press.
5. Hatcher, S. (2015). Group Interview Preparation: Learn How to Use Group Discussion to Your Advantage and Be Comfortable, Confident, and Likeable While Standing Out in a Group Interview. (n.p.): CreateSpace Independent Publishing Platform.
6. McKay, D. R. (2013). The Everything Job Interview Question Book: The Best Answers to the Toughest Interview Questions. United States: Adams Media.
7. Ryan, R. (2016). 60 Seconds and You're Hired!: Revised Edition. United States: Penguin Publishing Group.
8. Winter, S. (2020). Job Interview Preparation and Conversation Skills 2-in-1 Book: Learn How to Crush Your Next Job Interview and Develop A Magnetic Charisma to Enhance Your Communication Skills. United States: Native Publish

Online Resources

1. https://www.coursera.org/projects/preparation-for-job-interviews
2. https://www.coursera.org/projects/accomplishment-star-techniques-for-job-interviews
3. https://www.coursera.org/specializations/english-interview-resume

Assessment	
Formative	Summative
-----	1. Participation in Mock interviews (80%) 2. Career Readiness Portfolio Submission (20%)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
Mr. Bhuvana Sundar Soorappaiah Program Manager Bosch, Coimbatore	Dr Kishore Selva Babu Head and Associate Professor Department of English and Cultural Studies Christ University Bangalore-560029	Dr. J Srikala- AP III Dr. C Tissaa Tony - AP III Dr. S G Mohanraj – AP III Dr. S Sreejan – AP III Dr. R Hema – AP II Dr. A S Mythili - AP II

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	BOS **25.04.2025**

24EEI301	CONTROL SYSTEMS	L	T	P	J	C
		3	0	2	0	4
PC		SDG	7, 9, 12			

Pre-requisite courses	24EEI206, 24EEI101	Data Book / Code book (If any)	--

Course Objectives:	
The purpose of taking this course is to:	
1	Equip the students with ability to model and analyze dynamic systems using mathematical techniques in both time and frequency domains.
2	Develop competence in stability analysis and controller design, including compensators and PID controllers, for achieving desired system performance.
3	Enable students to utilize MATLAB-based simulation tools and explore contemporary control system applications for solving real-world engineering problems.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Develop mathematical models and derive transfer functions for physical systems	Ap
CO 2	Analyze the time response of first and second order systems and design P, PI, and PID controllers.	Ap
CO 3	Analyze system stability in frequency domain and design appropriate compensators for performance improvement.	An
CO 4	Investigate the stability of linear time-invariant systems using Routh-Hurwitz criterion and root locus techniques.	An
CO 5	Develop state space models of dynamic systems and apply the concepts of controllability and observability.	Ap
CO 6	Simulate, implement, and validate control system concepts using MATLAB/Simulink to analyze the behaviour of real-world systems.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	3	2	2	2	1					1	1	3
2	3	3	3	2	2	1					1	2	2
3	3	3	3	3	2	1					1	2	2
4	3	3	3	3	2	1					1	2	2

5	3	3	3	2	3	1					1	3	3
6	3	3	3	3	3	2	2	2	3	2	2	3	3

Course Content	
MATHEMATICAL MODELLING OF SYSTEMS Introduction to control systems – Open loop and closed loop systems - Components– Modelling of mechanical, electrical, electromechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graph. **Case Study:** DC servo motor in solar tracking systems. **Practical Component:** • Simulation of transfer function for a spring-mass-damper system. • Experimental validation of transfer function of a DC servo motor. • Experimental validation of transfer function of a 2-phase AC servo motor.	**9 Hours** **9 Hours**
TIME DOMAIN ANALYSIS Standard test signals – Time response of first and second order systems – Time domain specifications – Steady-state errors - Static error constants– P, PI and PID controllers. **Case Study:** PID controllers for motor drives **Practical Component:** • Simulation and experimental verification of time response analysis of Electrical system. • Op Amp based implementation of PI & PID controllers	**9 Hours** **6 Hours**
FREQUENCY DOMAIN ANALYSIS Frequency response specifications - Bode plot – Polar plot – Gain margin and phase margin- Lead, lag, lead-lag compensator design. **Case Study:** Stability analysis of Electrical system in frequency domain. **Practical Component:** • Magnitude/phase response, resonance and bandwidth of electrical system. • Lag and lead Compensator using Op Amp	**9 Hours** **6 Hours**
STABILITY ANALYSIS Definition of Stability - Location of roots of Characteristics equation in S plane for stability – Relative stability - Routh Hurwitz criterion – Root locus Techniques – Nyquist stability criterion. **Case Study:** Effect of Pole/Zero Addition on system stability **Practical Component:** • Stability analysis of linear systems	**9 Hours** **3 Hours**
STATE VARIABLE ANALYSIS State space formulation-state model of linear system-state diagram-state space representation using physical variable- state space representation using phase variable - state space representation using canonical variable-Solution of state equations using Laplace Transform-Concepts of Controllability and Observability. **Case study:** State space modelling of DC – DC converters • State space model for armature-controlled DC motor • Design Project using Microcontroller based system.	**9 Hours** **6 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources

Textbooks:

1. Nagrath, I. J., and Gopal, M., Control Systems Engineering, 7th Edition, New Age International Publishers, New Delhi (2021).
2. Nise, Norman S., Control Systems Engineering, 8th Edition, Wiley, New York (2024).
3. Ogata, Katsuhiko, Modern Control Engineering, 5th Edition, Pearson Education (2010; eTextbook reissue 2021).

References:

1. Golnaraghi, Farid, and Kuo, Benjamin C., *Automatic Control Systems*, 10th Edition, McGraw-Hill Education (2017).
2. Gopal, M., *Control Systems: Principles and Design*, 4th Edition, McGraw-Hill Education, New Delhi, 2012
3. Dorf, Richard C., and Bishop, Robert H., *Modern Control Systems*, 14th Edition, Pearson Education, 2021
4. Åström, Karl Johan, and Murray, Richard M., *Feedback Systems: An Introduction for Scientists and Engineers*, 2nd Edition, Princeton University Press (2021).

Online Educational Resources:

- Control Systems Engineering simulation companion: Brian Douglas YouTube channel- https://www.youtube.com/playlist?list=PLUMWjy5jgHK3j74Z5Tq6Tso1fSfVWZC8L
- NPTEL course Control System Design: https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_ee65
- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-302-feedback-systems-fall-2007/
- https://www.mathworks.com/help/control/
- https://ctms.engin.umich.edu/CTMS/

Assessment (Embedded course)

CAT, Activity and Learning Tasks, Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
[Mr.Anburaja Program Manager at Bosch Global Software Technologies Pvt Ltd]	[Name, Institution]	Dr.K.Premalatha, Mr. Omsuraj
Recommended by BoS on	10/06/2026	
Academic Council Approval	No.	**Date**

24EEI302	POWER ELECTRONICS	L	T	P	J	C
		3	0	2	0	4
PC		SDG	7, 9			

Pre-requisite courses	24ECI102	Data Book / Codes / Standards (If any)	Nil

Course Objectives:	The purpose of taking this course is to:
1	Equip the student with a foundational understanding of the structure, operation, and characteristics of power semiconductor devices along with associated gate driver and snubber circuits.
2	Provide theoretical and analytical skills to evaluate the performance of controlled rectifiers, choppers, inverters, voltage controllers and cycloconverters.
3	Impart practical knowledge on the operation of various power Electronics Converters

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Distinguish the operation, capabilities, characteristics of various power semiconductor devices and driver circuits.	Ap
CO 2	Analyze the performance of AC-DC converter for different loads	An
CO 3	Analyze the operation of step-down and step-up chopper circuits used in DC–DC converters.	An
CO 4	Apply voltage control techniques in inverter circuits for effective output regulation and waveform improvement.`1	Ap
CO 5	Apply frequency control methods in AC-AC converters for various industrial and domestic applications.	Ap
CO 6	Analyze through simulation and practical implementation of various power electronic conversion circuits.	An

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO1	3	2	1					1				2	1
CO2	3	2	1					1				3	2
CO3	3	2	2					1				3	2
CO4	3	1	1	1				1				3	2
CO5	3	1	1					1				3	2
CO6	3	2	2	3	3			3				3	3

Course Content

POWER SEMI-CONDUCTOR DEVICES Power diode, power BJT, SCR, Power MOSFET and IGBT: Structure, operation, and characteristics - Wide Bandgap Semiconductor devices: SiC and GaN- Gate Drive and Snubber circuits- Overview of Heat Sinks and Cooling Methods . **Case Study:** Data sheet study of IGBT/MOSFET, Safe Operating Area (SOA) **Practical Component** • Characteristics of MOSFET/SiC devices • Design and Testing of Gate Drive Circuit	**9 Hours** **6 Hours**
AC TO DC CONVERTERS Single phase, three phase half controlled and fully controlled converters – Effect of source inductance – Analysis of converters with R and RL loads - Performance parameters – Dual converters - PWM Rectifiers – Introduction to Power factor improvement technique – Application of AC to DC converters **Case Study:** Vienna rectifier for an EV charger. **Practical Component** • Single phase Fully Controlled Converter • Simulation of power factor correction circuits	**9 Hours** **6 Hours**
DC TO DC CONVERTERS Buck, boost, buck-boost converters- Isolated converter: forward and flyback topology-DC-DC Converters for PV systems - Two quadrant and four quadrant choppers – EV On-Board Charger (OBC): Dual Active Bridge (DAB) converter – Application of DC-DC converter: SMPS. **Case Study:** Bidirectional DC-DC converter for EV onboard chargers **Practical Component** • Buck-Boost Converter • Simulation of DC-DC Converter for PV System with MPPT	**9 Hours** **6 Hours**
DC TO AC CONVERTERS 4th module Single phase and three phase bridge voltage source inverters –Voltage and frequency control: Sinusoidal PWM and Space Vector PWM (SVPWM) - harmonic reduction - LCL filter - harmonic standard (IEEE 519)- Current source inverter - Concept of multi-level inverter: Cascaded H-Bridge multi-level inverter- Case study: Catalog of Inverters in various Industrial UPS. **Practical Component** • Single-Phase Voltage Source Inverter with PWM Control • Multilevel Inverter: Harmonic analysis using power logger	**12 Hours** **6 Hours**
AC TO AC CONVERTERS Single phase bidirectional voltage controller with RL load – Phase control – PWM control- single phase and three phase cyclo-converters - Introduction to	**6 Hours**

Matrix Converter -Application of AC to AC converter: Soft starter for three phase induction motor. Case Study: On load Transformer Tap Changers **Practical Component** • Voltage Control using AC Voltage Controller • Frequency control using Matrix converter	**6 Hours**

Theory Hours:	**45**	**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	**75**

Learning Resources*

Textbooks

1. M.H. Rashid, Power Electronics: Devices, Circuits and Applications, 4th Edition, Pearson Education, 2017.
2. M.D. Singh and K.B. Khanchandani, Power Electronics, 3rd Edition, Tata McGraw Hill / McGraw Hill Education, New Delhi, 2018.
3. John G. Hayes and G. Abas Goodarzi, Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, Wiley, 2nd Edition, 2018.

Reference books/ Web Links

1. Ned Mohan, Tore. M. Undeland, William. P. Robbins, "Power Electronics: Converters, Applications and Design", 3rd Edition, Wiley, 2022, India. ISBN-13978-9354640278
2. Vidhyathil Joseph, "Power Electronics Principles and Applications",McGraw Hill Education (India), 6th reprint, 2025.
3. M.H. Rashid, "Power Electronics Handbook" 5th Edition, Elsevier, 2023.
4. Branko L. Dokic and Branko Blanua, "Power Electronics: Converters and Regulators", 2nd Edition, Wiley India Pvt. Ltd., 2016.
5. P.S. Bimbhra, Power Electronics, 5th Edition, Khanna Publishers, New Delhi, 2022.

Online Educational Resources

NPTEL Course : Fundamentals of Power Electronics Prof. L Umanand IISc Bangalore: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee01
Coursera **Power Electronics Specialization:** https://www.coursera.org/specializations/power-electronics

Assessment (Embedded course)

SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
[Pon karthik kumar P Project Manager at Versa Drives Private Limited]	[Dr.Ragavan IIT, Gandhinagar]	Dr.M.Nirmala Dr. P.Maithili

24EEI303	POWER SYSTEM ANALYSIS AND PROTECTION	L	T	P	J	C
		3	0	2	0	4
PC		SDG	7, 9			

Pre-requisite courses	24EET205	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is:	
1	provide a comprehensive understanding of power system modeling, network analysis, and load flow studies for evaluating system operating conditions.
2	equip students with the knowledge of fault analysis, power system stability, and transient behavior for ensuring reliable system operation
3	develop an understanding of power system protection and switchgear equipment, including protective relays, circuit breakers, surge arresters, reclosers.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO	Description	RBT Level
CO1	Apply per unit representation to develop reactance diagram and determine load flow in power system using Gauss-Seidel and Newton-Raphson methods.	Ap
CO2	Analyze symmetrical and unsymmetrical faults and determine the fault currents using sequence networks.	An
CO3	Apply swing equation and equal area criterion to assess steady-state and transient stability of power systems.	Ap
CO4	Illustrate the operation of switchgear, circuit breakers and modern protection schemes including IEC 61850.	U
CO5	Apply and demonstrate overcurrent, distance, and differential protection schemes.	Ap
CO6	Perform load flow, fault analysis, and protection coordination using simulation platform (ETAP / MATLAB).	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2

CO1	3	3	2	2	2							2	2
CO2	3	3	2	2	2							2	2
CO3	3	3	2	2	2							2	2
CO4	3	2			2							2	2
CO5	3	2										2	2
CO6	3	3	3	2	3					2	2	3	3

Course Content	
POWER SYSTEM MODELLING & LOAD FLOW ANALYSIS Basic components of power system – Single line diagram – Impedance and reactance diagram – Per unit system – Bus classification – Primitive Bus Incidence matrix -Formation of Y-bus matrix – Load flow analysis using Gauss-Seidel and Newton-Raphson methods- Load flow analysis of DC system. **Practical Component** • Formation of Y-bus matrix using MATLAB • Load flow analysis using Newton-Raphson method using ETAP	**12 Hours** **6 Hours**
FAULT ANALYSIS Types of faults – Symmetrical faults – Formation of Z-bus – Case study: Calculation of symmetrical fault current – Unsymmetrical faults – Symmetrical components – Sequence networks – Analysis of LG, LL faults. **Practical Component** • Symmetrical and Unsymmetrical fault analysis using ETAP.	**12 Hours** **3 Hours**
POWER SYSTEM STABILITY Concept of stability – Steady state and transient stability – Swing equation – Equal area criterion – Critical clearing angle and time – Voltage stability – Introduction to power system security and reliability. **Practical Component** • Solution of swing equation using MATLAB. • Transient stability analysis using MATLAB.	**7 Hours** **6 Hours**
SWITCHGEAR AND PROTECTION (module 5) Protection against over voltages – Lightning and switching surges – Surge arresters – Insulation coordination – Earthing methods – Theory of arc interruption – Circuit breakers: ACB,Vacuum & SF6 – Fuses – RRRV – Reclosers and isolators – Switching techniques- Digital substation concept — process bus (IEC 61850) Case study: Breakers catalog of various industries **Practical Component** • Analysis of Circuit Breaker Performance During Fault Conditions using ETAP. • Concept of Earth mat. Earthing and grounding lightning arrestor, ATR, SPD surge protection devices DC and AC side	**7 Hours** **3 Hours**

• Relay interconnection in solar plant	
PROTECTIVE RELAYS AND SCHEMES (module 4) Relays: classification and principles – Static and numerical relays – Relay characteristics and torque equation – Overcurrent, distance and differential protection – Protection of generators, transformers, feeders and busbars – Relay coordination and settings- Differential protection for converter interfaced DGs. **Practical Component** • Analysis of Characteristics of IDMT earth fault Relay. • Analysis of Transformer Protection using simulation & Experimental setup. • Analysis of Micro controller based over/under voltage relay. • Study and testing of Electromagnet type over current relay.	**7 Hours** **12 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**Practical Hours:**	**30**	**Project Hours:**	**Total Hours:75**

Learning Resources
Textbooks:
4. Hadi Saadat, Power System Analysis, 3rd Edition (Latest Reprint), McGraw Hill Education, 2011. 5. D.P. Kothari & I.J. Nagrath, Modern Power System Analysis, 5th Edition, McGraw Hill, 2022. 6. D.P. Kothari & I.J. Nagrath, Power System Engineering, 3rd Edition, McGraw Hill, 2019.
References:
1. John J. Grainger & W.D. Stevenson, Power System Analysis, McGraw Hill, Latest Reprint Edition, 2016. 2. P. Kundur, Power System Stability and Control, McGraw Hill, Revised/Latest Edition, 2022. 3. B.R. Gupta, Power System Analysis and Design, S. Chand, Latest Revised Edition, 2008. 4. Badri Ram, D.N. Vishwakarma & Soumya R. Mohanty, Power System Protection and Switchgear, 3rd Edition, McGraw Hill, 2021. 5. Sunil S. Rao, Switchgear Protection and Power Systems, 14th Edition (2025), Khanna Publishers.
Online Educational Resources:
1. NPTEL Course : Power system analysis Prof Debapriya Das IIT Kharagpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc19_ee62 2. NPTEL Course : Power System Protection and Switchgear Prof. Bhaveshkumar R. Bhalja, IIT Roorkee https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee110 3. https://www.coursera.org/learn/electric-power-systems

Assessment (Embedded course)
SA, Activity and Learning Task(s) , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Shri.D.RAVISANKAR,B.E.,M.B.A., Assistant Executive Engineer, Operation, TANTRANSCO / TNEB, Coimbatore.	Dr V. Ravikumar Pandi, Associate Professor/EEE, Amrita School of Engineering, Kerala.		Dr.M.Mohanraj, Dr.T.Shanthi, Dr.D.Sharmitha, Dept. of EEE
Recommended by BoS on	10/06/2026		
Academic Council Approval		**Date**	

24EEI304	DATA STRUCTURES AND ALGORITHMS	L	T	P	J	C
		2	0	2	0	3
ES		SDG				

Pre-requisite courses	24CSI101	Data Book / Code book (If any)	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	equip the students with fundamental concepts of data structures and algorithm design techniques for developing efficient solutions to engineering problems.
2	enable students to analyze the performance of algorithms using appropriate complexity measures and select suitable data structures for problem-solving.
3	develop the ability to implement linear and non-linear data structures and apply optimization techniques to design scalable and efficient software systems.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Illustrate fundamentals of data structures, ADTs, and algorithm design with EEE-context examples.	U
CO 2	Apply linear data structures (linked lists, stacks, queues) for EEE problem-solving:	Ap
CO 3	Analyze algorithms using asymptotic techniques and compare sorting algorithms	An
CO 4	Implement non-linear data structures — BST, AVL trees, min/max heap, priority queue — for fault priority management and power network applications	Ap
CO 5	Design optimized algorithms and graph algorithms (Dijkstra, Prim, Kruskal) for power network shortest path and MST.	C
CO 6	Evaluate algorithm performance and trade-offs and complete EEE-domain mini-project	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	2						2		
2	3	3	2	-	3				2		2	1	2
3	3	3	-	2	2						2	1	2

4	3	3	3	2	3				2		2	2	2
5	3	3	3	3	3				2	1	3	2	2
6	3	3	2	3	2						3	2	2

Course Content

ALGORITHMIC FOUNDATIONS AND LINEAR DATA STRUCTURES Introduction to Algorithms, Data Structures and ADTs, Algorithm Design Steps, Time and Space Complexity, Asymptotic Notations (Big-O, Omega, Theta), Best, Average, Worst, Expected Case Analysis with examples, Arrays and Dynamic Arrays, Linked Lists (Singly, Doubly, Circular), Stacks & Queues **Case study:** Circular queue for rotating energy meter data buffer; linked list for power outage incident records **Practical Component:** • ADT Vs Implementation Contract - Stack Implementation (Array and Linked List) • Queue and Circular Queue implementation • Linked List Operations (insert, delete, reverse) • Application of Stacks in Expression Evaluation & Balanced Parenthesis Checking	**12 Hours** **12 Hours**
NON-LINEAR DATA STRUCTURES AND GRAPH ALGORITHMS Trees: Binary Tree, Binary Search Tree, AVL trees, Red-Black Trees, heap (min/max heap), Priority Queue, Tree Traversals; Graphs: representation, BFS, DFS, Shortest Path (Dijkstra, Bellman-Ford Algorithm), Minimum Spanning Tree (Prim's); Topological Sort — Kahn's Algorithm and DFS-based Variant, hashing techniques and collision resolution. **Practical Component:** • BST operations • Shortest Path and MST Algorithms • Hash Table Implementation • Priority queue for fault alarm management	**10 Hours** **10 Hours**
ALGORITHM DESIGN AND OPTIMIZATION Divide and Conquer Technique (Merge Sort, Quick Sort), Heap Sort, Radix Sort, Greedy Algorithms (Scheduling Problems), Dynamic Programming (Optimal Substructure, Overlapping Subproblems), Backtracking Technique (N-Queens), Introduction to Optimization Problems **Practical Component:** • Sorting algorithms (Heap Sort, Quick Sort) • Mini Project: Real-World EEE Domain Problem in Power system Protection, Fault Priority Management and Smart meter analytics using DSA.	**8 Hours** **8 Hours**

Theory Hours:	**30**	**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**		**Total Hours:**	60

Learning Resources

Textbooks:

1. Weiss, Mark Allen, *Data Structures and Algorithm Analysis in C*, 3rd Edition, Pearson Education, New Delhi, 2007.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", 4th edition, MIT Press, 2022.
3. R. Sedgewick and K. Wayne, "Algorithms", 4th edition, Addison-Wesley Professional, 2011.

References:

1. Steven S. Skiena, *The Algorithm Design Manual*, 3rd Edition, Springer, 2020.
2. Narasimha Karumanchi, *Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles*, 5th Edition, CareerMonk Publications, 2023.
3. M. A. Weiss, "Data Structures and Algorithm Analysis in C", 3rd edition, Pearson Education Asia, 2007.
4. S. Halim and F. Halim, "Competitive Programming", 3rd edition, Lulu Publishing, 2013.
5. A. Laaksonen, "Competitive Programmer's Handbook", Online edition, 2018.

Online Educational Resources:

1. MIT OCW 6.046J (Design and Analysis of Algorithms) — Erik Demaine, Charles Leiserson, Nancy Lynch: https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/
2. Stanford CS161 — Algorithms (Tim Roughgarden, on Coursera). https://www.coursera.org/specializations/algorithms
3. NPTEL — 'Design and Analysis of Algorithms' Prof. Madhavan Mukund, Chennai Mathematical Institute https://nptel.ac.in/courses/106106131

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	[Dr.R.S.Sandhyadevi, Mr.N.Mohana Sundaram]	
Recommended by BoS on	10/06/2026		
Academic Council Approval	No.	**Date**	XX/YY/2024

24EEJ204	Internship - II	L	T	P	J	C
		0	0	0	0	1
PRJ		SDG	7,9,12,13			
Pre-requisite courses	–	Data Book / Code book (If any)	–			

Course Objectives:	
The purpose of taking this course is to:	
1	Strengthen students' ability to apply electrical and electronics engineering concepts to real-world industrial projects and engineering challenges.
2	Develop competency in analyzing industrial processes, adopting modern engineering tools, and implementing effective technical solutions while adhering to safety standards and professional ethics.
3	Enhance technical, communication, teamwork, and project management skills through active participation in multidisciplinary industrial assignments and professional interactions.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply engineering knowledge, modern tools, and technical skills to execute industrial projects and solve real-world problems in Electrical and Electronics Engineering.	Ap
CO 2	Analyze industrial systems, operational practices, and engineering processes to identify opportunities for performance improvement and innovation.	Ap
CO 3	Evaluate the performance, reliability, and efficiency of electrical equipment, control systems, or industrial processes using appropriate engineering methods.	E
CO 4	Prepare comprehensive technical reports, project documentation, and deliver effective presentations demonstrating professional communication skills.	An
CO 5	Demonstrate leadership, teamwork, ethical responsibility, adaptability, and professional conduct while contributing to multidisciplinary industrial projects.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2

1	3	2	2	2	3				1		2	3	3
2	2	2			2	2	3		1		2	2	2
3	3	3	2	2	3			2	1		2	3	3
4	2	2	1	1	2			2	3		2	2	2
5	2	2	1			2	2	3	2	3	2	2	2

Assessment
Presentation and Internship Report

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
-	-	[Dr. P. Thirumoorthi, Prof/EEE]

24EEI305	SOLID STATE DRIVES AND CONTROLS	L	T	P	J	C
		3	0	2	0	4
PC		SDG	4,7&9			

Pre-requisite courses	Power Electronics &Electrical Machines	Data Book / Code book (If any)	NA/calculator allowed for exams

Course Objectives:	
The purpose of taking this course is :	
1	To electric drives and Types of loads
2	To analyse converter-fed DC and AC drives
3	To study control techniques of induction and synchronous motor drives
4	To explore special machines and modern drive applications
5	To develop simulation and experimental skills in electrical drives

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the fundamentals and dynamics of electric drives	K3
CO 2	Analyze and design DC motor drives using power electronic converters	K3
CO 3	Analyze control strategies for induction motor drives and synchronous drive	K4
CO 4	Compare and apply special electrical machines in drive systems	K3
CO 5	Apply electrical drives in real-world industrial and transportation systems	K3
CO 6	Design and implement laboratory experiments to simulate and analyze the performance of power converters and motor drives.	K4

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative	Communication	Project Management and	Life-Long Learning	PSO-1	PSO-2
1	1	2										2	
2	1	2	2									2	
3	1	2	2									1	2
4	1	2	2									1	2
5	1		3		2				1			2	2
6	1	2	2		3				2			2	2

Course Content	
MODULE 1: DRIVE FUNDAMENTALS Elements of electric drive system-Dynamics of electric drives – torque balance equation-Speed–torque characteristics of various loads-multi-quadrant operation of drives-Selection of motor power rating-Continuous, short-time, intermittent duty-Heating and cooling curves-Electric braking methods. **Practical Component:** 1. **Case study on drive system components** 2. **Case study on types of loads** 3. **Case study on types of motor duties and power ratings.**	**9 Hours** **6 Hours**
MODULE 2: DC DRIVES Single-phase and three-phase converter-fed self-excited DC drives: Single phase and three phase full control convert fed DC motor drives, three phased dual convert fed self-excited DC drives - Chopper-controlled DC drives-Step-down and step-up choppers -Speed control methods -Four-quadrant operation of DC drives-Closed-loop control of DC drives-Application -Steel rolling mill: Process &Drives **Practical Component:** • Speed control of DC motor using 3 phase full controlled convert fed DC motor. • Four-quadrant chopper fed DC motor drive • Simulation of DC drive using MATLAB/Simulink	**9 Hours** **6 Hours**
MODULE 3: AC DRIVES Induction motor drives-Stator voltage control-V/f control (open loop and closed loop)-Rotor resistance control-Slip power recovery schemes-Static Kramer Drive-Static Scherbius Drive-Vector control and direct torque control (basic concepts)-Speed control of synchronous motor drive (Self-control method)-Applications: Paper mill processes and Drives - Drives for Cranes and Lifts. **Practical Component:** • V/f control of induction motor • Study of slip power recovery scheme (simulation) • Speed control of Synchronous motor(simulation)	**9 Hours** **6 Hours**
MODULE 4: SPECIAL ELECTRICAL MACHINES Permanent Magnet Synchronous Motor (PMSM) drives-Brushless DC (BLDC) motor drives- Comparison and applications- Drives in electric traction systems- Pure Electric and hybrid vehicles- Application: Robotics and CNC machines- Electric Two-Wheeler-Electric Car-Drives.s **Practical Component:** • BLDC motor drive characteristics	**9 Hours**

• E Bike Power Train • **Simulation of PMS Drive**	**6 Hours**
MODULE 5: APPLICATIONS OF ELECTRICAL DRIVES Synchronous Reluctance Motor -Switched Reluctance Motor (SRM) drives-Stepper motor drives- -Linear Induction Motor (LIM)- MAGLEV train -Industrial Drives: Pumps, fans, compressors- -Energy-efficient drives and regenerative systems- Introduction to smart drives and IoT-based monitoring **Practical Component:** • Speed control of Stepper motor • SRM drive analysis (simulation/demo) • Study of Drive Analyser	**9 Hours** **6 Hours**

Theory Hours:45	Tutorial Hours:	Practical Hours:30	Project Hours:	Total Hours:75

Learning Resources

Textbooks:

1. ***Fundamentals of Electrical Drives* – Gopal K. Dubey,Edition: 2nd Edition (Latest) Publication Year: 2001,Publisher:** Alpha Science International / Narosa Publishing **ISBN:** 9781842650837 (Alpha Science edition) ,9788173194283 (Narosa edition) **Pages:** ~390–408.
2. Modern Power Electronics and AC Drives – Bimal K. Bose,edition: 1st Edition,,Original ,Latest Reprint: 2015 (Pearson India) ,Publisher: Prentice Hall / Pearson Education ,ISBN: 9780130167439 / 9789332557550,Pages: ~711–744 pages

References:

1. Vedam Subrahmanyam – Electric Drives(Electric Drives: Concepts and Applications – Latest Edition Details,Edition: 2nd Edition ,Publication Year: ~2010–2014 .,Publisher: McGraw Hill Education (formerly Tata McGraw-Hill) ISBN: 9780070701991 ,Pages: ~730 pages
2. Power Electronics Handbook by Muhammad H. Rashid ,Edition: 5th Edition , Publication Date: December 21, 2023 .
   .

Online Educational Resources:

1. Fundamentals Of Electric Drives - Course
2. EV - Vehicle Dynamics and Electric Motor Drives - Course

Assessment (Theory course)

Direct

1. Continuous Assessment Test I, II
2. Model Examination (For Practical Courses & Embedded Courses)
3. Assignment, Open Book Test, Cooperative Learning Report, Group Presentation, Problem based Learning, Project based Learning, Mini Projects, Project Report, Quiz, Role Play, Self-Explanatory Videos, Prototype or Product Demonstration etc. (as applicable)

End Semester Examination

Indirect

1. Course End Survey
2. Programme Exit Survey
3. Placement/Higher Education Record

Feedback (Students, Employers, Parents, Professional Body members, Alumni)

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	[Dr.P.Thirumoorthi Dr.B.Karunamoorthy]	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

24EEI306	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	J	C
PC		3	0	2	0	4
		SDG	7,8,9,11,13			

Pre-requisite courses	Electrical Machines & Power Electronics	Data Book / Code book (If any)	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand EV Fundamentals and Ecosystem
2	Analyze Vehicle Dynamics and Energy Consumption
3	Develop Knowledge of Electric Propulsion Systems
4	Explore Energy Storage and Battery Management
5	Identify and analyze key components in chargers, BMS, smart meters, and grid interfaces

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the basic principles of electric vehicle components and compare them with internal combustion engines and other power sources.	Ap
CO 2	Analyze vehicle dynamics, resistance factors, and subsystems to evaluate performance and efficiency of EV powertrains.	An
CO 3	Evaluate different electric motor drive technologies and power converter control strategies to recommend the most efficient propulsion systems for EVs.	An
CO 4	Compare and assess different battery chemistries, BMS strategies, and regenerative braking for efficient energy storage.	An
CO 5	Illustrate integrated vehicle-to-grid systems incorporating charging standards and components to enhance the interaction between electric vehicles and utility grids.	Ap

PRE-REQUISITE

1. Electrical Machines
2. Power Electronics

Course Outcomes	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)
	1	2	3	4	5	6	7	8	9	10	11	

	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	3			3							3	
2	3	3	2						2			3	
3	3			2			2					2	3
4	3	3	2		3							3	2
5	3		2								2	2	2

Course Content	
INTRODUCTION TO ELECTRIC VEHICLES AND MOBILITY ECOSYSTEM Evolution of EVs ,EV scenario in India, EV Architecture and Types - BEV, HEV, PHEV, FCEV, Components of EV, Comparison of EVs- ICE vs EV vs Hybrid vs Solar EV, Emerging trends - Shared mobility and Fleet Electrification, Autonomous EVs, Connected EVs - Introduction to EV communication protocols -Overview of EV standards **Practical Component:** • Modeling and Simulation of Electric Vehicle Architecture using MATLAB/Simulink • Case Study Analysis of Electric Vehicle System Architecture (Tata Nexon EV / Ather 450) • Study and Demonstration of CAN Communication in Electric Vehicles (Simulation-Based)	**9 Hours** **9 Hours**
VEHICLE DYNAMICS AND SUBSYSTEMS Vehicle resistance -Rolling resistance, Aerodynamic drag, Grading resistance, Acceleration resistance, Tractive effort, Wheel torque, Dynamic Equations, Drive cycle analysis (UDDS, WLTP, Indian Drive Cycle), Energy consumption modelling of EVs , Electric Vehicle subsystems and Power train components, Regenerative braking dynamics (mathematical modeling) **Practical Component:** • Simulation-Based Estimation of Electric Vehicle Driving Range using MATLAB • Study and Analysis of Vehicle Dynamics and Energy Consumption in Electric Vehicles under Different Driving Conditions	**9 Hours** **3 Hours**
	9 Hours

ELECTRIC PROPULSION SYSTEMS Electric motor drive technologies for Electric Vehicles – Permanent Magnet Synchronous Motors (PMSM),Switched Reluctance Motors (SRM), Brushless DC Motors (BLDC), Induction Motors (IM), Overview of Power Converters and its control Strategies, Multi-motor and all-wheel-drive propulsion, High-efficiency and wide-bandgap (SiC/GaN) motor technologies. **Practical Component:** • Efficiency analysis using Eddy current load set up for Electric Motors • Speed and Torque Control of PMSM for Electric Vehicle Applications	**6 Hours**
ENERGY STORAGE SOLUTIONS Electric Vehicle Batteries-Lead Acid, Lithium ion-Lithium Iron Phosphate (LFP), Nickel Manganese Cobalt (NMC), Nickel Cobalt Aluminium (NCA) Solid-State Batteries, Comparison of Battery parameters, Battery Management System - Battery monitoring, SOC estimation ,SOH and Remaining Useful Life (RUL), Cell balancing Regenerative Braking and Energy Recovery **Practical Component:** • Modeling of Electric Vehicle Battery and State of Charge (SOC) Estimation using MATLAB/Simulink • Design and Analysis of Electric Vehicle Battery Pack Configuration	**9 Hours** **6 Hours**
VEHICLE TO GRID AND SMART INTEGRATION TECHNOLOGIES Integration of Electric vehicle with electric utility systems - Electric vehicle charging infrastructure-Types, Components and Selection, Charging Standards, Bidirectional charger, Integration with renewable energy sources, Case Studies: Electric Bicycle, Electric Bike, Electric Car. **Practical Component:** • Simulation of Electric Vehicle Charging Load and Its Impact on Power System • Modeling and Analysis of Vehicle-to-Grid (V2G) Operation for Electric Vehicles • Case Study Analysis of Electric Vehicle Charging Infrastructure in India	**9 Hours** **6 Hours**

Theory Hours:45	**Tutorial Hours:**	**Practical Hours:30**	**Project Hours:**	**Total Hours:75**

Learning Resources
Textbooks:
1.
References:
1. Iqbal Husain ,“Electric and Hybrid Electric Vehicles-Design Fundamentals”,CRC Press,2005. 2. AntoniSzumanowski, “Hybrid Electric Power Train Engineering and Technology: Modelling, Control, and Simulation”, IGI Global, 2013.

3. Larminie, James, and John Lowry, “Electric Vehicle Technology Explained” ,John Wiley and Sons, 2012.
4. Tariq Muneer and Irene IllescasGarcía, “The automobile, In Electric Vehicles: Prospects and Challenges”, Elsevier, 2017.
5. Seth Leitman, Bob Brant, “Build your own Electric Vehicle”,McGraw Hill,2009.

Online Educational Resources:
1.

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
[Name, Organization]	[Name, Institution]		[Dr. K.Malarvizhi MS. G.Anushree Mr.Ravichandiran]
Recommended by BoS on			
Academic Council Approval		**Date**	

24EEI307	VLSI DESIGN	L	T	P	J	C
		2	0	2	0	3
PC		SDG	9			

Pre-requisite courses	24ECI102 24EEI203	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Understand CMOS technology and fabrication processes
2	Analyze digital circuits at transistor level
3	Design combinational and sequential circuits using VLSI principles
4	Implement digital systems using HDL tools
5	Develop optimized VLSI designs for real-world applications

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Explain VLSI design flow and CMOS fabrication	U
CO2	Analyze CMOS logic circuits	An
CO3	Design combinational and sequential circuits	C
CO4	Implement digital systems using HDL	Ap
CO5	Evaluate VLSI design performance (area, power, delay)	E
CO6	Develop optimized VLSI-based systems	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	CO1	3	2										2
2	CO2	3	2	2	3								2
3	CO3	3	2	3									2
4	CO4	3	2	2	2								2
5	CO5	3	3	3	3							2	2
6	CO6	3	3	2	3							2	3

Course Content	
CMOS TECHNOLOGY AND LOGIC DESIGN	10 Hours

Introduction to VLSI design, Moore's law, VLSI design flow, IC fabrication process (oxidation, diffusion, lithography), CMOS technology, MOS transistor operation, CMOS inverter characteristics, noise margins, power dissipation, stick diagrams, layout design rules **Practical Component:** • Introduction to EDA tools (Cadence / Tanner / LTSPICE/ Microwind) • CMOS inverter design and simulation • Layout design of inverter and NAND/NOR gates • Verification of layout using DRC and LVS **Self-study** Scaling issues and short-channel effects	**10 Hours** **2 Hours**
COMBINATIONAL AND SEQUENTIAL CIRCUITS DESIGN Static CMOS, pseudo-NMOS logic, pass transistor logic, transmission gate logic, dynamic CMOS logic, clocked CMOS logic, combinational circuits: basic gates, adder, multiplier, sequential circuits: Static and dynamic flip-flops, registers, timing issues: setup, hold, clock skew. **Practical Component:** • Design and simulation of combinational circuits • Implementation of adder circuits • Design of flip-flops using CMOS • Timing analysis of sequential circuits **Self-study** Low-power circuit design techniques	**10 Hours** **10 Hours** **2 Hours**
HDL-BASED DESIGN AND VLSI SYSTEM IMPLEMENTATION Hardware Description Languages (Verilog/VHDL), behavioral and structural modeling, RTL design, synthesis, FPGA-based design, testing and verification, introduction to ASIC design, performance metrics: area, power, delay optimization **Practical Component:** • Introduction to Verilog/VHDL programming • Design of combinational circuits using HDL • Sequential circuit implementation using HDL • FPGA implementation (simulation and synthesis) • Mini Project: VLSI system design (ALU / counter / controller) **Self-study** System-on-Chip (SoC) and emerging trends	**10 Hours** **10 Hours** **1 Hour**

Theory Hours:45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:45

Learning Resources

Textbooks:

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", 2nd Edition, Addision Wesley, 1993
2. A.Pucknell, Kamran Eshraghian, "Basic VLSI Design", 3rd Edition, Prentice Hall of India, 2007.

References:

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", 2nd Edition, Prentice Hall of India, 2003.
2. Sung Mo Kang and Y. Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 3rd ed., McGraw-Hill, 2003.
3. IEEE Transactions on VLSI Systems.

Online Educational Resources:

1. NPTEL: https://nptel.ac.in/courses/117106092
2. NPTEL: https://onlinecourses.nptel.ac.in/noc25_ee106/preview

Assessment (Embedded course)

SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)

Lab Workbook, Experimental Cycle tests, viva-voce, etc…

*

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
[Name, Organization]	[Name, Institution]	Dr. K.Paramasivam Dr.V.Kandasamy
Recommended by BoS on		
Academic Council Approval		**Date**

24EEI308	AI FOR ENERGY MANAGEMENT SYSTEMS	L	T	P	J	C
		2	0	2	0	4
PE		SDG	7,11,13			

Pre-requisite courses	• Basic Electrical Engineering • Programming (Python/MATLAB) • Fundamentals of Power Systems	Data Book / Code book (If any)	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand AI techniques for energy systems
2	Analyze data-driven approaches in energy management
3	Apply machine learning algorithms for load forecasting and optimization
4	Design intelligent energy management systems
5	Implement AI-based solutions for smart grids and renewable integration

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain AI concepts applied to energy systems	U
CO 2	Analyze energy data using machine learning techniques	An
CO 3	Apply AI models for load forecasting and optimization	Ap
CO 4	Design intelligent energy management systems	C
CO 5	Evaluate AI-based solutions for smart grids	E
CO 6	Implement AI models using programming tools	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2										1	1
2	3	3	2	2	2							2	2
3	3	3	2	2	2							2	2
4	3	3	3	2	2							3	3
5	3	3	2	2	2							3	3
6	3	3	2	3	3							3	3

Course Content	
MODULE 1: AI FUNDAMENTALS AND ENERGY DATA ANALYTICS **Theory** Introduction to Artificial Intelligence, Machine Learning basics, supervised and unsupervised learning, data preprocessing, feature extraction, energy data characteristics, smart meters and IoT data, introduction to energy analytics, visualization techniques **Practical** 1. Introduction to Python/MATLAB for AI 2. Data preprocessing and visualization of energy datasets 3. Implementation of regression models (linear regression) 4. Classification techniques for energy data **Self-study (2 Hours)** Big data analytics in smart grids	**10 Hours** **10 Hours**
MODULE 2: AI TECHNIQUES FOR ENERGY MANAGEMENT **Theory (10 Hours)** Load forecasting (short-term, long-term), machine learning algorithms: regression, decision trees, support vector machines, artificial neural networks, optimization techniques (genetic algorithms, particle swarm optimization), demand response strategies **Practical** 5. Load forecasting using regression models 6. ANN implementation for energy prediction 7. Optimization using genetic algorithms 8. Demand-side management simulation **Self-study (2 Hours)** Deep learning for energy systems	**10 Hours** **10 Hours**
MODULE 3: AI-BASED SMART ENERGY SYSTEMS **Theory (10 Hours)** AI in smart grids, renewable energy forecasting (solar, wind), energy management systems (EMS), microgrid optimization, fault detection and predictive maintenance, AI in electric vehicles and charging optimization **Practical** 9. Renewable energy forecasting using ML models 10. Smart grid simulation using AI tools 11. Fault detection using classification algorithms 12. Mini Project: AI-based energy management system **Self-study (1 Hour)** AI ethics and cybersecurity in energy systems	**10 Hours** **10 Hours**

Theory Hours:30	Tutorial Hours:	Practical Hours:30	Project Hours:	Total Hours:60

Learning Resources
Textbooks:
1. Stuart Russell & Peter Norvig, *Artificial Intelligence: A Modern Approach* 2. S. Haykin, *Neural Networks and Learning Machines*
References:

1. Andreas Sumper, *Smart Grid: Fundamentals of Design and Analysis* 2. Handschin, *AI in Power Systems* 3. IEEE Transactions on Smart Grid
Online Educational Resources:

Assessment (Theory course)
• CAT: 30% • Continuous Assessment (Assignments, Coding, Mini Project): 20% • Lab Evaluation (Record, Viva, Experiments): 20% • End Semester Exam: 30%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr. Suganthi S T Dr. S Kaliappan Dr.J Ramprabu	
Recommended by BoS on			
Academic Council Approval		**Date**	

24EEE001	ENERGY STORAGE SYSTEMS	L	T	P	J	C
		3	0	0	0	3
PE		SDG	7,13			

Pre-requisite courses	-	Data Book / Code book (If any)	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Equip students with the fundamental concepts, classification, and operating principles of various energy storage systems.
2	Familiarize the students with the working principles, performance characteristics, and operational aspects of electrical energy storage technologies.
3	Explore the application of energy storage systems in renewable energy integration and smart grid development.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyse various energy storage technologies and compare their performance characteristics for grid and mobility applications	An
CO 2	Analyze electrochemical energy storage systems	An
CO 3	Analyse and compare electrical, thermal, and mechanical storage technologies based on performance parameters and applications	Ap
CO 4	Analyse the performance and efficiency of storage systems	An
CO 5	Evaluate and select suitable energy storage solutions for grid, EV, and renewable integration applications .	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2										2	2
2	3	3	2									2	
3	3	3	2									2	2
4	3	3	2		2		2					3	
5	3	3	3		3	2	3					3	3

Course Content	
INTRODUCTION TO ENERGY STORAGE Energy scenario and need for storage, role in modern power systems, classification of energy storage systems (mechanical, electrical, electrochemical, thermal), comparison of energy storage technologies, performance parameters: energy density, power density, efficiency, lifecycle, cost analysis- Indian context: PLI - ACC scheme. **Case study** : NITI Aayog Energy Storage Mission, Indian Green Hydrogen Mission overview.	**9 Hours**
ELECTROCHEMICAL ENERGY STORAGE Battery fundamentals, electrochemical principles, construction and operation of batteries: Lead-acid, Lithium-ion, Nickel- Cd batteries, Sodium-Sulphur battery, solid-state battery, Flow batteries, battery charging/discharging characteristics, state of charge (SOC), state of health (SOH)- IEC 62619 safety standard- Battery recycling Technologies – EPR rules 2022 **Case study**: Thermal runaway and Li-ion safety risk Sizing of the Battery , High power and low power battery design	**9 Hours**
ELECTRICAL ENERGY STORAGE Supercapacitors: working, characteristics, applications; Superconducting Magnetic Energy Storage (SMES), Fuel Cells , Hydrogen storage- comparison of electrical storage technologies, hybrid Energy storage systems - active cell balancing topology. Case study : Hybrid ESS for EV acceleration cycle	**9 Hours**
THERMAL AND MECHANICAL ENERGY STORAGE Pumped hydro storage systems, compressed air energy storage (CAES), Flywheel energy storage systems , thermal energy storage: phase change materials (PCM), thermochemical storage – comparison of thermal and mechanical energy storage Case study : India pumped-Hydro Storage Plant (PSP)- Kadamparai PSP	**9 Hours**
APPLICATIONS AND GRID INTEGRATION Energy storage in renewable energy systems (solar, wind), electric vehicles and charging infrastructure, grid stabilization, microgrids, smart grid integration - economic and environmental aspects of energy storage – BESS connection codes: IEEE 2030.2, IEEE 2030.3 standards for grid integration. Case study : Hybrid Battery Energy Storage and PV system	**9 Hours**

Theory Hours:45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:45

Learning Resources
Textbooks:
1. Ibrahim Dincer, Halil S. Hamut, Energy Storage Systems: Principles, Technologies and Applications, 2019, Elsevier. 2. Yao Sun, Chengshan Wang, Electric Energy Storage Systems, 2018, Academic Press (Elsevier). 3. Ibrahim Dincer, “Thermal Energy Storage Systems and Applications”, 2021, Wiley. 4. Dirk Uwe Sauer, Kai Peter Birke and Oliver Bohlen, *Battery Technology Handbook*, Springer, 2023.
References:

1. Frank S. Barnes, Jonah G. Levine, Energy Storage Systems: Fundamentals, Classification and a Technical Comparative, 2011, McGraw-Hill Education.
2. James Larminie and Andrew Dicks, *Fuel Cell Systems Explained*, Wiley, 2012.
3. Paul Breeze, *Grid Energy Storage*, Academic Press, 2018.

Online Educational Resources:

Next-Gen. Energy Storage - Battery and Hydrogen Technology : https://www.coursera.org/learn/next-gen-energy-storage---battery-and-hydrogen-technology
NPTEL Energy Materials and Devices **:** https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ph56
BEE Certified Energy Manager / Energy Auditor Exam https://www.beeindia.gov.in/

Assessment (Theory course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
[Mr. Illangovan A Director, Sodian Energy Pvt.Lts]	[Dr.Kumaravel NIT, Calicut]		Dr. T. Shanthi Dr.Omsuraj Gutti Department of EEE
Recommended by BoS on	10/06/2026		
Academic Council Approval	No.	**Date**	XX/YY/2026

24EEE016	AUTOMOTIVE ELECTRONICS	L	T	P	J	C
		3	0	0	0	3
PE		SDG				9, 11

Pre-requisite courses	24ECI203	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Illustrate the operation of automotive electronic systems and architectures, sensors, actuators and control systems used in vehicles
3	Provide comprehensive understanding of electronic control units (ECUs) and communication networks.
4	Familiarize the students with safety, diagnostics and advanced driver assistance systems and modern automotive electronic technologies

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Illustrate automotive electronic architecture and subsystems	U
CO 2	Analyze sensors, actuators and control systems in vehicles	An
CO 3	Apply knowledge of automotive communication networks and ECUs in vehicle electronics systems.	Ap
CO 4	Analyze safety, diagnostics and ADAS technologies	An
CO 5	Evaluate the solutions of modern automotive electronic systems	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2					1				1	3	2
2	3	2										2	3
3	3	2										2	3
4	3	2	2				1				1	2	3
5	3	3	2									3	3

Course Content

MODULE 1: AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS Evolution of automotive electronics - Automotive electrical and electronic systems - Construction and working: Starting system - Charging system - onboard charger (OBC) - Ignition system – Electrical power distribution in vehicles- Multiplexed wiring and domain architecture- wiring harness weight reduction and optimization - switching and lighting system in an automobile - Indian context — AIS-038 Rev.2, PLI Auto scheme. **Case Study:** Comparative Analysis of Powertrain Architectures in BEV, HEV, PHEV, and FCEV Vehicles Powertrain comparison of various automotives in India	**9 Hours**
MODULE 2: AUTOMOTIVE SENSORS AND ACTUATORS Types of sensors: Temperature, piezoresistive pressure, position, speed, oxygen sensors, MEMS sensor fabrication: bulk and surface micromachining- MEMS accelerometer- MEMS gyroscope - Automotive Radar, LIDAR - Actuators: Motors, solenoids, injectors, relays - Actuator control methods -Applications in engine management systems. **Case Study:** Pressure measurement using piezoresistive sensor for ABS	**9 Hours**
MODULE 3: ELECTRONIC CONTROL UNITS AND VEHICLE NETWORKS Electronic Control Units (ECUs): Architecture and functions - Microcontrollers and embedded systems in vehicles - Communication protocols in embedded systems: SPI, I2C, USB - Automotive communication networks: Introduction to CAN, CAN FD, LIN, FLEXRAY, MOST, KWP2000 and Automotive Ethernet - Unified Diagnostic Services (UDS) as per ISO 14229- On-Board Diagnostics (OBD-II) - AUTOSAR basics. **Case Study**: Comparison of CAN, CAN FD, OBD II.	**9 Hours**
MODULE 4: AUTOMOTIVE CONTROL SYSTEMS AND SAFETY Engine control systems and fuel injection - Transmission control systems - Power train and Chassis subsystem – Cruise control - Brake control systems: ABS, EBD - Stability control: ESC - Safety systems: Airbags, collision detection - Functional safety standards: ASIL, ISO 26262, AIS-156. **Case Study**: ADAS-Based Autonomous Emergency Braking (AEB) System. ASIL A/B/C/D classification and Hazard Analysis and Risk Assessment (HARA)	**9 Hours**
MODULE 5: ADVANCED AUTOMOTIVE ELECTRONICS AND FUTURE TRENDS Advanced Driver Assistance Systems (ADAS) - Infotainment and human-machine interface (HMI) - Electric and hybrid vehicle electronics - Autonomous vehicle electronics overview - Cybersecurity in automotive systems: ISO21434 TARA - Future trends: Over the Air (OTA) software update, Connected cars, AI in vehicles, Digital Twin Technology in Automotive Design and Diagnostics **Case Study:** Demo based case study for ADAS and driver safety	**9 Hours**

Theory Hours:45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:45

Learning Resources

Textbooks:
1. **Tom Denton**, *Automobile Electrical and Electronic Systems*, Routledge (Taylor & Francis), 2023, 6th Edition. 2. **Robert Bosch GmbH**, *Automotive Electrics and Automotive Electronics: Systems and Components, Networking and Hybrid Drive*, Springer Vieweg, 2018. 3. **William B. Ribbens**, *Understanding Automotive Electronics*, Butterworth-Heinemann (Elsevier), 2017, 8th Edition.
References:
1. **James D. Halderman**, *Automotive Electricity and Electronics*, Pearson Education, 2022, 7th Edition 2. **Konrad Reif (Editor)**, *Automotive Mechatronics: Automotive Networking, Driving Stability Systems, Electronics*, Springer Vieweg, 2022, 7th Edition. 3. **Barry Hollembeak**, *Automotive Electricity, Electronics and Computer Controls*, Delmar Cengage Learning, 2021.
Online Educational Resources:
NPTEL: Autotronics https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_me101 NPTEL Fundamentals of Automotive Electronics : https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_de02 Coursera: Automotive Embedded systems : https://www.coursera.org/learn/introduction-to-automotive-embedded-systems

Assessment (Theory course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Mr Karthik Sathianathan, Chief Engineer, ePropelled Systems Private Limited]	[Name, Institution]	Dr. P. Maithili Mrs. G. Anushree	
Recommended by BoS on	10/06/2026		
Academic Council Approval		**Date**	

		L	T	P	J	C
	DISTRIBUTED ENERGY RESOURCES AND MICRO GRID	2	0	2	0	3
PE		**SDG**	**7, 13**			

Pre-requisite courses	• Power Systems • Power Electronics • Renewable Energy Systems	**Data Book / Code book (If any)**	**NIL**

Course Objectives:	
The purpose of taking this course is to:	
1	Understand distributed energy resources (DER) and microgrid concepts.
2	Analyze operation and control of microgrids.
3	Design energy management strategies for DER integration.
4	Evaluate performance and reliability of microgrids.
5	Develop practical skills using simulation and hardware tools.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain DER technologies and microgrid architectures	U
CO 2	Analyze operation and control of microgrids	AN
CO 3	Design control strategies and energy management systems	C
CO 4	Evaluate integration of DER and storage systems	E
CO 5	Implement microgrid models using simulation tools	AP

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	2	-	-	-	1	3	2	-
2	3	3	2	2	3	-	1	-	-	-	1	3	3	-
3	3	3	3	2	3	2	2	-	1	2	1	3	3	2
4	3	3	2	3	3	3	2	1	-	2	2	3	3	2
5	3	3	3	3	3	3	3	2	1	2	3	3	3	3

Course Content	
MODULE 1: DER TECHNOLOGIES AND MICROGRID ARCHITECTURE **Theory** • Introduction to Distributed Energy Resources (DER)	**10 Hours**

• Types of DER: Solar PV, Wind, Biomass, Fuel cells • Microgrid concept and classification (AC, DC, Hybrid) • Components of microgrid (generation, storage, loads) • Grid-connected and islanded modes of operation • Benefits and challenges of microgrids **Self-Study (2 Hours)** • Case study: Campus and rural microgrids • Policies and standards (MNRE, IEEE 1547) **Practical** • Modeling of solar PV system using MATLAB/Simulink • Wind energy system simulation • Microgrid architecture simulation (AC/DC microgrid) • Load flow analysis in microgrid • Study of DER characteristics	**10 Hours**
MODULE 2: CONTROL AND ENERGY MANAGEMENT OF MICROGRIDS **Theory** • Microgrid control hierarchy (Primary, Secondary, Tertiary) • Voltage and frequency control • Droop control methods • Energy Management System (EMS) • Load sharing and demand response • Communication protocols and smart grid integration **Self-Study (2 Hours)** • Smart grid technologies in microgrids • Case study: Smart microgrid implementation **Practical** • Simulation of droop control techniques • Frequency and voltage control experiments • Implementation of EMS using MATLAB/Simulink • Load sharing between multiple DER sources • Demand response simulation	**10 Hours** **10 Hours**
MODULE 3: ENERGY STORAGE, PROTECTION AND APPLICATIONS **Theory** • Role of energy storage in microgrids • Battery and supercapacitor integration • Power electronic converters for DER • Microgrid protection schemes • Power quality issues and mitigation • Applications: EV integration, smart cities, rural electrification **Self-Study (1 Hour)** • Emerging technologies in microgrids (AI, IoT) • Case study: Resilient microgrids **Practical** • Battery storage modeling and simulation • Converter control for DER integration • Power quality analysis in microgrid • Fault analysis and protection schemes Mini project: Design of microgrid with DER and storage	**10 Hours** **10 Hours**

Theory Hours:30	Tutorial Hours:	Practical Hours:30	Project Hours:	Total Hours:60

Learning Resources
Textbooks:
1. Hatziargyriou, N., *Microgrids: Architectures and Control*, Wiley, 2014. 2. Ackermann, T., *Distributed Generation*, Wiley, 2001.
References:
1. Lasseter, R.H., IEEE Papers on Microgrids 2. IEEE 1547 Standards for DER Integration 3. IEA Reports on Distributed Energy Systems
Online Educational Resources:

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 20% • Lab Performance & Records – 20% • Mini Project / Activities – 20% • End Semester Examination (ESE) – 40%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
[Name, Organization]	[Name, Institution]		Dr. M. Nirmala
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

		L	T	P	J	C
	SMART GRID TECHNOLOGIES AND ARCHITECTURE	3	0	0	0	3
PE		**SDG**	**7,9,11**			

Pre-requisite courses	• Power Systems • Power Electronics • Control Systems • Basics of Communication Systems	**Data Book / Code book (If any)**	**NIL**

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the concepts and evolution of smart grids.
2	Analyze smart grid architecture and key enabling technologies.
3	Study communication, control and automation in smart grids.
4	Evaluate integration of renewable energy and distributed resources.
5	Develop solutions for efficient, reliable and secure smart grid operation.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain smart grid concepts, architecture and components	U
CO 2	Analyze communication and control technologies in smart grids	AN
CO 3	Evaluate integration of renewable energy and DER in smart grids	E
CO 4	Analyze smart grid automation, protection and monitoring systems	AN
CO 5	Develop solutions for smart grid optimization and security	C

Course Outcomes (CO)	**Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)**											**Program Specific Outcomes (PSO)**		
	1 Engineering Knowledge	**2** Problem Analysis	**3** Design/Development of Solutions	**4** Conduct Investigations of Complex Problems	**5** Engineering Tool Usage	**6** The Engineer and The World	**7** Ethics	**8** Individual and Collaborative Team work	**9** Communication	**10** Project Management and Finance	**11** Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	2	-	-	-	1	3	2	-
2	3	3	2	2	3	-	1	-	-	-	1	3	3	-
3	3	3	3	2	3	3	2	1	1	2	2	3	3	2
4	3	3	3	3	3	3	2	1	-	2	2	3	3	2
5	3	3	3	3	3	3	3	2	1	2	3	3	3	3

Course Content	
MODULE 1: INTRODUCTION TO SMART GRID AND ARCHITECTURE **Theory Topics:** • Evolution of conventional grid to smart grid • Definition, features and benefits of smart grid • Smart grid architecture (generation, transmission, distribution, consumer) • Smart grid components and stakeholders • Smart grid standards and frameworks (IEEE, IEC, NIST) • Challenges in smart grid implementation	**9 Hours**
MODULE 2: COMMUNICATION AND ICT IN SMART GRID **Theory Topics:** • Role of communication in smart grid • Communication technologies: Wired and wireless (PLC, ZigBee, Wi-Fi, 5G) • Smart grid communication protocols (IEC 61850, DNP3, Modbus) • Advanced Metering Infrastructure (AMI) • Supervisory Control and Data Acquisition (SCADA) systems • Cybersecurity in smart grids	**9 Hours**
MODULE 3: DISTRIBUTED ENERGY RESOURCES AND SMART GRID INTEGRATION **Theory Topics:** • Integration of renewable energy sources (solar, wind) • Distributed Energy Resources (DER) and microgrids • Energy storage systems in smart grids • Demand response and load management • Electric vehicle integration (V2G concept) Grid stability and power quality issues	**9 Hours**
MODULE 4: SMART GRID CONTROL, AUTOMATION AND PROTECTION **Theory Topics:** • Smart grid control strategies • Distribution automation systems • Fault detection, isolation and service restoration (FDIR) • Wide Area Monitoring Systems (WAMS) and PMUs • Smart grid protection schemes Self-healing grid concepts	**9 Hours**
MODULE 5: SMART GRID APPLICATIONS AND FUTURE TRENDS **Theory Topics:** • Smart homes and smart cities • Energy management systems (EMS) • Artificial Intelligence and IoT in smart grids • Blockchain in energy trading • Smart grid economics and policies • Case studies of smart grid implementations	**9 Hours**

Theory Hours:45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:45**

Learning Resources
Textbooks:
1. Momoh, J.A., *Smart Grid: Fundamentals of Design and Analysis*, Wiley, 2012. 2. Gungor, V.C., Sahin, D., *Smart Grid Technologies: Communication Technologies and Standards*, Wiley, 2013
References:
1. Amin, S.M., *Smart Grid: Overview, Issues and Opportunities*, IEEE Publications 2. IEC 61850 Standards Documentation 3. NIST Smart Grid Framework
Online Educational Resources:
• NPTEL: Smart Grid • SWAYAM: Power System Modernization • IEEE Xplore Digital Library • National Smart Grid Mission (India)

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 30% • Assignments / Activities / Mini Project – 20% • End Semester Examination (ESE) – 50%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr.K.Premalatha	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

EE24C310	ELECTRICAL SAFETY AND ENERGY AUDITING	L	T	P	J	C
		3	0	0	0	3
PE		SDG	7,8,13			

Pre-requisite courses	• Basic Electrical Engineering • Power Systems	Data Book / Code book (If any)	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand electrical hazards and safety practices
2	Apply safety standards and protection methods
3	Analyze energy consumption patterns in systems
4	Conduct energy audits in industrial and commercial sectors
5	Recommend energy conservation and efficiency measures

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain electrical safety principles and hazards	U
CO 2	Apply safety standards and protective measures	AP
CO 3	Analyze electrical energy consumption and losses	AN
CO 4	Evaluate energy auditing techniques and tools	E
CO 5	Propose energy conservation measures and audit reports	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	2	-	3	3	-	-	-	2		
2	3	3	2	2	3	-	3	3	-	-	-	2		
3	3	3	2	2	3	-	3	-	-	-	-	3		
4	3	3	2	3	3	2	3	-	-	-	-	3		
5	3	3	3	3	3	2	3	3	1	1	1	3		

Course Content	
MODULE 1: ELECTRICAL SAFETY FUNDAMENTALS Basics of electrical safety, types of electrical hazards (shock, arc flash, arc blast), effects of electric current on human body, safety procedures, safety signs and symbols, personal protective equipment (PPE), safe working practices	**9 Hours**

Self-study Topics: Case studies of electrical accidents and lessons learned	
MODULE 2: PROTECTION AND SAFETY STANDARDS Earthing and grounding systems, protective devices (fuses, MCB, MCCB, relays), insulation and isolation techniques, safety regulations and standards (IEC, IS, OSHA), electrical installation safety, maintenance safety procedures **Self-study Topics:** Latest amendments in electrical safety standards	**9 Hours**
MODULE 3: ENERGY AUDIT FUNDAMENTALS Energy scenario and need for energy auditing, types of energy audits (preliminary, detailed), audit methodology, energy flow diagrams, energy balance, benchmarking and performance indicators **Self-study Topics:** Energy policies and regulations	**9 Hours**
MODULE 4: ENERGY AUDIT INSTRUMENTATION AND ANALYSIS Measurement instruments (power analyzer, clamp meter, lux meter, thermography), data collection and analysis, load monitoring, power quality analysis, identification of energy losses, efficiency evaluation **Self-study Topics:** Digital energy monitoring systems and IoT-based audits	**9 Hours**
MODULE 5: ENERGY CONSERVATION AND MANAGEMENT Energy conservation techniques in electrical systems, energy-efficient equipment (motors, lighting, HVAC), demand-side management, economic analysis (payback period, ROI), preparation of energy audit reports, case studies of industrial and commercial audits **Self-study Topics:** Green energy and sustainability practices	**9 Hours**

Theory Hours:45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:45

Learning Resources
Textbooks:
1. W.R. Murphy, *Electrical Safety Handbook*, McGraw-Hill 2. A.K. Tyagi, *Handbook on Energy Audits and Management*, TERI
References:
1. Bureau of Energy Efficiency (BEE) Manuals 2. IEEE Safety Standards 3. IEC Standards Documentation
Online Educational Resources:

Assessment (Theory course)
• CAT: 30% • Assignment / Case Study / Mini Project: 20% • End Semester Examination: 50%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE)

Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr.P.Thirumoorthi	
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

	ENERGY CONSERVATION AND GREEN BUILDING	L	T	P	J	C
		3	0	0	0	3
PE		SDG	7,11			

Pre-requisite courses	• Basic Electrical Engineering • Power Systems • Environmental Studies	Data Book / Code book (If any)	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand principles of energy conservation and efficiency.
2	Analyze energy consumption in electrical and building systems.
3	Study green building concepts and rating systems.
4	Evaluate energy-efficient technologies and practices.
5	Develop sustainable energy solutions for buildings and industries.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain energy conservation principles and building energy use	U
CO 2	Analyze energy consumption and efficiency in electrical systems	AN
CO 3	Evaluate green building standards and rating systems	E
CO 4	Analyze energy-efficient technologies for buildings	AN
CO 5	Develop sustainable energy conservation solutions	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	2	-	-	-	1	3	2	-
2	3	3	2	2	3	-	2	-	-	-	1	3	3	-
3	3	3	2	2	2	3	3	1	1	1	2	3	3	2
4	3	3	3	2	3	3	3	1	1	2	2	3	3	2
5	3	3	3	3	3	3	3	2	1	2	3	3	3	3

Course Content	
MODULE 1: FUNDAMENTALS OF ENERGY CONSERVATION **Theory Topics:**	**9 Hours**

• Introduction to energy conservation and efficiency • Global and national energy scenario • Principles of energy management • Energy conservation opportunities in electrical systems • Energy auditing basics • Role of Bureau of Energy Efficiency (BEE)	
MODULE 2: ENERGY EFFICIENCY IN ELECTRICAL SYSTEMS **Theory Topics:** • Energy-efficient electrical equipment • Efficiency improvement in motors and drives • Lighting systems: Conventional vs LED systems • Power factor improvement techniques • Energy savings in transformers and distribution systems • Demand-side management	**9 Hours**
MODULE 3: BUILDING ENERGY SYSTEMS AND ANALYSIS **Theory Topics:** • Energy consumption in buildings • HVAC systems and energy optimization • Lighting design for buildings • Building energy modeling and simulation • Load estimation and energy analysis • Smart building technologies	**9 Hours**
MODULE 4: GREEN BUILDING CONCEPTS AND RATING SYSTEMS **Theory Topics:** • Introduction to green buildings • Principles of sustainable building design • Materials and resources efficiency • Indoor environmental quality • Green building rating systems: LEED, GRIHA, IGBC • Net-zero energy buildings	**9 Hours**
MODULE 5: ENERGY CONSERVATION TECHNIQUES AND CASE STUDIES **Theory Topics:** • Energy conservation in industrial and commercial sectors • Renewable energy integration in buildings • Waste heat recovery systems • Economic analysis: Payback, life cycle cost • Case studies of green buildings and energy-efficient systems • Future trends: Smart cities and sustainable infrastructure	**9 Hours**

Theory Hours:45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:45

Learning Resources
Textbooks:
1. Capehart, B.L., Turner, W.C., Kennedy, W.J., *Guide to Energy Management*, CRC Press, 2020. 2. Krarti, M., *Energy Audit of Building Systems*, CRC Press, 2016
References:

1. BEE India Manuals on Energy Conservation
2. U.S. Green Building Council, *LEED Reference Guide*
3. IGBC Green Building Guidelines
4. IEEE Papers on Energy Efficiency and Smart Buildings

Online Educational Resources:

- NPTEL: Energy Conservation and Management
- SWAYAM: Green Building Design
- BEE (India) Portal

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 30% • Assignments / Activities / Mini Project – 20% • End Semester Examination (ESE) – 50%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr. D. Sharmitha	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

	SUSTAINABILITY AND CLIMATE CHANGE	L	T	P	J	C
		3	0	0	0	3
PE		SDG	7,11,13			

Pre-requisite courses	Environmental Studies	Data Book / Code book (If any)	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand sustainability principles and climate science fundamentals.
2	Analyze causes and impacts of climate change.
3	Study mitigation and adaptation strategies.
4	Evaluate sustainable energy and technological solutions.
5	Develop engineering solutions for climate resilience and sustainability

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain sustainability concepts and climate change science	U
CO 2	Analyze causes and impacts of climate change	AN
CO 3	Evaluate mitigation and adaptation strategies	E
CO 4	Analyze sustainable technologies and energy solutions	AN
CO 5	Develop engineering solutions for sustainability and climate resilience	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	3	-	-	-	1	3	2	-
2	3	3	2	2	2	-	3	-	-	-	1	3	3	-
3	3	3	3	2	2	3	3	1	1	1	2	3	3	2
4	3	3	3	2	3	3	3	1	1	2	2	3	3	2
5	3	3	3	3	3	3	3	2	1	2	3	3	3	3

Course Content	
MODULE 1: FUNDAMENTALS OF SUSTAINABILITY **Theory Topics:** • Concept of sustainability and sustainable development • Triple bottom line: Environmental, social and economic sustainability	**9 Hours**

• United Nations Sustainable Development Goals (SDGs) • Resource depletion and ecological footprint • Environmental ethics and policy frameworks • Role of engineers in sustainable development	
MODULE 2: CLIMATE CHANGE SCIENCE **Theory Topics:** • Climate system and atmospheric processes • Greenhouse effect and global warming • Sources of greenhouse gases (GHGs) • Carbon cycle and radiative forcing • Climate modeling and prediction Evidence of climate change (temperature rise, sea level, glaciers)	**9 Hours**
MODULE 3: IMPACTS OF CLIMATE CHANGE **Theory Topics:** • Environmental impacts: Biodiversity loss, extreme weather events • Impacts on water resources and agriculture • Impacts on human health and ecosystems • Urban climate challenges and heat islands • Climate change and energy systems Socio-economic implications	**9 Hours**
MODULE 4: MITIGATION AND ADAPTATION STRATEGIES **Theory Topics:** • Climate change mitigation strategies • Renewable energy and low-carbon technologies • Carbon capture and storage (CCS) • Energy efficiency and conservation • Climate adaptation strategies Policies and international agreements (Paris Agreement, Kyoto Protocol)	**9 Hours**
MODULE 5: SUSTAINABLE TECHNOLOGIES AND ENGINEERING SOLUTIONS **Theory Topics:** • Sustainable energy systems (solar, wind, hydrogen) • Smart grids and energy-efficient systems • Green buildings and sustainable infrastructure • Electric vehicles and sustainable transportation • Life Cycle Assessment (LCA) Circular economy and waste management	**9 Hours**

Theory Hours:	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:

Learning Resources
Textbooks:
Textbooks 1. Boyle, G., *Renewable Energy: Power for a Sustainable Future*, Oxford University Press, 2012. 2. IPCC Reports, *Climate Change Assessment Reports*

References:
1. Stern, N., *The Economics of Climate Change*, Cambridge University Press. 2. UNEP and UNDP Sustainability Reports 3. IEEE Papers on Sustainable Energy Systems
Online Educational Resources:
• NPTEL: Climate Change and Sustainability • SWAYAM: Environmental Studies • IPCC Official Website • UN SDG Portal

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 30% • Assignments / Activities / Mini Project – 20% • End Semester Examination (ESE) – 50%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr.S.T.Suganthi	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

		L	T	P	J	C
	HIGH VOLTAGE ENGINEERING	3	0	0	0	3
PE		**SDG**	**7,9**			

Pre-requisite courses	• Electrical Machines • Power Systems • Electromagnetic Fields	**Data Book / Code book (If any)**	**NIL**

Course Objectives:	
The purpose of taking this course is to:	
1	Understand generation and measurement of high voltages.
2	Analyze breakdown mechanisms in insulating materials.
3	Study high voltage testing techniques and standards.
4	Evaluate insulation coordination and protection systems.
5	Develop knowledge of modern high voltage engineering applications

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain high voltage generation methods and measurement techniques	U
CO 2	Analyze breakdown mechanisms in gases, liquids and solids	AN
CO 3	Evaluate high voltage testing methods and standards	E
CO 4	Analyze insulation coordination and overvoltage protection	AN
CO 5	Apply high voltage engineering concepts to practical systems	AP
CO 6		

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	2	-	-	-	1	3	2	-
2	3	3	2	2	3	-	1	-	-	-	1	3	3	-
3	3	3	2	3	3	2	2	-	1	1	2	3	3	2
4	3	3	3	2	3	3	2	1	-	2	2	3	3	2
5	3	3	3	3	3	3	3	2	1	2	3	3	3	3

Course Content	
MODULE 1: GENERATION OF HIGH VOLTAGES	**9 Hours**

Theory Topics: • Introduction to high voltage engineering • Need for high voltage generation and applications • Generation of high AC voltages (transformers, cascade transformers) • Generation of high DC voltages (rectifiers, voltage multipliers) • Generation of impulse voltages (Marx generator) • Generation of impulse currents	
MODULE 2: MEASUREMENT OF HIGH VOLTAGES AND CURRENTS **Theory Topics:** • Measurement of high AC and DC voltages • Electrostatic voltmeters and sphere gaps • Measurement of impulse voltages and currents • Voltage dividers (resistive, capacitive) • Digital measurement techniques • Errors and calibration methods	**9 Hours**
MODULE 3: BREAKDOWN MECHANISMS IN INSULATING MEDIA **Theory Topics:** • Breakdown in gases: Townsend and streamer theories • Paschen's law and corona discharge • Breakdown in liquids: Mechanisms and factors affecting breakdown • Breakdown in solid dielectrics • Partial discharge and insulation failure • Insulation materials and properties	**9 Hours**
MODULE 4: HIGH VOLTAGE TESTING AND INSULATION COORDINATION **Theory Topics:** • Testing of electrical equipment: Transformers, cables, switchgear • High voltage testing methods: AC, DC and impulse testing • Non-destructive testing techniques • Insulation coordination principles • Overvoltage phenomena (switching and lightning surges) Surge protection devices (lightning arresters)	**9 Hours**
MODULE 5: ADVANCED HIGH VOLTAGE ENGINEERING AND APPLICATIONS (**Theory Topics:** • High voltage transmission (HVDC systems) • Gas Insulated Substations (GIS) • High voltage cables and accessories • Electromagnetic interference and shielding • Digital monitoring and diagnostics of insulation Case studies and recent advancements in HV engineering	**9 Hours**

Theory Hours:45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:45

Learning Resources
Textbooks:

1. Naidu, M.S., Kamaraju, V., *High Voltage Engineering*, McGraw-Hill, 2013.
2. Kuffel, E., Zaengl, W.S., Kuffel, J., *High Voltage Engineering Fundamentals*, Elsevier, 2010

References:

1. Kind, D., Feser, K., *High Voltage Test Techniques*, Newnes.
2. IEC Standards on High Voltage Testing
3. IEEE Papers on Insulation and High Voltage Systems

Online Educational Resources:

- NPTEL: High Voltage Engineering
- SWAYAM Electrical Engineering Courses
- IEEE Xplore Digital Library

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 30% • Assignments / Activities / Mini Project – 20% • End Semester Examination (ESE) – 50%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr. T. Shanthi	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

	DIGITAL PROTECTION OF POWER SYSTEM	L	T	P	J	C
		3	0	0	0	3
PE		SDG	7			

Pre-requisite courses	• Power System Analysis • Electrical Machines • Control Systems • Basic Programming (C/MATLAB)	Data Book / Code book (If any)	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand principles of power system protection and need for digital relaying.
2	Analyze digital signal processing techniques used in protection.
3	Study design and operation of numerical relays.
4	Evaluate protection schemes using digital techniques.
5	Develop skills in simulation and implementation of digital protection algorithms.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain fundamentals of digital protection and relaying	U
CO 2	Analyze signal processing techniques for protection	AN
CO 3	Design digital protection algorithms for power systems	C
CO 4	Evaluate performance of numerical relays and protection schemes	E
CO 5	Apply simulation tools for digital protection implementation	AP

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	2	-	-	-	1	3	2	-
2	3	3	2	2	3	-	1	-	-	-	1	3	3	-
3	3	3	3	2	3	2	2	-	1	2	1	3	3	2
4	3	3	2	3	3	3	2	1	-	2	2	3	3	2
5	3	3	3	3	3	3	3	2	1	2	3	3	3	3

Course Content	
MODULE 1: FUNDAMENTALS OF POWER SYSTEM PROTECTION **Theory Topics:** • Introduction to power system protection • Objectives and requirements of protection schemes • Types of faults and abnormal conditions • Conventional relays: Electromechanical and static relays • Limitations of conventional protection and need for digital protection • Introduction to numerical relays	**9 Hours**
MODULE 2: SIGNAL PROCESSING FOR DIGITAL PROTECTION **Theory Topics:** • Basics of signal sampling and quantization • Analog to Digital Conversion (ADC) • Filtering techniques (analog and digital filters) • Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) • Extraction of fundamental components • Removal of DC offset and harmonics	**9 Hours**
MODULE 3: DIGITAL RELAYING PRINCIPLES **Theory Topics:** • Architecture of digital relays • Microprocessor-based relay design • Overcurrent protection using digital relays • Distance protection using digital relays • Differential protection principles • Relay coordination using digital methods	**9 Hours**
MODULE 4: PROTECTION OF POWER SYSTEM COMPONENTS **Theory Topics:** • Digital protection of transmission lines • Protection of transformers • Protection of generators • Busbar protection schemes • Adaptive protection techniques • Wide Area Monitoring and Protection	**9 Hours**
MODULE 5: ADVANCED DIGITAL PROTECTION AND APPLICATIONS **Theory Topics:** • Communication-based protection (IEC 61850) • Smart grid protection schemes • AI and machine learning in protection • Real-time implementation and hardware-in-loop simulation • Cybersecurity issues in digital relays • Case studies of modern protection systems	**9 Hours**

Theory Hours:45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:45

Learning Resources
Textbooks:
1. Horowitz, S.H., Phadke, A.G., *Power System Relaying*, Wiley, 2014. 2. Blackburn, J.L., Domin, T.J., *Protective Relaying: Principles and Applications*, CRC Press, 2015.
References:
1. Phadke, A.G., Thorp, J.S., *Computer Relaying for Power Systems*, Wiley. 2. IEEE Standards on Protection and Relaying 3. IEC 61850 Standard Documentation
Online Educational Resources:

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 30% • Assignments / Activities / Mini Project – 20% • End Semester Examination (ESE) – 50%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr .M. Mohanraj	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

		L	T	P	J	C
	ADVANCED POWER CONVERTERS	2	0	2	0	3
PE		**SDG**			7, 9	

Pre-requisite courses	• Power Electronics • Electrical Machines • Control Systems	**Data Book / Code book (If any)**	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand advanced DC-DC and DC-AC converter topologies.
2	Analyze operation and control of modern power converters.
3	Study high-frequency switching and soft-switching techniques.
4	Evaluate converter performance in renewable and EV applications.
5	Develop practical skills in simulation and hardware implementation.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain advanced power converter topologies	U
CO 2	Analyze operation and performance of converters	AN
CO 3	Design control strategies for power converters	C
CO 4	Evaluate converter applications in EV and renewable systems	E
CO 5	Implement converters using simulation and hardware tools	AP

Course Outcomes (CO)	**Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)**											**Program Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	2	-	-	-	1	3	2	-
2	3	3	2	2	3	-	1	-	-	-	1	3	3	-
3	3	3	3	2	3	2	2	-	1	2	1	3	3	2
4	3	3	2	3	3	3	2	1	1	2	2	3	3	2
5	3	3	3	3	3	3	3	2	1	2	3	3	3	3

Course Content	
MODULE 1: ADVANCED DC-DC CONVERTERS **Theory** • Review of basic DC-DC converters (Buck, Boost, Buck-Boost) • Isolated converters: Flyback, Forward converters • Resonant converters (Series, Parallel, LLC) • High-frequency switching concepts • Soft switching techniques: ZVS, ZCS • Design considerations and efficiency analysis **Self-Study (2 Hours)** • Wide bandgap devices (SiC, GaN) in converters • Applications in EV and renewable systems **Practical** • Simulation of DC-DC converters using MATLAB/Simulink • Design and testing of buck/boost converters • Flyback converter implementation • Resonant converter simulation • Efficiency and ripple analysis	**10 Hours** **10 Hours**
MODULE 2: ADVANCED INVERTERS AND AC CONVERTERS **Theory** • Voltage source and current source inverters • Multilevel inverters: Diode clamped, Flying capacitor, Cascaded H-bridge • PWM techniques (SPWM, SVPWM) • Matrix converters • Harmonic analysis and filtering techniques • Grid-connected converter systems **Self-Study (2 Hours)** • Applications of multilevel inverters in renewable energy • Grid codes and standards **Practical** • Multilevel inverter • Matrix Converter • Harmonic analysis using FFT • Grid-connected inverter	**10 Hours** **10 Hours**
MODULE 3: CONTROL, APPLICATIONS AND INTEGRATION **Theory** • Control techniques for power converters (PI, PID, digital control) • Closed-loop control of converters • Power converters in renewable energy systems (PV, wind) • Power factor correction (PFC) converters • Converter integration with smart grid **Self-Study (1 Hour)** • AI-based control of converters • Case studies: EV fast chargers, solar inverters **Practical** • Closed-loop control implementation • PFC converter design • Simulation of PV-fed converter system	**10 Hours** **10 Hours**

• EV charger modeling • Mini project: Design of advanced power converter system	

Theory Hours:30	Tutorial Hours:	Practical Hours:30	Project Hours:	Total Hours:60

Learning Resources
Textbooks:
1. Erickson, R.W., Maksimovic, D., *Fundamentals of Power Electronics*, Springer. 2. Rashid, M.H., *Power Electronics Handbook*, Elsevier.
References:
1. Mohan, N., *Power Electronics: Converters, Applications and Design* 2. IEEE Transactions on Power Electronics 3. IEC Standards for Power Converters
Online Educational Resources:
1.

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 20% • Lab Performance & Record – 20% • Mini Project / Activities – 20% • End Semester Examination (ESE) – 40%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr. B. Karunamoorthy	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

		L	T	P	J	C
PE	**ELECTRIC DRIVES AND MOTOR CONTROL FOR ELECTRIC VEHICLES**	**SDG**	**7, 11, 13**			

Pre-requisite courses	• Electrical Machines • Power Electronics • Basic Control Systems	**Data Book / Code book (If any)**	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand electric drive systems used in electric vehicles
2	Analyze motor characteristics and control strategies
3	Apply power electronic converters in EV drives
4	Design motor control systems for EV applications
5	Implement EV drive systems using simulation tools

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain EV drive system components and characteristics	U
CO 2	Analyze performance of different motors used in EVs	AN
CO 3	Apply control techniques for electric drives	AP
CO 4	Design motor control strategies for EV applications	C
CO 5	Evaluate efficiency and performance of EV drive systems	E

Course Outcomes (CO)	**Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)**											**Program Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	2	-	2	-	-	-	2			
2	3	3	2	2	3	-	2	-	-	-	2			
3	3	3	3	3	3	-	3	1	1	1	3			
4	3	3	3	3	3	2	3	2	1	1	3			
5	3	3	2	3	3	2	3	-	-	-	3			
6	3	3	2	3	3	-	2	2	1	1	3			

Course Content	
MODULE 1: ELECTRIC DRIVES IN EVs – FUNDAMENTALS AND MOTOR SELECTION **Theory** Introduction to electric drives, EV drivetrain architecture, Traction requirements and drive cycle , torque-speed characteristics of EV loads, motor selection criteria, comparison of motors used in EVs: DC motor, induction motor, PMSM, BLDC motor, drive cycles and vehicle dynamics, tractive effort and power requirement **Practical** 1. Modeling of EV drivetrain using MATLAB/Simulink 2. Torque-speed analysis of EV motors 3. Simulation of drive cycles (UDDS / WLTP) 4. Comparative study of different EV motors **Self-study (2 Hours)** Advanced EV motor technologies (axial flux, hub motors)	**10 Hours** **10 Hours**
MODULE 2: POWER ELECTRONIC CONVERTERS AND MOTOR CONTROL **Theory** Power converters for EV drives: DC-DC converters (buck, boost), DC-AC inverters, switching techniques (PWM), control of DC motor drives, vector control of induction motor, field-oriented control (FOC) of IM and PMSM, BLDC motor control (commutation techniques), Sensor-based and sensorless control methods, regenerative braking **Practical** 5. Speed control of DC motor using PWM 6. Implementation of FOC using simulation tools 7. DSP based BLDC/PMSM motor control 8. Sensorless control demonstration **Self-Study (2 Hours)** • DSP and microcontroller-based motor control • Case study: EV motor controllers	**10 Hours** **10 Hours**
MODULE 3: EV DRIVE CONTROL, OPTIMIZATION AND APPLICATIONS **Theory** Closed-loop control of EV drives, PID control for speed and torque, energy efficiency and optimization, battery-drive interaction, thermal management of drives, drive system integration with EV, AI-based control strategies, applications in electric cars, buses, and two-wheelers **Practical** 9. Closed-loop speed control using PID controller 10. Simulation of regenerative braking system 11. Efficiency analysis of EV drive system 12. Mini Project: Design of EV drive system (motor + converter + control) **Self-study (1 Hour)** Autonomous EV drive control systems	**10 Hours** **10 Hours**

Theory Hours:30	Tutorial Hours:	Practical Hours:30	Project Hours:	Total Hours:60

Learning Resources
Textbooks:
1. B.K. Bose, *Modern Power Electronics and AC Drives*, Pearson 2. Iqbal Husain, *Electric and Hybrid Vehicles*, CRC Press
References:
1. Krishnan, *Electric Motor Drives* 2. Ned Mohan, *Power Electronics* 3. IEEE Transactions on Industrial Electronics
Online Educational Resources:

Assessment (Theory course)
• CAT: 30% • Continuous Assessment (Assignments, Simulation, Mini Project): 20% • Lab Evaluation (Record, Viva, Experiments): 20% • End Semester Exam: 30%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr.K.Malarvizhi	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

		L	T	P	J	C
	BATTERY TECHNOLOGIES AND MANAGEMENT SYSTEMS	2	0	2	0	3
PE		**SDG**			**7**	

Pre-requisite courses	• Basic Electrical Engineering • Electrochemistry fundamentals • Power Electronics	**Data Book / Code book (If any)**	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand different battery technologies and their characteristics.
2	Analyze battery modeling, charging and discharging mechanisms.
3	Design and implement Battery Management Systems (BMS).
4	Evaluate safety, thermal management and lifecycle performance.
5	Develop practical skills in battery testing and BMS implementation

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain battery chemistries and performance characteristics	U
CO 2	Analyze battery models, charging and discharging behavior	AN
CO 3	Design Battery Management Systems for EV/energy storage	C
CO 4	Evaluate thermal, safety and lifecycle issues of batteries	E
CO 5	Perform battery testing and implement BMS using tools	AP

Course Outcomes (CO)	**Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)**											**Program Specific Outcomes (PSO)**		
	1 Engineering Knowledge	**2** Problem Analysis	**3** Design/Development of Solutions	**4** Conduct Investigations of Complex Problems	**5** Engineering Tool Usage	**6** The Engineer and The World	**7** Ethics	**8** Individual and Collaborative Team work	**9** Communication	**10** Project Management and Finance	**11** Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	2	-	-	-	1	3	2	-
2	3	3	2	2	3	-	1	-	-	-	1	3	3	-
3	3	3	3	2	3	2	2	-	1	2	1	3	3	2
4	3	3	2	3	3	3	2	1	-	2	2	3	3	2
5	3	3	3	3	3	3	3	2	1	2	3	3	3	3

Course Content	
MODULE 1: BATTERY TECHNOLOGIES AND CHARACTERIZATION **Theory** • Basics of electrochemical energy storage • Battery types: Lead-acid, NiMH, Li-ion, Solid-state • Battery parameters: Energy density, power density, efficiency • Charge/discharge characteristics • State of Charge (SOC) and State of Health (SOH) estimation **Self-Study (2 Hours)** • Emerging battery technologies (Na-ion, Li-S, Solid-state) • Comparison of EV battery chemistries **Practical** • Measurement of battery voltage, current and capacity • Charge/discharge characteristics of Li-ion battery • SOC estimation using coulomb counting • Battery efficiency calculation • Open circuit voltage test	**10 Hours** **10 Hours**
MODULE 2: BATTERY MODELING AND MANAGEMENT SYSTEMS **Theory** • Battery modeling: Electrical equivalent models • Charging methods: CC, CV, CC-CV • Battery Management System (BMS) architecture • Cell balancing techniques (Passive & Active) • Battery protection systems **Self-Study (2 Hours)** • BMS ICs and real-time monitoring systems • Case study: EV battery pack design **Practical** • Simulation of battery models using MATLAB/Simulink • Implementation of CC-CV charging method • Design of simple BMS using microcontroller (Arduino/ESP32) • Cell balancing experiment Overcharge/over-discharge protection testing	**10 Hours** **10 Hours**
MODULE 3: THERMAL MANAGEMENT, SAFETY AND APPLICATIONS **Theory** • Thermal behavior of batteries • Cooling techniques (Air, Liquid, PCM) • Battery safety issues (thermal runaway, short circuit) • Lifecycle analysis and degradation • Applications: EVs, grid storage, renewable integration **Self-Study (1 Hour)** • Battery recycling and sustainability • Second-life battery applications **Practical** • Thermal performance testing of batteries • Temperature monitoring using sensors • Fault detection in battery systems • Lifecycle testing and degradation analysis • Mini project: Design of battery pack with BMS	**10 Hours** **10 Hours**

Theory Hours:30	Tutorial Hours:	Practical Hours:30	Project Hours:	Total Hours:60

Learning Resources
Textbooks:
1. Pistoia, Gianfranco., *Battery Operated Devices and Systems*, Elsevier, 2009. 2. Linden, David., *Handbook of Batteries*, McGraw-Hill, 2011.
References:
1. Huggins, Robert., *Advanced Batteries*, Springer, 2008. 2. IEEE Journals on Battery Management Systems 3. IEA Energy Storage Reports
Online Educational Resources:

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 20% • Lab Performance & Records – 20% • Mini Project / Activities – 20% • End Semester Examination (ESE) – 40%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Mr.M.Ravi Chandiran	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

		L	T	P	J	C
	EV CHARGING INFRASTRUCTURE AND GRID INTEGRATION	3	0	0	0	3
PE		**SDG**	**7.11**			

Pre-requisite courses	• Basics of Electrical Machines • Power Systems • Power Electronics	**Data Book / Code book (If any)**	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand electric vehicle architectures and charging standards.
2	Analyze EV charging technologies and infrastructure planning.
3	Study grid integration challenges and smart charging strategies.
4	Evaluate impact of EV penetration on power systems.
5	Develop solutions for sustainable and intelligent EV charging networks

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain EV types, components and charging standards	U
CO 2	Analyze EV charging methods and power electronic interfaces	AN
CO 3	Evaluate design and deployment of EV charging infrastructure	E
CO 4	Analyze grid integration challenges due to EV penetration	AN
CO 5	Develop smart charging and V2G solutions for grid stability	C
CO 6		

Course Outcomes (CO)	**Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)**											**Program Specific Outcomes (PSO)**		
	1 Engineering Knowledge	**2** Problem Analysis	**3** Design/Development of Solutions	**4** Conduct Investigations of Complex Problems	**5** Engineering Tool Usage	**6** The Engineer and The World	**7** Ethics	**8** Individual and Collaborative Team work	**9** Communication	**10** Project Management and Finance	**11** Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	2	-	-	-	1	3	2	-
2	3	3	2	2	3	-	1	-	-	-	1	3	3	-
3	3	3	3	2	3	2	2	-	1	2	1	3	3	2
4	3	3	2	3	3	3	2	1	-	2	2	3	3	2
5	3	3	3	3	3	3	3	2	1	2	3	3	3	3

Course Content	
MODULE 1: EV FUNDAMENTALS AND ARCHITECTURE **Theory Topics:** • Types of EVs: BEV, HEV, PHEV, FCEV • EV powertrain architecture • Energy storage systems: Batteries (Li-ion, Solid-state), supercapacitors • Battery characteristics and SOC estimation • EV standards: IEC, SAE, CHAdeMO, CCS	**9 Hours**
MODULE 2: EV CHARGING TECHNOLOGIES **Theory Topics:** • Charging levels: Level 1, Level 2, Level 3 (DC Fast Charging) • Conductive and inductive charging • On-board and off-board chargers • AC-DC and DC-DC converters for EV charging • Wireless charging principles	**9 Hours**
MODULE 3: EV CHARGING INFRASTRUCTURE **Theory Topics:** • EV charging station design and layout • Residential, commercial and public charging infrastructure • Charging station components and protection systems • Load estimation and site selection • Standards and policies for EV infrastructure deployment	**9 Hours**
MODULE 4: GRID INTEGRATION OF EVs **Theory Topics:** • Impact of EV charging on power system • Load profiles and demand forecasting • Harmonics and power quality issues • Distribution network constraints • Renewable energy integration with EV charging	**9 Hours**
MODULE 5: SMART CHARGING AND V2G SYSTEMS **Theory Topics:** • Smart charging strategies (Time-of-use, demand response) • Vehicle-to-Grid (V2G), V2H, V2V concepts • Communication protocols (OCPP, IEC 61850) • Energy management systems AI and IoT in EV charging infrastructure	**9 Hours**

Theory Hours:45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:45

Learning Resources
Textbooks:
1. Ehsani, Mehrdad., *Modern Electric, Hybrid Electric and Fuel Cell Vehicles*, CRC Press, 2018. 2. Larminie, James., *Electric Vehicle Technology Explained*, Wiley, 2012.

References:
1. Tie, S.F., Tan, C.W., *A Review of Energy Sources and Energy Management System in EV*, Renewable and Sustainable Energy Reviews. 2. IEA Reports on EV Charging Infrastructure. 3. IEEE Papers on Smart Charging and V2G Systems
Online Educational Resources:
• NPTEL: Electric Vehicles • SWAYAM EV Courses • IEEE Xplore Digital Library

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 30% • Assignments / Activities / Mini Projects – 20% • End Semester Examination (ESE) – 50%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Mr.G.Om suraj	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

	AUTONOMOUS AND CONNECTED VEHICLES	L	T	P	J	C
		2	0	2	0	3
PC		SDG			9,11	

Pre-requisite courses	• Control Systems • Embedded Systems • Signals and Systems • Basic Programming	**Data Book / Code book (If any)**	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand architecture and components of autonomous vehicles.
2	Analyze sensing, perception and localization techniques.
3	Study vehicle communication and networking systems.
4	Design control and decision-making algorithms.
5	Develop practical skills using simulation and embedded platforms.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain architecture of autonomous and connected vehicles	U
CO 2	Analyze sensing, perception and localization techniques	An
CO 3	Evaluate V2X communication systems	E
CO 4	Design control and decision-making algorithms	C
CO 5	Implement autonomous vehicle models using tools/platforms	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1 Engineering Knowledge	2 Problem Analysis	3 Design/Development of Solutions	4 Conduct Investigations of Complex Problems	5 Engineering Tool Usage	6 The Engineer and The World	7 Ethics	8 Individual and Collaborative Team work	9 Communication	10 Project Management and Finance	11 Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	2	-	-	-	1	3	2	-
2	3	3	2	2	3	-	1	-	-	-	1	3	3	-
3	3	3	2	2	3	2	2	-	1	2	1	3	3	2
4	3	3	3	3	3	3	2	1	-	2	2	3	3	2
5	3	3	3	3	3	3	3	2	1	2	3	3	3	3

Course Content	
MODULE 1: VEHICLE ARCHITECTURE, SENSING AND PERCEPTION **Theory** • Introduction to autonomous vehicles and SAE levels (0–5) • Architecture of autonomous vehicle systems • Sensors: LiDAR, RADAR, cameras, ultrasonic sensors • Sensor fusion techniques • Perception algorithms: Object detection, lane detection • Environmental modeling **Self-Study (2 Hours)** • Case study: Tesla Autopilot, Waymo systems • Basics of computer vision in autonomous vehicles **Practical** • Sensor data acquisition and analysis (camera/ultrasonic) • Object detection using Python/OpenCV • Lane detection algorithms implementation • Sensor fusion basics (simulation) • Environment mapping using simulation tools	**10 Hours** **10 Hours**
MODULE 2: LOCALIZATION, COMMUNICATION AND NETWORKING **Theory** • Localization techniques: GPS, IMU, SLAM • Mapping and navigation systems • Vehicle-to-Everything (V2X) communication • V2V, V2I, V2P, V2G communication • Communication technologies: DSRC, LTE, 5G • Cybersecurity in connected vehicles **Self-Study (2 Hours)** • Smart transportation systems • Cloud-based vehicle communication **Practical** • GPS and IMU data processing • SLAM simulation using MATLAB/ROS • V2X communication simulation • Network simulation for connected vehicles • Data transmission and latency analysis	**10 Hours** **10 Hours**
MODULE 3: CONTROL, DECISION MAKING AND APPLICATIONS **Theory** • Vehicle dynamics and modeling • Path planning algorithms (A*, Dijkstra) • Motion control and trajectory tracking • Adaptive cruise control and lane keeping • AI and machine learning in autonomous driving • Safety standards (ISO 26262) and regulations **Self-Study (1 Hour)** • Ethical issues in autonomous driving • Autonomous mobility in smart cities **Practical** • Path planning algorithm implementation • Simulation of vehicle motion control	**10 Hours** **10 Hours**

• Adaptive cruise control design • AI-based decision-making (basic ML models) Mini project: Autonomous vehicle simulation (CARLA/MATLAB)	

Theory Hours:30	Tutorial Hours:	Practical Hours:30	Project Hours:	Total Hours:60

Learning Resources
Textbooks:
1. Rajamani, R., *Vehicle Dynamics and Control*, Springer, 2012. 2. Thrun, S., Burgard, W., Fox, D., *Probabilistic Robotics*, MIT Press.
References:
1. Winner, H., *Handbook of Driver Assistance Systems*, Springer 2. IEEE Papers on Autonomous Vehicles and V2X 3. SAE Standards on Autonomous Driving
Online Educational Resources:

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 20% • Lab Performance & Record – 20% • Mini Project / Activities – 20% • End Semester Examination (ESE) – 40%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr. R. Kavitha	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

		L	T	P	J	C
	INTELLIGENT AND SUSTAINABLE TRANSPORTATION SYSTEM	3	0	0	0	3
PE		**SDG**	**7,11,13**			

Pre-requisite courses	**requisites** • Basic Electrical Engineering • Control Systems • Communication Systems • Environmental Studies	**Data Book / Code book (If any)**	**NIL**

Course Objectives:	
The purpose of taking this course is to:	
1	Understand smart city transportation infrastructure and ITS architecture.
2	Analyze green vehicle technologies including solar and fuel cell vehicles.
3	Study communication, sensing and control systems in smart mobility.
4	Evaluate sustainable and energy-efficient transportation solutions.
5	Develop smart and eco-friendly mobility solutions for future cities

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain ITS architecture and smart city mobility systems	U
CO 2	Analyze sensing, communication and traffic systems	AN
CO 3	Evaluate green vehicle technologies (solar, fuel cell, EV)	E
CO 4	Analyze intelligent traffic control and energy-efficient transport	AN
CO 5	Develop sustainable smart mobility solutions	C

Course Outcomes (CO)	**Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)**											**Program Specific Outcomes (PSO)**		
	1 Engineering Knowledge	**2** Problem Analysis	**3** Design/Development of Solutions	**4** Conduct Investigations of Complex Problems	**5** Engineering Tool Usage	**6** The Engineer and The World	**7** Ethics	**8** Individual and Collaborative Team work	**9** Communication	**10** Project Management and Finance	**11** Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	3	-	-	2	1	3	2	-
2	3	3	2						-	-	1	3	3	-
3	3	3	2								2	3	3	2
4	3	3	3								2	3	3	2
5	3	3	3								3	3	3	3

Course Content	
MODULE 1: SMART CITY TRANSPORTATION AND ITS ARCHITECTURE **Theory Topics:** • Concept of smart cities and smart mobility • Role of transportation in smart city infrastructure • Intelligent Transportation Systems (ITS): Architecture and components • Integration of transportation with energy, communication and urban systems • Urban mobility challenges: congestion, emissions, energy demand • National Smart City Mission and ITS initiatives (India)	**9 Hours**
MODULE 2: SENSING, DATA ANALYTICS AND CONNECTED TRANSPORT **Theory Topics:** • Traffic sensing technologies: Cameras, LiDAR, GPS, IoT sensors • Data acquisition and real-time traffic monitoring • Big data analytics for urban mobility • Vehicle-to-Everything (V2X) communication • Cloud computing and IoT in smart transportation Cybersecurity in smart city transportation systems	**9 Hours**
MODULE 3: GREEN VEHICLE TECHNOLOGIES (SOLAR, EV, FUEL CELL) **Theory Topics:** • Overview of green vehicles and sustainable mobility • Electric vehicles (EVs) and hybrid vehicles • Solar-powered vehicles: PV integration, energy management • Hydrogen fuel cell vehicles (FCV): Working principles and components • Comparison: EV vs Solar vs Fuel Cell vehicles • Charging infrastructure and hydrogen refueling systems	**9 Hours**
MODULE 4: INTELLIGENT TRAFFIC MANAGEMENT AND ENERGY OPTIMIZATION **Theory Topics:** • Traffic flow modeling and smart signal control • Adaptive traffic control systems • Smart parking and congestion management • Energy-efficient transportation systems • Integration of renewable energy with transportation Demand-side management in urban mobility	**9 Hours**
MODULE 5: SUSTAINABLE URBAN MOBILITY AND FUTURE TRENDS **Theory Topics:** • Sustainable mobility solutions: Public transport, shared mobility • Integration of EVs and FCVs in smart cities • Smart grid interaction with transportation (V2G concept) • Autonomous and connected vehicles in smart cities • Policies, regulations and environmental impact Future trends: AI, digital twins, smart mobility ecosystems	**9 Hours**

Theory Hours:45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:45

Learning Resources
Textbooks:
1. Sussman, J.M., *Perspectives on Intelligent Transportation Systems*, Springer. 2. Ehsani, M., *Modern Electric, Hybrid and Fuel Cell Vehicles*, CRC Press
References:
1. IEA Reports on Sustainable Transportation 2. IEEE Transactions on Intelligent Transportation Systems 3. Ministry of Housing & Urban Affairs (Smart City Mission) 4. Hydrogen Energy Reports and Fuel Cell Technology Papers
Online Educational Resources:
• NPTEL: Intelligent Transportation Systems • SWAYAM: Smart Cities and Sustainability • IEEE Xplore Digital Library • Smart Cities Mission Portal (India)

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 30% • Assignments / Mini Project / Case Study – 20% • End Semester Examination (ESE) – 50%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Ms. G. Anushree	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024

		L	T	P	J	C
PE	**CAD FOR ELECTRICAL MACHINES**	2	0	2	0	3
		SDG	9, 7			

Pre-requisite courses	• Electrical Machines • Electromagnetic Fields • Numerical Methods • Basic • rogramming (MATLAB/Python)	**Data Book / Code book (If any)**	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand principles of computer-aided design (CAD) for electrical machines.
2	Analyze electromagnetic field problems using numerical techniques.
3	Design electrical machines using modern simulation tools.
4	Evaluate machine performance through CAD tools.
5	Develop practical skills in modeling and optimization of machines.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain CAD concepts and numerical methods for machine design	U
CO 2	Analyze electromagnetic field problems using numerical techniques	AN
CO 3	Design electrical machines using CAD tools	C
CO 4	Evaluate machine performance using simulation tools	E
CO 5	Implement machine models using software tools	AP

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2	PSO-3
1	3	2	-	-	-	-	1	-	-	-	1	3	2	-
2	3	3	2	3	3	-	1	-	-	-	1	3	3	-
3	3	3	3	2	3	2	2	-	1	2	1	3	3	2
4	3	3	2	3	3	2	2	1	1	2	2	3	3	2
5	3	3	3	3	3	3	2	2	1	2	3	3	3	3

Course Content	

MODULE 1: CAD FUNDAMENTALS AND NUMERICAL METHODS
Theory
• Introduction to CAD in electrical machine design
• Design procedures for electrical machines
• Formulation of electromagnetic field problems
• Numerical methods:
  o Finite Difference Method (FDM)
  o Finite Element Method (FEM)
• Discretization techniques
• Boundary conditions and solution techniques
Self-Study (2 Hours)
• Comparison of FDM and FEM
• Overview of commercial CAD tools (ANSYS Maxwell, FEMM, COMSOL)
Practical
• Introduction to FEM software (FEMM/ANSYS)
• Basic electromagnetic field simulation
• 2D field analysis of simple geometries
• Mesh generation and refinement
• Validation of numerical results
	10 Hours
	
	10 Hours

MODULE 2: CAD OF ELECTRICAL MACHINES **Theory (10 Hours)** • CAD modeling of DC machines • CAD modeling of induction machines • CAD modeling of synchronous machines • Magnetic circuit analysis using FEM • Loss calculation (core loss, copper loss) • Thermal considerations in machine design **Self-Study (2 Hours)** • Optimization techniques in machine design • Case study: Industrial motor design **Practical (10 Hours)** • Modeling of DC machine using FEM software • Induction motor design and simulation • Magnetic flux distribution analysis • Torque calculation and performance evaluation • Loss estimation using simulation	**10 Hours** **10 Hours**
MODULE 3: ADVANCED DESIGN AND OPTIMIZATION **Theory (10 Hours)** • Advanced machine design: BLDC, PMSM • Performance analysis under different operating conditions • Optimization techniques (genetic algorithms, parametric optimization) • Multi-physics simulation (thermal, electromagnetic coupling) • Design validation and prototyping • Applications in EVs and renewable systems **Self-Study (1 Hour)** • AI-based optimization in electrical machine design	**10 Hours**

• Case study: EV motor design **Practical (10 Hours)** • BLDC/PMSM modeling using CAD tools • Parametric analysis and optimization • Thermal analysis of machines • Multi-physics simulation Mini project: Design and optimization of electrical machine	**10 Hours**

Theory Hours:30	Tutorial Hours:	Practical Hours:30	Project Hours:	Total Hours:60

Learning Resources
Textbooks:
1. Salon, S.J., *Finite Element Analysis of Electrical Machines*, Springer. 2. Boldea, I., Nasar, S.A., *Electric Machines: Dynamics and Control*, CRC Press.
References:
1. Silvester, P.P., Ferrari, R.L., *Finite Elements for Electrical Engineers* 2. IEEE Transactions on Energy Conversion 3. ANSYS/COMSOL Documentation
Online Educational Resources:

Assessment (Theory course)
• Continuous Assessment Tests (CAT) – 20% • Lab Performance & Record – 20% • Mini Project / Activities – 20% • End Semester Examination (ESE) – 40%

Assessment (Embedded course)
SA, Activity and Learning Task(s)* , Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce, etc…

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
[Name, Organization]	[Name, Institution]	Dr. N. Prakash	
Recommended by BoS on	XX/YY/2024		
Academic Council Approval	No.	**Date**	XX/YY/2024