ANNEXURE –I

Syllabus of III and IV Semester Courses for Four-Year Multidisciplinary Undergraduate B.Tech. Degree Programme in Electrical Engineering

(In view of NEP-2020)

For students admitted in academic session 2025-26 and onwards



03/09/2026

SHRI JAWAHARLAL DARDA EDUCATION SOCIETY'S
JAWAHARLAL DARDA
INSTITUTE OF ENGINEERING AND TECHNOLOGY, YAVATMAL
AN AUTONOMOUS INSTITUTE
Affiliated to Sant Gadge Baba Amravati University, Approved by AICTE, New Delhi and DTE Maharashtra
93VP+PWF: P6, MIDC Area, Lohara, Yavatmal - 445 001, Maharashtra (www.jdiet.ac.in)

1. Vision

To establish a leading Electrical Engineering Department which will produce competent technocrats capable of facing global technical challenges.

2. Mission

1. To impart quality education by compatible teaching-learning process and skill development.
2. To motivate students and faculty members for innovation and research.
3. To practice concepts of Electrical Engineering along with industrial association so as to develop competent technocrats capable of contributing to society.

3. Programme Education Objectives

PEO1: Graduates will demonstrate expertise in analysis, design and evaluation of electrical engineering and allied technical systems.

PEO2: Graduates will locally and globally engage with technical fraternity and contribute to ethical and creative practice of electrical engineering.

PEO3: Graduates will adapt with the dynamics in the constantly changing technical field through lifelong learning, self-study and continuous professional development.

PEO4: Graduates will demonstrate leadership and also a commitment to teamwork while working with others having diverse culture and interdisciplinary backgrounds.

4. SDG of United Nation

1. **No Poverty:** End poverty in all its forms everywhere.
2. **Zero Hunger:** End hunger, achieve food security, improve nutrition, and promote sustainable agriculture.
3. **Good Health and Well-being:** Ensure healthy lives and promote well-being for all at all ages.
4. **Quality Education:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities.
5. **Gender Equality:** Achieve gender equality and empower all women and girls.
6. **Clean Water and Sanitation:** Ensure availability and sustainable management of water and sanitation for all.
7. **Affordable and Clean Energy:** Ensure access to affordable, reliable, sustainable, and modern energy.
8. **Decent Work and Economic Growth:** Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work.
9. **Industry, Innovation, and Infrastructure:** Build resilient infrastructure, promote sustainable industrialization, and foster innovation.

10. **Reduced Inequalities:** Reduce inequality within and among countries.
11. **Sustainable Cities and Communities:** Make cities and human settlements inclusive, safe, resilient, and sustainable.
12. **Responsible Consumption and Production:** Ensure sustainable consumption and production patterns.
13. **Climate Action:** Take urgent action to combat climate change and its impacts.
14. **Life Below Water:** Conserve and sustainably use oceans, seas, and marine resources.
15. **Life on Land:** Protect, restore, and promote sustainable use of terrestrial ecosystems, forests, and biodiversity.
16. **Peace, Justice, and Strong Institutions:** Promote peaceful and inclusive societies, provide access to justice, and build effective, accountable institutions.
17. **Partnerships for the Goals:** Strengthen the means of implementation and revitalize the global partnership for sustainable development.

5. WK: Washington Accord Knowledge Profile-Attributes for engineering program

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 mo01delling applicable to the discipline.

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

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

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

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

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

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

WK9: Ethics, inclusive behaviour 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.

6. Programme Outcomes (NBA, Jan 2025)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization

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

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.

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.

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.

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.

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

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.

7. Programme Specific Indicators

Power Generation and Distribution

1. Understanding and analyzing electrical circuits using Ohm's and Kirchhoff's laws.
2. Design, operation, and maintenance of generation, transmission, and distribution systems.
3. Application of electronic devices in controlling power rectifiers, inverters, converters.
4. Knowledge of IEEE, IEC, and local safety standards and codes.
5. Techniques for improving energy efficiency and conducting energy audits.
6. Understanding insulation coordination, breakdown mechanisms, and equipment used in high-voltage systems.
7. Analyzing and mitigating voltage sags, surges, harmonics, and power factor issues in electrical networks.
8. Designing and implementing control strategies for AC/DC drives used in industrial applications.
9. Designing systems to protect electrical networks from lightning and ensure proper grounding.
10. Identifying, analyzing, and solving complex engineering problems.
11. Planning, executing, and closing electrical engineering projects.
12. Proficiency in software tools, simulation platforms, and digital collaboration systems.

Electrical Machinery and Equipment Manufacturing

13. Knowledge of motors, generators, and transformers - operation, control, and maintenance.
14. Application of electronic devices in controlling power rectifiers, inverters, converters.
15. Designing and implementing control strategies for AC/DC drives used in industrial applications.
16. Identifying, analyzing, and solving complex engineering problems.
17. Planning, executing, and closing electrical engineering projects.
18. Generating new ideas or applying existing knowledge in innovative ways to solve engineering problems.

Renewable Energy (Solar, Wind, Hydro)

19. Design, operation, and maintenance of generation, transmission, and distribution systems.
20. Design and integration of solar, wind, and other renewable energy sources.
21. Techniques for improving energy efficiency and conducting energy audits.
22. Identifying, analyzing, and solving complex engineering problems.
23. Ability to self-learn and adapt to technological advancements.
24. Understanding the impact of engineering solutions in societal and ethical contexts.

Industrial Automation and Control Systems

25. Application of electronic devices in controlling power rectifiers, inverters, converters.
26. Use of feedback and automation in electrical systems for stability and accuracy.
27. Programming and integration of programmable logic controllers and SCADA systems
28. Designing and implementing control strategies for AC/DC drives used in industrial applications.
29. Setting up Supervisory Control and Data Acquisition systems for real-time monitoring and control.
30. Knowledge of Modbus, Profibus, Ethernet/IP, etc., for data communication in automation systems
31. Planning, executing, and closing electrical engineering projects.
32. Proficiency in software tools, simulation platforms, and digital collaboration systems.

Electric Vehicles (EVs) and Automotive Electronics

33. Knowledge of motors, generators, and transformers—operation, control, and maintenance
34. Application of electronic devices in controlling power—rectifiers, inverters, converters.
35. Designing microcontroller-based systems for smart devices and applications.
36. Designing and implementing control strategies for AC/DC drives used in industrial applications
37. Identifying, analyzing, and solving complex engineering problems.
38. Ability to self-learn and adapt to technological advancements.
39. Flexibility in working with new technologies and under dynamic industry environments.

Semiconductor and Electronics Industry

40. Application of electronic devices in controlling power—rectifiers, inverters, converters.
41. Designing microcontroller-based systems for smart devices and applications.
42. Knowledge of Modbus, Profibus, Ethernet/IP, etc., for data communication in automation systems.
43. Ability to self-learn and adapt to technological advancements.
44. Proficiency in software tools, simulation platforms, and digital collaboration systems.
45. Generating new ideas or applying existing knowledge in innovative ways to solve engineering problems.

Railway Electrification and Traction Systems

46. Understanding and analyzing electrical circuits using Ohm's and Kirchhoff's laws.
47. Knowledge of motors, generators, and transformers operation, control, and maintenance.

48. Design, operation, and maintenance of generation, transmission, and distribution systems.
49. Analyzing and mitigating voltage sags, surges, harmonics, and power factor issues in electrical networks.
50. Designing and implementing control strategies for AC/DC drives used in industrial applications.
51. Designing systems to protect electrical networks from lightning and ensure proper grounding.
52. Identifying, analyzing, and solving complex engineering problems.

Aerospace and Defense Electronics

53. Application of electronic devices in controlling power—rectifiers, inverters, converters.
54. Use of feedback and automation in electrical systems for stability and accuracy.
55. Designing microcontroller-based systems for smart devices and applications.
56. Knowledge of Modbus, Profibus, Ethernet/IP, etc., for data communication in automation systems.
57. Ability to self-learn and adapt to technological advancements.
58. Working effectively with global teams and diverse work environments.

Building and Infrastructure Electrical Services

59. Design, operation, and maintenance of generation, transmission, and distribution systems.
60. Preparing electrical layouts using CAD tools and understanding electrical codes.
61. Knowledge of IEEE, IEC, and local safety standards and codes.
62. Electrical design and control of heating, ventilation, and air conditioning systems.
63. Integration of lighting, HVAC, security, and energy systems for smart building operations.
64. Planning, executing, and closing electrical engineering projects.

Marine and Naval Electrical Systems

65. Knowledge of motors, generators, and transformers—operation, control, and maintenance.
66. Design, operation, and maintenance of generation, transmission, and distribution systems.
67. Understanding insulation coordination, breakdown mechanisms, and equipment used in high-voltage systems.
68. Designing and implementing control strategies for AC/DC drives used in industrial applications.
69. Designing systems to protect electrical networks from lightning and ensure proper grounding.
70. Identifying, analyzing, and solving complex engineering problems.

Medical Equipment and Biomedical Devices

71. Measuring electrical quantities using sensors, transducers, and digital instruments.
72. Designing microcontroller-based systems for smart devices and applications.
73. Knowledge of IEEE, IEC, and local safety standards and codes.
74. Ability to self-learn and adapt to technological advancements.
75. Generating new ideas or applying existing knowledge in innovative ways to solve engineering problems.

Embedded Systems and IoT

76. Programming and integration of programmable logic controllers and SCADA systems.
77. Designing microcontroller-based systems for smart devices and applications.
78. Knowledge of Modbus, Profibus, Ethernet/IP, etc., for data communication in automation systems.
79. Use of Internet of Things for predictive maintenance, load monitoring, and system diagnostics.
80. Proficiency in software tools, simulation platforms, and digital collaboration systems.
81. Generating new ideas or applying existing knowledge in innovative ways to solve engineering problems.
82. Delivering technical information clearly to both technical and non-technical audiences.

Basic Science

83. Apply mathematical techniques such as algebra, trigonometry, calculus, differential equations, linear algebra, probability and statistics to solve problems.
84. Apply physical principles such as motion, forces, energy and materials to solve problems.
85. Apply knowledge of chemical properties and reactions for construction material and environment (Corrosion, polymer, electro chemistry etc.).

Engineering Science Courses

86. Demonstrate proficiency in basic workshop operations (fitting, carpentry, welding, sheet metal, plumbing and machining etc.).
87. Apply the principles of engineering mechanics to analyse and solve problems involving forces, moment, equilibrium, friction, centred and MOI etc.
88. Apply the principles electrical engineering to analyse and maintain electrical systems, circuits, machines and power systems.
89. Demonstrate ability to interpreted and create drawings using geometric constructions, orthographic projections, isometric projections and CAD tools.
90. Demonstrate ability to apply fundamental principles of algorithms, programming, data structures and computing system to solve conceptual problems.

Generic Competencies

A. Problem-Solving Skills

91. Analytical Thinking: Ability to analyze complex problems, break them down into smaller components, and find effective solutions.
92. Critical Thinking: Ability to evaluate multiple solutions to a problem and choose the best course of action based on available data, safety, and cost-efficiency.

B. Communication Skills

93. Oral Communication: Ability to communicate complex technical information clearly to a variety of audiences, including clients, stakeholders, contractors, and team members.
94. Written Communication: Proficiency in drafting reports, proposals, technical specifications, and documentation that are clear, concise, and accurate.
95. Interpersonal Communication: Ability to collaborate effectively with multidisciplinary teams, clients, and project stakeholders.

C. Project Management

96. Time Management: Efficiently managing time and prioritizing tasks to meet deadlines in a dynamic project environment.
97. Resource Management: Ability to plan, allocate, and manage resources such as labour, materials, and equipment to ensure project efficiency.
98. Budgeting and Cost Control: Skills in estimating project costs, monitoring budgets, and ensuring projects are completed within financial constraints.
99. Risk Management: Ability to identify, assess, and mitigate risks during the planning and execution of engineering projects.

D. Team work and Leadership

100. Team Collaboration: Working effectively as part of a team, contributing to the success of the project through collaboration, open communication, and respect for others' expertise.
101. Leadership Skills: Leading and motivating a team of engineers, contractors, and other stakeholders to meet project goals and deadlines.
102. Conflict Resolution: Ability to resolve conflicts between team members, clients, or contractors, ensuring that project objectives are still achieved.

E. Attention to Detail

103. Accuracy: Ensuring all engineering calculations, designs, and project plans are accurate and align with building codes, regulations, and standards.
104. Quality Assurance: Ensuring that the materials and processes used in construction adhere to high standards of quality and safety.

F. Ethical and Professional Integrity

105. Ethical Decision Making: Adhering to a strict code of ethics, ensuring public safety, environmental protection, and transparency in all dealings.
106. Accountability: Taking responsibility for the success or failure of a project, being proactive in addressing issues, and delivering results.

G. Adaptability and Flexibility

107. Openness to Change: Being able to adapt to new technologies, tools, and methods, as well as evolving project requirements or environmental conditions.
108. Learning and Development: Actively seeking opportunities for professional growth, staying current with industry trends, and acquiring new skills to remain competitive.

H. Creativity and Innovation

109. Creative Problem Solving: Thinking outside the box and coming up with novel solutions to engineering challenges.
110. Innovative Design: Contributing new ideas for designs and processes that can improve efficiency, reduce costs, or make better use of resources.

I. Cultural and Environmental Awareness

111. Sustainability Awareness: Knowledge of sustainable construction methods, green building practices, and the importance of reducing the environmental impact of engineering projects.
112. Cultural Sensitivity: Understanding and respecting cultural differences when working in diverse teams or international projects.
113. Environmental Impact Understanding: Considering the environmental consequences of engineering decisions and striving to minimize negative impacts through design and construction methods.

J. Decision-Making Skills

114. Data-Driven Decisions: Using available data, facts, and technical analysis to make informed decisions about the design, execution, and management of projects.
115. Prioritizing Decisions: Knowing which decisions need immediate attention and which can be deferred, especially in a high-pressure environment.

K. Regulatory and Legal Knowledge

116. Familiarity with Building Codes and Standards: Understanding and ensuring compliance with local, national, and international building codes, safety regulations, and legal standards.
117. Health and Safety: Knowledge of safety regulations and best practices for ensuring the health and safety of workers, the public, and the environment throughout the project lifecycle.

L. Client-Focused Mindset

118. Client Management: Building and maintaining strong relationships with clients, understanding their needs, and ensuring their expectations are met throughout the project.
119. Customer Service Orientation: Ensuring that client concerns are addressed promptly, and working toward providing value-added solutions that meet their goals.

8. Scheme of Electrical Engineering Department

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Electrical Engineering Degree Programme

Semester - I (First Year) [Group - A/B]

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Mathematics - I	BSC	1SH101BS1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Applied Physics	BSC	1SH102BS1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
3	Programming for Problem Solving	ESC	1CS103ES1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
4	Engineering Mechanics	ESC	1CE104ES1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
5	Applied Physics Lab	BSC	1SH105BS1	0	0	2	0	2	1					25	25	50	25	50	
6	Programming for Problem Solving Lab	ESC	1CS106ES1	0	0	2	0	2	1					25	25	50	25	50	
7	Engineering Mechanics Lab	ESC	1CE107ES1	0	0	2	0	2	1					25	25	50	25	50	
8	Workshop	ESC	1ME108ES1	0	0	2	0	2	1					25	25	50	25	50	
9	Electronics Technology	VSC	1EE109VS1	1	0	2	1	4	2						50	50	25	50	
10	English Communication	AEC	1SH110AE1	1	0	2	1	4	2					25	25	50	25	50	
11	Sports & Yoga	CC	1SH111CC1	0	0	4	0	4	2						50	50	25	50	
Total				**14**	**0**	**16**	**14**	**44**	**22**			**400**				**350**		**750**	

Notional Learning Hours : [Workload (teaching/guidance/practicum) 30x15 = 450 Hrs] + [Learner-engaged time 14x15 = 210 Hrs]

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)
Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Electrical Engineering Degree Programme
Semester - II (First Year) [Group - A/B]

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Mathematics - II	BSC	2SH112BS1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Applied Chemistry	BSC	2SH113BS1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
3	Basic Electrical Engineering	ESC	2EE114ES1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
4	Engineering Graphics	ESC	2ME115ES1	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
5	Electrical Technology	PCC	2EE116PC1	1	0	2	1	4	2						50	50	25	50	
6	Origin and pioneers of Vidyut Shastra	IKS	2EE117IK1	1	0	2	1	4	2						50	50	25	50	
7	Applied Chemistry - Lab	BSC	2SH118BS1	0	0	2	0	2	1					25	25	50	25	50	
8	Basic Electrical Engineering - Lab	ESC	2EE119ES1	0	0	2	0	2	1					25	25	50	25	50	
9	Engineering Graphics/CAD Lab	ESC	2ME120ES1	0	0	2	0	2	1					25	25	50	25	50	
10	Universal Human values	SEC	2SH121VS1	1	0	2	1	4	2						50	50	25	50	
11	Digital Wellness	CC	2SH122CC1	1	0	2	1	4	2						50	50	25	50	
Total				**15**	**0**	**14**	**15**	**44**	**22**			**400**				**350**		**750**	
Notional Learning Hours : [Workload (teaching/guidance/practicum) 29x15 = 435 Hrs] + [Learner-engaged time 15x15 = 225 Hrs]																			
Exit Option (Level 4.5) for Undergraduate Certificate in Odd Semester of next Academic Year as approved by BOS																			
12	Electrification of Building	EC	3EE123EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
13	Repairing and Maintenance of Domestic Appliances	EC	3EE124EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
OR																			
14	Internship / Apprenticeship in Industry	EI	3EE125EI1	0	0	16	0	288	8					100	100	200	100	200	
OR																			
15	Two MOOC/NPTEL Courses	EC	3EE126OC_	8	0	0	8	16	8										

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Electrical Engineering Degree Programme

Semester - III (Second Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Network Analysis	PCC	3EE201PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Electronic Devices & Circuits	PCC	3EE202PC1	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
3	Electrical Machines-I	PCC	3EE203PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
4	Multi Disciplinary Minor- I	MDM	3__ 204MD_	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
5	Open Elective - I	OE	3__205OE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
6	Network Analysis - Lab	PCC	3EE206PC1	0	0	2	0	2	1					25	25	50	25	50	
7	Electronic Devices & Circuits - Lab	PCC	3EE207PC1	0	0	2	0	2	1					25	25	50	25	50	
8	Electrical Machines-I - Lab	PCC	3EE208PC1	0	0	2	0	2	1					25	25	50	25	50	
9	Economics of Energy Markets	EEM	3EE209EM1	2	0	0	2	4	2						50	50	25	50	
10	Constitutional Values and Fundamental Duties	VEC	3SH210VE1	2	0	0	2	4	2						50	50	25	50	
11	Field Project	FP	3EE400FP1	0	0	4	0	4	2					25	25	50	25	50	
12	Disaster Management and Preparedness	NC	3AL001NC1	2	0	0	0	2	-						50	50	25	50	
Total				**19**	**0**	**10**	**17**	**46**	**22**			**450**				**300**		**750**	
Notional Learning Hours : [Workload (teaching/guidance/practicum) 29x15 = 435 Hrs] + [Learner-engaged time 17x15 = 255 Hrs]																			
Optional Course for Double Minor / Honours Degree																			
12	Double Minor / Honours Course - I	DH	3__211DH_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)
Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Electrical Engineering Degree Programme
Semester - IV (Second Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Analog and Digital circuit	PCC	4EE212PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Electrical Measurement & Instrumentation	PCC	4EE213PC1	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
3	Power Systems-I	PCC	4EE214PC1	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
4	Multi Disciplinary Minor- II	MDM	4__215MD_	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
5	Open Elective - II	OE	4__216OE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
6	Electrical Measurement & Instrumentation - Lab	PCC	4EE217PC1	0	0	2	0	2	1					25	25	50	25	50	
7	Power Systems-I - Lab	PCC	4EE218PC1	0	0	2	0	2	1					25	25	50	25	50	
8	Electrical CAD	VSC	4EE219VS1	0	0	4	0	4	2						50	50	25	50	
9	Technical Writing	AEC	4SH220AE1	1	0	2	1	4	2						50	50	25	50	
10	Fundamentals of Book Keeping & Accounting	EEM	4SH221EM1	1	0	2	1	4	2						50	50	25	50	
11	Environmental Science	VEC	4CE222VE1	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
Total				**16**	**0**	**12**	**16**	**44**	**22**			**500**				**250**		**750**	
Notional Learning Hours : [Workload (teaching/guidance/practicum) 28x15 = 420 Hrs] + [Learner-engaged time 16x15 = 240 Hrs]																			
Optional Course for Double Minor / Honours Degree																			
12	Double Minor / Honours Course - II	DH	4__223DH_	4	0	0	4	8	4	60	40	100	40					100	3 Hrs.
Exit Option (Level 5) for Undergraduate Diploma in Odd Semester of next Academic Year as approved by BOS																			
14	Solar Panel Design and Implementation	EC	5EE224EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
15	Repairing and maintenance of Electrical Machines	EC	5EE225EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
OR																			
16	Internship / Apprenticeship in Industry	EI	5EE226EI1	0	0	16	0	288	8					100	100	200	100	200	
OR																			
17	Two MOOC/NPTEL Courses	OC	5EE227OC_	8	0	0	8	16	8										

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (An Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Electrical Engineering Degree Programme

Semester - V (Third Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Electrical Machines-II	PCC	5EE228PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Computer Aided Electrical Machine Design	PCC	5EE229PC1	3	1	0	4	8	4	60	40	100	40					100	3 Hrs.
3	Control Systems	PCC	5EE230PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
4	Programme Elective Course - I	PEC	5EE231PE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
5	Multi Disciplinary Minor-III	MDM	5__232MD_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
7	Open Elective - III	OE	5__233OE_	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
8	Electrical Machines-II - Lab	PCC	5EE234PC1	0	0	2	0	2	1					25	25	50	25	50	
9	Control Systems - Lab	PCC	5EE235PC1	0	0	2	0	2	1					25	25	50	25	50	
10	Programme Elective Course - I - Lab	PEC	5EE236PE_	0	0	2	0	2	1					25	25	50	25	50	
11	Multi Disciplinary Minor-III Lab	MDM	5__237MD_	0	0	2	0	2	1					25	25	50	25	50	
Total				**17**	**1**	**8**	**18**	**44**	**22**			**550**				**200**		**750**	
Notional Learning Hours : [Workload (teaching/guidance/practicum) 26x15 = 390 Hrs] + [Learner-engaged time 18x15 = 270 Hrs]																			
Optional Course for Double Minor / Honours Degree																			
12	Double Minor / Honours Course - III	DH	5__238DH_	4	0	0	4	8	4	60	40	100	40					100	3 Hrs.

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (An Autonomous Institute)
Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Electrical Engineering Degree Programme
Semester - VI (Third Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Power Electronics	PCC	6EE239PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Computer Application in Power Systems	PCC	6EE240PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
3	Power Systems-II	PCC	6EE241PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
4	Programme Elective Course - II	PEC	6EE242PE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
5	Programme Elective Course - III	PEC	6EE243PE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
6	Multi Disciplinary Minor- IV	MDM	6__244MD_	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
7	Power Electronics - Lab	PCC	6EE245PC1	0	0	2	0	2	1					25	25	50	25	50	
8	Computer Application in Power Systems - Lab	PCC	6EE246PC1	0	0	2	0	2	1					25	25	50	25	50	
9	Programme Elective Course - II Lab	PEC	6EE247PE_	0	0	2	0	2	1					25	25	50	25	50	
10	Personal Skills (GD& PI)	SEC	6SH248VS1	1	0	2	1	4	2						50	50	25	50	
Total				**18**	**0**	**8**	**18**	**44**	**22**			**550**				**200**		**750**	
Notional Learning Hours : [Workload (teaching/guidance/practicum) 26x15 = 390 Hrs] + [Learner-engaged time 18x15 = 270 Hrs]																			
Optional Course for Double Minor / Honours Degree																			
11	Double Minor / Honours Course - IV	DH	6__249DH_	4	0	0	4	8	4	60	40	100	40					100	3 Hrs.
Exit Option (Level 5.5) for B. Voc in Odd Semester of next Academic Year as approved by BOS																			
12	Industrial Electrical Systems installation and maintenance	EC	7EE250EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
13	PCB Design and circuit simulation	EC	7EE251EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
OR																			
14	Internship / Apprenticeship in Industry	EI	7EE252EI1	0	0	16	0	288	8					100	100	200	100	200	
OR																			
15	Two MOOC/NPTEL Courses	OC	7EE253OC_	8	0	0	8	16	8										

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Electrical Engineering Degree Programme

Semester - VII (Final Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Electrical Installation & Design	PCC	7EE301PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Switchgear and Protection	PCC	7EE302PC1	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
3	Programme Elective Course - IV	PEC	7EE303PE_	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
4	Programme Elective Course - V	PEC	7EE304PE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
5	Multi Disciplinary Minor- V	MDM	7__305MD_	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
6	Switchgear and Protection - Lab	PCC	7EE306PC1	0	0	2	0	2	1					25	25	50	25	50	
7	Programme Elective Course - IV - Lab	PEC	7EE307PE_	0	0	2	0	2	1					25	25	50	25	50	
8	Research Methodology	RM	7EE401RM1	2	0	4	2	8	4	30	20	50	20		50	50	25	100	2 Hrs.
9	Project	PR	7EE402PR1	0	0	8	0	8	4					50	100	150	75	150	
				14	**0**	**16**	**14**	**44**	**22**			**500**				**300**		**800**	
Notional Learning Hours : [Workload (teaching/guidance/practicum) 33x15 = 495 Hrs] + [Learner-engaged time 14x15 = 225 Hrs]																			
Optional Course for Double Minor / Honours Degree																			
10	Double Minor / Honours Course - V	DH	7__308DH_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
Optional Course for Honours with Research Degree																			
11	Research Project	RP	7EE403RP1	0	0	18	0	18	9	0	0	0	0	100	100	200	100	200	

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Electrical Engineering Degree Programme

Semester - VIII (Final Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	High Voltage Engineering (Online)	PCC	8EE309PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Programme Elective Course - VI (Online)*	PEC	8EE310PE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
3	Multi Disciplinary Minor-VI (Online)	MDM	8__311MD_	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
4	On Job Training (Internship/Apprenticeship)	OJT	8EE404IN1	0	0	24	0	24	12					100	100	200	100	200	
Total				**8**	**0**	**24**	**8**	**40**	**20**			**250**				**200**		**450**	
Notional Learning Hours : [Workload (teaching/guidance/practicum) 32x15 = 480 Hrs] + [Learner-engaged time 8x15 = 120 Hrs]																			
Optional Course for Honours with Research Degree																			
5	Research Project	RP	8EE405RP1	0	0	18	0	18	9	0	0	0	0	100	100	200	100	200	
* Can be considered for MOOCS/NPTEL courses.																			

9. List of Programme Elective Courses

Students will have an option to choose the PEC offered by their respective Major Discipline offered during semester V to VIII. Programme Elective Courses offered by Electrical Engineering

Sr. No.	Semester	Programme Elective Course/Subjects Name	Course Code
1	V	Power System Operation & Control (PEC-I)	5EE231PE1
2		Power System Operation & Control-Lab (PEC- Lab I)	5EE236PE1
		OR	
3		Green and Sustainable Energy (PEC-I)	5EE231PE2
4		Green and Sustainable Energy-Lab (PEC- Lab I)	5EE236PE2
5	VI	Electrical safety (PEC-II)	6EE242PE1
6		Electrical safety-Lab (PEC-Lab II)	6EE247PE1
		OR	
7		Electrical Machine Design (PEC-II)	6EE242PE2
8		Electrical Machine Design- Lab (PEC-Lab II)	6EE247PE2
9		Electrical & hybrid Vehicles (PEC-III)	6EE243PE1
		OR	
10		Industrial Electrical System (PEC-III)	6EE243PE2
11	VII	Signals & Systems (PEC-IV)	7EE303PE1
12		Signals & Systems-Lab (PEC- Lab IV)	7EE308PE1
		OR	
13		Power Semiconductor Based Drives (PEC-IV)	7EE303PE2
14		Power Semiconductor Based Drives-Lab (PEC- Lab IV)	7EE308PE2
15		Artificial Intelligence in Electrical Engineering (PEC-V)	7EE304PE1
		OR	
16		EV charging systems & Infrastructure (PEC-V)	7EE304PE2
17	VIII	HVDC & FACTS (PEC-VI)	8EE310PE1
		OR	
18		Digital Signal Processing (PEC-VI)	8EE310PE2

.

10. Syllabus for Semester III & IV

Level: **5.0**		Course Code:	**3EE201PC1**	Course Category:	**PCC**
Course Name	**Network Analysis**				
Credits	**03**	Total L:T:P etc. Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 3EE201PC1 Network Analysis is compulsory Program Core Course for Second Year B. Tech Electrical Engineering.

Course Objectives:

The objective of this course is to develop a clear understanding of electrical network concepts and analysis methods for effectively solving diverse circuit problems.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE201PC1.1	Determine the basic circuit elements and their interconnections to develop foundational knowledge and skills in electrical circuit behaviour	C-3
3EE201PC1.2	Evaluate the transient response of electrical circuits using Laplace transform methods to gain essential skills in dynamic circuit analysis	C-5
3EE201PC1.3	Demonstrate the application of mesh current and node voltage methods to analyse electrical circuits and develop practical skills in systematic circuit evaluation.	C-4
3EE201PC1.4	Analyse electrical circuits using network simplification theorems to ensure accurate evaluation and effective interpretation of circuit behaviour	C-4
3EE201PC1.5	Solve circuit problems using concepts of electric network topology to strengthen analytical skills in circuit interpretation.	C-3
3EE201PC1.6	Evaluate various network functions and examine two-port network behaviour to build foundational understanding of advanced circuit characteristics.	C-5

Course Contents:

Unit 1	**Basic Concept of Electrical Circuits:** Electric circuit, Types of Electric circuit, Ideal source, Practical source, dependent and independent source Voltage and Current sources, source transformation, Duality network transformation.	6Hrs
Unit 2	**Electric Circuit Analysis using Laplace Transforms:** Review of Laplace transform, waveform synthesis, Analysis of electrical circuits using Laplace transform for standard inputs (unit step, ramp and impulse). Solution of first and second order differential equations of different combinations of series and parallel RLC networks.	6 Hrs
Unit 3	**Mesh and Node Analysis:** Introduction, mesh analysis, super mesh. Nodal analysis, the super node, nodal vs mesh analysis.	9 Hrs
Unit 4	**Network Theorems:** Superposition, Thevenin's, Norton's, Maximum Power transfer, Reciprocity theorems, Millman's theorem, Tellegen's theorem.	8 Hrs
Unit 5	**Network Topology and Equations:** Graph of a network, trees and loops. Incidence matrix, tie set and cut set matrix of a network, network equilibrium equations.	6 Hrs
Unit 6	**Two port networks and Network functions:** Two port networks: open circuit impedance parameter, short circuit admittance parameter, transmission parameter, hybrid parameter, interrelationship between parameters. interconnection of two port networks Network functions**:** Driving point and transfer functions, Poles and zeros. Necessary conditions for driving point and transfer function.	10 Hrs

Text Books:

1. Van Valkenburg, Network Analysis, Third Edition, 2009, Prentice Hall of India.
2. Sudhakar, A Shyam Mohan,Circuits and Networks, Third Edition, 2006, Tata McGraw-Hill.
3. Ravish R. Singh, Network Analysis and Synthesis, McGraw Hill education (India).

Reference Books:

1. Mahmood Nahvi, Joseph A Edminister, Schaum's, Outline of Electric Circuits, 6th Edition, Tata McGraw-Hill, 6th Edition, 2013.

2. W. H. Hayt and J. E. Kemmerly, Engineering Circuit Analysis, McGraw Hill Education, 2013.
3. K. Sureshkumar, Electric Circuits & Network, PearsonPublication.
4. D. Roy Choudhary, Networks and Systems, New Age International Publishers, 2nd Edition, 2012.

E-Resources:

1. https://www.allaboutcircuits.com/textbook/
2. https://www.open.edu/openlearn/science-maths-technology/basics-electrical-engineering/content-section-
3. https://nptel.ac.in/courses/108/104/108104049/
4. https://nptel.ac.in/courses/108/105/108105159/

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
3EE201PC1.1	3	2	-	-	-	-	-	-	-	-	-	2	2	-
3EE201PC1.2	3	2	-	2	1	-	-	-	-	-	-	3	3	-
3EE201PC1.3	3	2	-	-	1	-	-	-	-	-	-	2	3	-
3EE201PC1.4	3	3	-	-	2	-	-	-	-	-	-	2	3	-
3EE201PC1.5	3	3	-	-	-	-	-	-	-	-	-	2	3	-
3EE201PC1.6	3	2	-	2	2	-	-	-	-	-	-	3	3	-
3EE201PC1CO	3	2	-	-	1	-	-	-	-	-	-	2	3	-

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**3EE202PC1**		Course Category:	**PCC**
Course Name	**Electronic Devices & Circuits**				
Credits	**02**	Total L: T:P etc. Hours	2:0:0 **30 Hrs**	Total SL Hours:	**30 Hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	**60**	SEE Time	**03 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 3EE202PC1 Electronic Devices & Circuits is a compulsory Program Core Course for Second Year B.Tech. Electrical Engineering.

Course Objectives:

The objective of this course is to equip students with the knowledge to analyze semiconductor device characteristics and design fundamental analog circuits using diodes, transistors, FETs, special diodes, and operational amplifiers for practical electronic applications.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE202PC1.1	Apply the fundamentals of semiconductor physics to analyse the V–I characteristics of Diodes and Zener regulators, enabling correct selection and use in voltage regulation applications	C-3
3EE202PC1.2	Design and analyse diode-based circuits such as half-wave/full-wave rectifiers and simple filters to develop the ability to create basic DC power supply systems.	C-3, C-4
3EE202PC1.3	Determine the construction and operation of BJTs and UJTs and calculate suitable DC biasing and stability factors to ensure reliable and predictable transistor operation.	C-3, C-4
3EE202PC1.4	Analyse power amplifiers and oscillator circuits by evaluating their power gain, efficiency, and distortion.	C-4
3EE202PC1.5	Apply the operational principles and structural characteristics of JFETs and MOSFETs to determine appropriate biasing methods and utilize them in switching and voltage-control applications.	C-3

3EE202PC1.6	Apply the principles and characteristics of Special Diodes to appropriately select and use them in specialised electronic circuit applications.	C-3, C-5

Course Contents:

Unit 1	**Semiconductor Physics and Devices:** P-N Junction diode theory, Energy bands in intrinsic and extrinsic silicon, Carrier transport, Diffusion current, Drift current, Mobility and resistivity, Zener diode as voltage regulator.	4 Hrs
Unit 2	**Rectifiers, Filters, and Power Supply Circuits:** DC regulated power supply, Halfwave, Full wave centre tapped, Full wave and bridge rectifier. Filters - C, LC and their analysis, clipping and clamping.	4 Hrs
Unit 3	**Bipolar Junction Transistors (BJTs) and UJT:** Theory and Analysis of Bipolar Junction transistor, Methods of biasing and their needs, 'Q' and stability factors. UJT: Characteristics, working.	5 Hrs
Unit 4	**Power Amplifiers:** Class 'A', 'B', 'AB' and 'C' amplifiers, Calculations of power gain, efficiency, power dissipation and distortion oscillators, their criteria, Hartley, Colpitts and R-C Oscillators, Crystal Oscillator.	6 Hrs
Unit 5	**Introduction & Classification: JFET & MOSFET:** Construction and operation, Drain and Transfer characteristics, parameters, Applications (JFET as a voltage variable resistor) (MOSFET as a switch)	5 Hrs
Unit 6	**Special Semiconductor Diodes and Optoelectronic Devices:** Theory, construction and application Sof Schottky diode, Tunnel diode, Varactor diode, Selenium diode, LED, Photo diode, PIN diode, phototransistor.	6 Hrs

Text Books:

1. Jacob Millman and Christos C. Halkias,Integrated Electronics: Analog and Digital Circuits and Systems, McGraw-Hill.
2. Robert L. Boyles tad and Louis Nashelsky, Electronic Devices and Circuits Theory, Prentice-Hall.
3. Adel S. Sedra and Kenneth C. Smith, Holt, Rinehart, and Winston,Microelectronic Circuits, Inc.
4. Jacob Millman, Christos C. Halkias, Integrated Electronic, McGraw Hill Education.
5. Robert L. Boylestead, Louis Nashelsky, Electronic Devices and Circuits Theory, 11th Edition, 2009, Pearson.

Reference Books:

1. Horowitz,The Art of Electronics, 3rdEdition Cambridge University Press.
2. David A. Bell, Electronic Devices and Circuits, 5thEdition, Oxford.
3. J. Millman, H. Taub and Mothiki S. PrakashRao, Pulse, Digital and Switching Waveforms, 2ndEd., 2008, McGrawHill.
4. Jacob Millman, Electronic Devices and Circuits, McGraw Hill.

E-Resources:

1. https://www.youtube.com/watch?v=S76CnEJMl5E
2. https://www.youtube.com/watch?v=MZPeRlst8rQ
3. https://www.youtube.com/watch?v=-VwPSDQmdjM
4. https://www.youtube.com/watch?v=i2t9GTAd2I0

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3EE202PC1.1	3	2	-	-	-	-		-	-	-	-	-	3	1
3EE202PC1.2	3	2	3	-	-	-	-	-	-	-	-	-	3	2
3EE202PC1.3	3	2	3	-	-	-	-	-	-	-	-	1	3	1
3EE202PC1.4	3	-	3	-	-	-	-	-	-	-	1	1	3	2
3EE202PC1.5	3	-	-	-	-	-	-	-	-	-	1	1	3	2
3EE202PC1.6	3	2	-	-	-	-	-	-	-	-	1	-	3	2
3EE202PC1CO	3	1	2	-	-	-	-	-	-	-	1	1	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**3EE203PC1**		Course Category:	**PCC**
Course Name	**Electrical Machines- I**				
Credits	**03**	Total L:T:P etc. Hours	3:0:0 **45 Hrs**	Total SL Hours:	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 3EE203PC1 Electrical Machine- I is a compulsory Program Core Course for Second Year B. Tech Electrical Engineering.

Course Objectives:

The objective of this course is to develop understanding and practical skills in the principles, operation, and performance analysis of electrical machines.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE203PC1.1	Explain construction, operation, EMF, torque, windings, and commutation to analyze rotating machine performance.	C-3
3EE203PC1.2	Classify DC generators, analyze characteristics, applications, parallel operation, and testing for efficient system use.	C-4
3EE203PC1.3	Analyze types, characteristics, starting methods, speed control, braking techniques, losses, efficiency, and testing of D.C. motors to apply them effectively in controlled motion and industrial drive applications.	C-4
3EE203PC1.4	Explain transformer construction, operation, losses, equivalent circuit, and tests to evaluate performance.	C-3
3EE203PC1.5	Compare autotransformers with two-winding transformers, derive voltage and current ratios, calculate copper savings, and analyze construction, operation, advantages, limitations, and applications to assess their economic and practical use in electrical systems.	C-3
3EE203PC1.6	Analyze construction, working, types, connections, vector groups, open-delta operation, and testing of three-phase transformers to ensure proper	C-3

	selection, connection, and performance evaluation in power and distribution systems.	

Course Contents:

Unit 1	**Fundamentals of Rotating Machines:** Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding Lap, wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.	8 Hrs
Unit 2	**D.C. Generators**: Types, Characteristics and Applications of D.C. Generators, Parallel Operation of D.C. Generators, Introduction to testing of D.C. Generators as per Indian standard.	7 Hrs
Unit 3	**D.C. Motors:** Types, characteristics and Applications of D.C. Motors. Starting, Electric Braking, Speed Control of DC Motors. Losses, efficiency and testing of DC Motors.	7 Hrs
Unit 4	**Single phase Transformer:** Construction and Working principle, EMF Equation, losses. Equivalent Circuit, Parallel Operation. Open Circuit, Short Circuit & Sumpner's test on transformer as per Indian standard.	9 Hrs
Unit 5	**Single phase Autotransformer:** Comparison between two-winding transformer and auto-transformer, Construction, working, merits, demerits and application of Autotransformer, Derivation of voltage ratio, current ratio, copper saving, transformation ratio.	6 Hrs
Unit 6	**Three Phase Transformer:** Construction, Working, Types, connections, vector group connections, open delta Connection, OC, SC, load test, vector group test on three phase transformers, Power transformers and Distribution transformers.	8 Hrs

Text-Books:

1. D P Kothari & I J Nagrath, Electrical Machines,TMH. New Delhi.
2. S. K. Bhattacharya, Electrical Machines, McGraw Hill Education.
3. P. S. Bimbhra, Electrical Machines, Khanna Publications.
4. A.E. Fitzgerald, Charles Kingsley, and Stephen D. Umans, Electric Machinery, 7th Edition, McGraw-Hill Education, New York, 2014.

Reference Books:

1. H. Cotton, Advance Electrical Technology, Wheeler publication.

2. Stephen J. Chapman, Electric Machinery Fundamentals, McGraw-Hill Education
3. V.K. Mehta & Rohit Mehta, Principles of Electrical Machines, S. Chand Publishing

E-Resources:

1. https://nptel.ac.in/courses/108/105/108105149/
2. https://www.coursera.org/courses?query=electric%20machine
3. https://www.allaboutcircuits.com/textbook/alternating-current/
4. https://www.youtube.com/channel/UCdJ9apM9g7SPDLTuV2kRNO
5. https://www.edx.org/course

Mapping of COs with Pos & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3EE203PC1.1	3	2	1	-	3	-	-	-	-	-	-	2	1	1
3EE203PC1.2	2	3	1	-	2	-	-	-	-	-	-	3	2	1
3EE203PC1.3	2	3	2	-	2	-	-	-	-	-	-	3	2	1
3EE203PC1.4	3	2	2	-	2	-	-	-	-	-	-	2	2	-
3EE203PC1.5	3	2	2	-	3	-	-	-	-	-	-	2	2	1
3EE203PC1.6	2	2	2	-	2	-	-	-	-	-	-	3	2	1
3EE203PCCO	3	3	2	-	2	-	-	-	-	-	-	3	2	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**3EE204MD1**	Course Category:	**MDM**
Course Name	**Electrical Energy Generation**			
Credits	**02**	Total L:T:P etc. Hours	2:0:0 **30 Hrs**	Total SL Hours **30 Hrs**
Total Credit Hours	**60 Hrs**			
SEE Marks	**30**	SEE Time	**2 Hrs**	CIA Marks **20**
EE Marks	**--**	PA Marks	**--**	Total Marks **50**

Course Description:

Subject Code 3EE204MD1 Electrical Energy generation is a compulsory Multidisciplinary Minor Course offered by the department of Electrical Engineering for other Second Year B. Tech, major disciplines.

Course Objectives:

The objective of this course is to enable students to integrate knowledge and skills from multiple disciplines for innovative problem solving.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE204MD1.1	Classify energy sources and explain working principles of various power plants to recognize their role in meeting electricity demand.	C-3
3EE204MD1.2	Explain the layout, components, and operation of thermal, hydro, and nuclear power plants to assess their performance and suitability for power generation.	C-4
3EE204MD1.3	Describe biomass, solar, and wind energy systems and their working principles to apply renewable energy technologies for sustainable power generation.	C-3

Course Contents:

Unit 1	**Basics of Power Generation:** Energy sources and their classification (conventional & non-conventional), Types of power plants, Selection of site for power plants Load curves, load duration curves, and plant capacity factors Terms: Connected load, Maximum demand, Demand factor, Load factor, Diversity factor, Plant capacity factor, Plant use factor	06 Hrs

Unit 2	**Thermal power plant:** Layout of Thermal power plant, Selection of site, working of various parts: Economizer, air preheater, condenser, cooling tower, ash & coal handling plant. Advantages & disadvantages. **Hydro power plant**: Layout of Hydro power plant, Selection of site, classification of hydro power plant according to available head, nature of load, functions of different components and their working, mini and micro hydro-electric power generation, advantages & disadvantages. **Nuclear power plant:** Layout of Nuclear power plant, Functions of different components of nuclear plant, types of nuclear reactors, advantages & disadvantages.	12 Hrs
Unit 3	**Biomass Power Plant:** Layout of Biomass Power Plant, Functions of Different Components, Types of Biomass Conversion Systems, Advantages of Biomass Power Plant, Disadvantages of Biomass Power Plant, Applications of Biomass Energy. **Solar Energy:** Solar energy — importance and potential, Solar radiation, Solar constant, Earth-sun relationship: declination, hour angle, latitude, Solar angles: Zenith, Azimuth, Altitude angles, Measurement of solar radiation — Pyranometer, Pyrheliometer. **Wind energy:** Basic principle of wind energy conversion, selection of site, basic components of wind energy conversion system, Applications, Advantages and disadvantages.	12 Hrs

Text-Books:

1. B. R. Gupta, Generation of electrical energy, Eurasia Publishing House, New Delhi
2. Tanmay Deb, Electrical Power Generation (Conventional and Renewable), Khanna Publishing house, New Delhi.

Reference Books:

1. G. D. Rai, Non-conventional energy resources, Khanna Publishers New Delhi.
2. S.P. Sukhatme, Solar energy, Tata McGraw Hill Publication.
3. V.K. Mehta, Principles of Power System, S. Chand publication.
4. M.V. Deshpande, Elements of Electrical Power Station Design, Wheeler Publishing.
5. S.B. Pandya, Conventional energy technology, Tata McGraw Hill Publication.

E-Resources:

1. https://openlibrary.org/works/OL16578271W/Power_plant_engineering
2. https://openlibrary.org/works/OL4584032W/Electric_power_generation
3. https://nptel.ac.in/courses/108/101/108101140/
4. https://nptel.ac.in/courses/108/106/108106081/

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3EE204MD1.1	3	2	-	-	-	2	-	-	-	-	-	2	-	1
3EE204MD1.2	3	2	1	-	-	-	-	-	-	-	-	1	1	1
3EE204MD1.3	3	3	2	-	-	-	-	-	-	-	-	2	2	2
3EE204MD1CO	3	3	2	-	2	-	-	-	-	-	-	2	2	1

Correlation levels-1:Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**3SH205OE1**	Course Category:	**OE**
Course Name	**Soft Skills & Profile Building**			
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours **45 Hrs**
Total Credit Hours	**90 Hrs**			
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks **40**
EE Marks	**--**	PA Marks	**--**	Total Marks **100**

Course Description:

Subject Code 3SH205OE1Soft Skills & Profile Building is a compulsory Open Elective Course for Second Year B. Tech All Branch Students.

Course Objectives:

The objective of this course is to focus on developing advanced communication skills, leadership qualities and professional etiquette among engineering graduates.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3SH205OE1.1	Apply advanced interpersonal, analytical, and persuasive communication techniques in professional contexts for effective professional interactions.	C-3
3SH205OE1.2	Demonstrate professional workplace etiquette, business communication, and group discussion skills to enhance employability.	C-3 A-3
3SH205OE1.3	Analyze leadership styles, emotional intelligence, and team dynamics for effective collaboration.	C-4 A-3
3SH205OE1.4	Design a structured and realistic career plan aligned with industry expectations and personal goals for professional growth.	C-6
3SH205OE1.5	Create ATS-friendly résumés, professional portfolios, and digital profiles for personal branding.	C-6 P-4
3SH205OE1.6	Perform effectively in interviews, workplace simulations, and job-search processes with professional confidence for enhanced employability.	C-3 P-3 A-3

Course Contents:

Unit 1	**Advanced Communication Dynamics:** Advanced interpersonal communication strategies; speech articulation; structuring thoughts and fluency techniques; analytical and critical communication; storytelling techniques for impactful presentations; persuasive communication models.	7Hrs
Unit 2	**Global Workplace Etiquettes, Email Writing & GD–PI Perspective:** Professional greetings and workplace conduct; giving and receiving feedback; handling criticism and adaptability issues; professional values such as punctuality and attire; types of handshakes and significance; effective business email writing; types of Group Discussions, purpose of GDs; mock GDs (video-based); interview strategies and techniques.	8Hrs
Unit 3	**Leadership, Team Dynamics & Corporate Skills:** Personality types using 9/9 matrix; leadership styles; emotional intelligence and leadership relationship; conflict resolution and negotiation techniques; team-building skills (Johari Window perspective); cross-cultural communication; creativity and design thinking; structured problem-solving and decision-making**.**	7 Hrs
Unit 4	**Strategizing Career Planning:** SMART goal setting; mapping skills to career paths; understanding industry expectations; emerging futuristic soft and hard skills (domain-wise); personalized career roadmap; certification planning (technical and non-technical); networking skills and participation in professional communities	7 Hrs
Unit 5	**Profile Building, Portfolio & Personal Branding:** ATS-friendly résumé preparation and common mistakes; video résumé creation and self-marketing pitch; LinkedIn profile optimization and networking strategies; developing online portfolios using platforms such as GitHub, Behance, Google Sites, and Toastmasters	8 Hrs
Unit 6	**Employment Readiness & Industry Integration:** Workplace simulation activities (mock emails, meetings, discussions); mock personal interviews; understanding sector-specific industry dynamics; unconventional career opportunities after engineering; job-hunting strategies and popular job platforms	8 Hrs

Text Books:

1. Alex K., Soft Skills, S. Chand Publishing
2. Meenakshi Raman & Prakash Singh, Business Communication, Oxford University Press

Reference Books:

1. Stephen R. Covey, The 7 Habits of Highly Effective People, Free Press Publication
2. Daniel Goleman, Emotional Intelligence, published by Bantam Books.
3. Shiv Khera, You Can Win, published by Bloomsbury Publishing
4. Richard N. Bolles, What Color Is Your Parachute? Published by Ten Speed Press, Crown Publishing Group

E Resources:

1. NPTEL: Soft Skills and Personality Development
2. LinkedIn Learning – Communication & Career Development Courses
3. Harvard Business Review – Communication & Leadership Articles
4. Coursera /edX – Career Development & Employability Skills Modules

Mapping of COs with POs & PSO

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3SH205OE1.1	2	3	2	–	–	–	–	2	3	–	–			
3SH205OE1.2	–	2	–	–	–	2	3	3	3	–	–			
3SH205OE1.3	–	3	2	–	–	2	2	3	–	–	–			
3SH205OE1.4	–	3	3	–	–	2	–	–	–	2	3			
3SH205OE1.5	–	2	3	–	3	–	–	–	2	–	2			
3SH205OE1.6	–	2	2	–	2	2	–	2	3	–	2			
3SH205OE1CO	1	3	2	-	1	2	1	2	2	1	1			

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	**5**	Course Code:	**3SH205OE2**	Course Category:	**OE**
Course Name	**Team Building & Management**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 3SH205OE2Team Building & Management is a compulsory Open Elective Course for Second Year B. Tech All Branch Students.

Course Objectives:

The Objective of the course is to develop teamwork capabilities, leadership and managerial skills, collaborative problem-solving abilities, conflict management techniques, and effective decision-making skills required in professional and organizational settings.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3SH205OE2.1	Explain the principles and importance of effective team building in organizations to foster collaborative work culture.	C-2
3SH205OE2.2	Apply team dynamics and collaboration strategies to achieve common goals.	C-3 A-3
3SH205OE2.3	Analyze leadership styles and managerial roles for effective team performance.	C-4
3SH205OE2.4	Demonstrate conflict resolution, negotiation, and interpersonal management skills for effective team performance.	C-3 A-3
3SH205OE2.5	Apply motivation and performance management techniques in team-based environments for achieving organizational goals.	C-3
3SH205OE2.6	Perform effectively as a team member or leader in simulated managerial scenarios to develop leadership competencies	C-3 P-3 A-3

Course Contents:

Unit 1	**Fundamentals of Team Building:** Concept of teams; types of teams; stages of team development; characteristics of effective teams; roles and responsibilities of team members; barriers to effective teamwork; team norms and values.	7Hrs
Unit 2	**Team Dynamics & Interpersonal Relationships:** Group behavior and dynamics; interpersonal communication in teams; trust and collaboration; listening as a team skill; diversity and inclusion in teams; cross-cultural team management	8Hrs
Unit 3	**Leadership in Teams:** Leadership concepts; leadership styles; emotional intelligence and leadership; situational leadership; influence and power in teams; leadership ethics and responsibilities.	7 Hrs
Unit 4	**Conflict Management & Negotiation:** Sources and types of conflict; conflict resolution techniques; negotiation strategies; managing difficult team members; stress management; maintaining team harmony	7 Hrs
Unit 5	**Motivation, Performance & Team Effectiveness:** Motivation theories; team motivation techniques; goal setting and performance measurement; feedback and appraisal systems; decision-making in teams; problem-solving techniques.	8 Hrs
Unit 6	**Managerial Skills & Team-Based Applications:** Managerial roles and functions; planning, organizing, and controlling teams; delegation and coordination; workplace simulations (team meetings, role plays); case studies on team management; team performance evaluation.	8 Hrs

Text Books:

1. Stephen P. Robbins, Organizational Behavior, Pearson Education
2. L.M. Prasad, Management Principles and Practices, published by Sultan Chand & Sons

Reference Books:

1. Patrick Lencioni, The Five Dysfunctions of a Team, published by Jossey-Bass
2. Peter G. Northouse, Leadership, published by SAGE Publications
3. Daniel Goleman, Emotional Intelligence, published by Bantam Books

E Resources:

1. NPTEL – Organizational Behavior & Management Courses
2. LinkedIn Learning – Team Leadership & Management Modules
3. Harvard Business Review – Teamwork & Leadership Articles
4. Coursera / edX – Team Management and Leadership Courses

Mapping of COs with POs & PSO

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3SH205OE2.1	2	–	–	–	–	–	–	–	–	–	–			
3SH205OE2.2	–	2	2	–	–	–	–	3	2	–	–			
3SH205OE2.3	–	3	3	–	–	–	–	2	–	–	–			
3SH205OE2.4	–	2	2	–	–	2	3	3	–	–	–			
3SH205OE2.5	–	2	2	–	–	–	–	2	–	2	–			
3SH205OE2.6	–	2	2	–	–	2	–	3	2	–	2			
3SH205OE2 CO	1	2	2	-	-	1	1	2	1	1	1			

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	**5.0**	Course Code:	**3EE206PC1**	Course Category:	**PCC**
Course Name	**Network Analysis Lab**				
Credits	**01**	Total L:T:P etc. Hours	0:0:2 **30 Hrs**	Total SL Hours	**--**
Total Credit Hours	**30 Hrs**				
SEE Marks	**--**	SEE Time	**--**	CIA Marks	**--**
EE Marks	**25**	PA Marks	**25**	Total Marks	**50**

Course Description:

Subject Code 3EE206PC1Network Analysis Lab is a Program Core Course for Second Year B. Tech Electrical Engineering.

Course Objectives:

The objective of this course is to reinforce students' understanding of network analysis concepts through hands-on experiments and to develop competency in analyzing electrical circuits.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE206PC1.1	Demonstrate experimental skills in using mesh, nodal, and network theorems to analyse DC and AC circuits, enhancing both theoretical understanding and practical competency.	C-3, P-5
3EE206PC1.2	Analyse, interpret, and validate experimental results of electrical networks.	C-4
3EE206PC1.3	Participate collaboratively in planning, executing, and presenting practical skills in electrical circuit design and testing	C-3, P-4, A-2

List of Practicals:

Minimum eight practicals from the list mentioned below.

1. Experimental Study and Verification of Mesh analysis.
2. Experimental Study and Verification of Nodal analysis.
3. Experimental Study and verification of the superposition theorem.
4. Experimental Study and verification Thevenin's theorem
5. Experimental verification of reciprocity theorem
6. Verification of maximum power transfer theorem
7. Analyse of the electric circuit using Nortons theorem
8. Analysis of Series RLC Resonance and Determination of Resonant Frequency

9. Determination of Open-Circuit Impedance (Z) Parameters of a two-Port network
10. Determination of short circuit admittance (Y) parameters of a two-port network.

E-Resources:

1. https://asnm-iitkgp.vlabs.ac.in/exp/verification-norton-theorem/
2. https://asnm-iitkgp.vlabs.ac.in/exp/verification-thevenin-theorem/
3. https://asnm-iitkgp.vlabs.ac.in/exp/verification-superposition-theorem/
4. https://asnm-iitkgp.vlabs.ac.in/exp/rlc-circuit-analysis/
5. https://asnm-iitkgp.vlabs.ac.in/exp/verification-millman-theorem/
6. https://asnm-iitkgp.vlabs.ac.in/exp/maximum-power-transfer-theorem/
7. https://asnm-iitkgp.vlabs.ac.in/exp/two-port-network/

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
3EE206PC1.1	3	1	-	-	3	-	-	2	-	-	-	2	2	1
3EE206PC1.2	3	1	-	2	3	-	-	2	2	-	-	2	2	1
3EE206PC1.3	3	1	-	1	3	-	-	2	1	-	-	2	2	1
3EE206PC1CO	3	1	-	1	3	-	-	2	1	-	-	2	2	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**3EE207PC1**		Course Category:	**PCC**
Course Name	**Electronic Devices & Circuits - Lab**				
Credits	**01**	Total L:T:P etc. Hours	0:0:2 **30 Hrs**	Total SL Hours	**--**
Total Credit Hours	**30 Hrs**				
SEE Marks	**--**	SEE Time	**--**	CIA Marks	**--**
EE Marks	**25**	PA Marks	**25**	Total Marks	**50**

Course Description:

Subject Code 3EE207PC1 Electronic Devices & Circuits - Lab is a compulsory Program Core Course for Second Year B.Tech. Electrical Engineering.

Course Objectives:

Objective of this course is to achieve hands-on proficiency with fundamental electronic components and lab equipment, and to design, characterize, and analyze basic analog circuits.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE207PC1.1	Apply the fundamentals of semiconductor physics to analyze the V-I characteristics and function of Diodes and Zener regulators.	P-4
3EE207PC1.2	Design and analyze basic diode circuits like half-wave, full-wave rectifiers, and simple section filters for DC power supply applications.	P-4
3EE207PC1.3	Explain the construction and operation of BJTs and UJT, and determine appropriate DC biasing circuits and stability factors for transistor operation.	P-3

List of Praticals:

Minimum eight practicals from the list mentioned below.

1. Study the V-I Characteristics of a PN Junction Diode and determine its Static and Dynamic Resistances in Forward and Reverse Bias.
2. Determine the Ripple Factor and Voltage Regulation of a Full Wave Rectifier.
3. Verify the various clipping and clamping circuits using PN junction diode in Hardware as well Using Multisim software.
4. Study the V-I characteristics of Zener diode.

5. Study the static and transfer characteristics of the FET using Hardware and multi sim software.
6. Obtain the input and output characteristics of transistor in Common Emitter Configuration using Hardware and multi sim software.
7. Obtain the input and output characteristics of transistor in Common Base configuration using Hardware and multi sim software.
8. Draw the volt ampere / static characteristics of UJT using Hardware as well as Multisim software.
9. Design the Voltage divider bias circuit using BJT in Hardware and Multisim software.
10. Design the Voltage divider bias circuit using JFET in Hardware and Multisim software.
11. Design the Switch with self-bias using BJT.
12. Calculate the band width of given amplifier.

E-Resources:

1. https://nptel.ac.in/courses/108101091
2. http://vlabs.iitkgp.ac.in/be/
3. https://www.multisim.com/
4. https://www.falstad.com/circuit/

Mapping of COs with Pos & PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3EE207PC1.1	3	3	-	2	1	-	-	1	-	-	-	-	1	-
3EE207PC1.2	2	3	3	2	2	-	-	1	-	-	-	1	1	2
3EE207PC1.3	3	2	2	2	3	-	-	1	-	-	-	1	1	1
3EE207PC1CO	3	2	2	2	2	-	-		-	-	-	1	1	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**3EE208PC1**	Course Category:	**PCC**
Course Name	**Electrical Machines-I – Lab**			
Credits	**01**	Total L:T:P etc. Hours	0:0:2 **30Hrs**	Total SL Hours: **--**
Total Credit Hours	**30 Hrs**			
SEE Marks	**--**	SEE Time	**--**	CIA Marks **--**
EE Marks	**25**	PA Marks	**25**	Total Marks **50**

Course Description:

Subject Code 3EE208PC1Electrical Machines-I - Lab is a compulsory Program Core Course for Second Year B. Tech Electrical Engineering.

Course Objectives:

The objective of this course is to provide hands-on experience in measuring, calibrating, testing, and analyzing electrical machine parameters and characteristics to develop practical skills for accurate and reliable results.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE208PC1.1	Perform tests on DC machines and transformers to determine characteristics and improve understanding of machine performance.	C-2
3EE208PC1.2	Apply OCC, load tests, braking, polarity, ratio, and OC/SC methods to analyze machines for effective operation.	C-4
3EE208PC1.3	Interpret experimental results to validate theoretical concepts and enhance the ability to assess machine behavior.	C-5

List of Practicals:

Minimum eight practicals from the list mentioned below.

1. Plot the Open Circuit Characteristics of DC generator and find its critical resistance and critical speed.
2. Study the build-up of DC shunt generator, calculate critical resistance at different speeds.
3. Plot/Compare: External, Internal Characteristics of DC Shunt/series/compound generator.
4. Calculate the efficiency and voltage regulation of DC generator by the direct load test.

5. Speed Control of DC Shunt motor by armature control & Field Control method.
6. Perform Electric Braking Operation on DC shunt Motor.
7. Conduct the Polarity test and Ratio test on transformer
8. Perform Parallel operation of two single phase two winding transformers.
9. Calculate the Equivalent circuit parameters of three-phase transformer by performing OC & SC test on it and determine its efficiency and voltage regulation.
10. Conversion of three phase to two phase supply system using Scott Connection.

E-Resources:

1. https://nptel.ac.in/courses
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science
3. www.youtube.com/c/LearnEngineering

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
3EE208PC1.1	3	2	1	1	1	-	-	1	1	-	-	3	2	1
3EE208PC1.2	3	3	2	2	1	-	-	1	1	-	-	3	2	1
3EE208PC1.3	3	3	3	2	1	-	1	1	1	-	-	2	2	1
3EE208PCCO	3	3	2	2	1	-	-	1	1	-	-	3	2	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**3EE209EM1**		Course Category:	**EEM**
Course Name	**Economics of Energy Markets**				
Credits	**02**	Total L:T:P etc. Hours	2:0:0	Total SL Hours	**30 Hrs**
Total Credit Hours	**60 Hrs**		**30 Hrs**		
SEE Marks	**--**	SEE Time	**--**	CIA Marks	**--**
EE Marks	**--**	PA Marks	**50**	Total Marks	**50**

Course Description:

Subject Code 3EE209EM1 Economics of Energy Markets is an Electrical Engineering Management course for Second Year B.Tech Electrical Engineering students.

Course Objectives:

The objective of this course is to provide an overview of the power sector, focusing on data interpretation, regulatory structures, and global energy market trends.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE209EM1.1	Apply fundamental power sector cost metrics and load definitions to construct accurate power flow models and bid strategies.	C-3, P-3
3EE209EM1.2	Analyze the Indian tariff structure and billing components to defend opinions on regulatory fairness and cross-subsidization policies.	C-4, A-3
3EE209EM1.3	Evaluate global energy trends and emerging technologies to justify the economic and ethical adoption of sustainable solutions like EVs.	C-5, A-3

Course Contents:

Unit 1	**Data Foundations of Power Economics:** Power Systems Overview: Generation, Transmission, Distribution; Load Data Analysis: Connected Load, Maximum Demand, Load Factor, Cost Structuring: Fixed Cost (Capital) vs. Variable Cost (Fuel), Unit Costing: Per-Unit Cost (kWh) Calculation, Depreciation.	10 Hrs

Unit 2	**Advancements in Indian Power Sector & Tariff Structures:** Sector hierarchy involving generation (NTPC), transmission (Power Grid) and distribution (DISCOMs); role of regulatory and market bodies such as CERC and IEX; concept of Open Access and electricity trading. Renewable energy mechanisms including Renewable Energy Certificates (REC) and Green Energy Open Access. Electricity tariff structure covering fixed charges, energy charges, electricity duty and tariff types such as flat rate, block rate and Time-of-Day (ToD) tariff.	12 Hrs
Unit 3	**Global Energy Scenarios & Future Trends:** Global Energy Mix: Coal, Oil, Renewables, Trade Dynamics: Import/Export of Fuel and Solar Components, Emerging Technologies: Electric Vehicles (EVs), Rooftop Solar Economics, Sustainability Goals: Climate Change Targets, Energy Efficiency	8 Hrs

Text Books:

1. Subhes C. Bhattacharyya, Energy Economics: Concepts, Issues, Markets and Governance, Springer.
2. (Standard Author), Elements of Electrical Engineering, (Standard Publisher).
3. C.L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age International.
4. U.A. Bakshi & V.U. Bakshi, Elements of Electrical Engineering, Technical Publications.

Reference Books:

1. A. J. Wood & B. F. Wollenberg, Power Generation, Operation, and Control, Wiley.
2. James Larminie & John Lowry, Electric Vehicle Technology Explained, Wiley.
3. TERI Energy & Environment Data Diary and Yearbook (TEDDY), TERI Press.
4. James Momoh, Smart Grid: Fundamentals of Design and Analysis, Wiley.

E-Resources:

1. https://www.iexindia.com/
2. https://powermin.gov.in/
3. https://cea.nic.in/
4. https://beeindia.gov.in/
5. https://nptel.ac.in/courses/110105078
6. https://www.vlab.co.in/

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
3EE209EM1.1	3	3	3	2	3	-	-	-	2	-	3	3	2	-
3EE209EM1.2	-	3	-	2	-	2	-	2	2	2	-	2	3	2
3EE209EM1.3	-	-	-	-	-	2	3	3	2	2	-	2	2	3
3EE209EM1CO	1	3	1	2	1	2	3	2	2	2	1	2	2	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code:	**3SH210VE1**	Course Category:	**VEC**
Course Name	**Constitutional Values and Fundamental Duties**			
Credits	**02**	Total L:T:P Hours	2:0:0 **30 Hrs**	Total SL Hours **30 Hrs**
Total Credit Hours	**60 Hrs**			
SEE Marks	--	SEE Time	--	CIA Marks --
EE Marks	**25**	PA Marks	**25**	Total Marks **50**

Course Description:

Subject Code 3SH210VE1 Constitutional Values and Fundamental Duties is a compulsory Values enhancement Course for Second Year B. Tech.

Course Objectives:

The objective of the course is to introduce the Indian Constitution, its historical background, fundamental values, rights, and duties.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3SH210VE1.1	Explain the historical background, making, and significance of the Indian Constitution to Understand the Constitution, Preamble, and core values.	C2
3SH210VE1.2	Interpret Fundamental Rights and Duties (Articles 12–35, 51A) to evaluate their implications through case studies in professional and civic life.	C3
3SH210VE1.3	Apply constitutional principles to engineering ethics, sustainability concerns (Articles 48A, 51A(g)), and demonstrate social commitment, innovation, and inclusive growth as nation builders.	C3

Course Contents:

Unit 1	**Introduction to the Constitution and Fundamental Values**: Overview of the Indian Constitution – Historical background and making of the Constitution; Meaning of Constitution; Preamble – Meaning and significance. Core Constitutional Values – Justice (Social, Economic, Political); Liberty (thought, expression, belief, faith, worship); Equality (status and opportunity); Fraternity (dignity and unity of the nation). Relevance of constitutional values for professionals and citizens.	10 Hrs

Unit 2	**Fundamental Rights and Duties**: Fundamental Rights (Articles 12–35) – Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies. Fundamental Duties (Article 51-A) – Importance and implications; Role of youth and professionals in upholding duties. Case studies highlighting real-life significance of rights and duties.	10 Hrs
Unit 3	**Application of Constitutional Values in Engineering and Public Life**: Ethical Responsibilities and Constitutional Alignment – Engineering ethics and public interest; Environment and sustainability as constitutional concern (Articles 48A, 51A(g)); Engineers as nation builders – Social commitment, innovation, and inclusive growth.	10 Hrs

Text Books:

1. Basu D. D., Introduction to the Constitution of India, LexisNexis Publication, New Delhi (Twenty-Third Edition).
2. Jain M. P., Constitution of India, LexisNexis Publication, New Delhi (Eighth Edition).
3. Laxmikanth M., Indian Polity, McGraw Hill Education, New Delhi (Sixth Edition).
4. Austin Granville, The Indian Constitution: Cornerstone of a Nation, Oxford University Press, New Delhi.
5. Shukla V. N., Constitution of India, Eastern Book Company, Lucknow (Twelfth Edition).
6. Government of India, Constitution of India (Bare Act), Government of India Publication, New Delhi.

Reference Books:

1. Subhash Kashyap, Our Constitution, National Book Trust, New Delhi.
2. Durga Das Basu, Shorter Constitution of India, LexisNexis Publication.
3. P. M. Bakshi, The Constitution of India, Universal Law Publishing.
4. J. N. Pandey, Constitutional Law of India, Central Law Agency.
5. Seervai H. M., Constitutional Law of India, N. M. Tripathi Pvt. Ltd. (Vols. I–III).
6. B. Shiva Rao, The Framing of India's Constitution: A Study, Indian Institute of Public Administration.
7. D. C. Wadhwa, Political Science and Constitutional Law, Eastern Book Company.
8. Madhav Khosla, The Indian Constitution: Oxford India Short Introductions, Oxford University Press.

E-Resources:

1. NPTEL course on Constitutional Studies, Prof. Sudhir Krishnaswamy, National Law School of India University
2. Constitutional Values and Fundamental Duties (University of Delhi – aligned with NEP 2020, available via NPTEL/DU open learning) https://kmc.du.ac.in/kmcouter/collnews/download/40727448169063791359.pdf/LinkedContents/pdf/All/All

Mapping of COs with POs & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3SH210VE1.1	3	2	-	1	-	-	-	-	-	-	-	2	2	
3SH210VE1.2	-	3	2	2	-	2	3	3	-	-	-	3	2	-
3SH210VE1.3	-	-	3	3	-	2	3	2	-	2	-	3	3	2
3SH210VE1CO	1	2	2	2	-	2	2	2	-	1	-	3	2	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**3EE400FP1**		Course Category:	**FP**
Course Name	**Field Project**				
Credits	**02**	Total L:T:P Hours	0:0: 4 **60 Hrs**	Total SL Hours	--
Total Credit Hours	**60 Hrs**				
SEE Marks	--	SEE Time	--	CIA Marks	--
EE Marks	**25**	PA Marks	**25**	Total Marks	**50**

Course Description:

Subject Code 3EE400FP1Field project is a compulsory Experiential Learning Course for Second Year B. Tech Electrical Engineering.

Course Objectives:

This course enables students to understand the project development cycle through mini projects, apply hardware and software implementation skills, and communicate technical information effectively through report writing.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE400FP1.1	Conduct field - based surveys and assessments to identify electrical, renewable energy, and power quality issues.	C-3, P-3, A-2
3EE400FP1.2	Apply electrical engineering principles to design and implement practical, safe, and low-cost solutions for community needs.	C-4, P-4, A-2
3EE400FP1.3	Execute performance evaluation and energy auditing to improve efficiency, reduce losses, and assess societal impact.	C-5, P-4, A-3

Note:

Students are required to select any one of the project types/domains listed below, working in groups with a minimum of 4 and a maximum of 10 members.

Project Type:

1. Survey and evaluation of schemes related to rural electrification or renewable energy.
2. Design of Solar installations
3. Electrical Energy auditing and conservation strategies in residential, industrial and institutional setups.
4. Investigation of performance of solar inverters, battery systems, or smart metering.

5. Design of low-cost electrical training kits or laboratory aids.
6. Study of power quality issues or losses in local power distribution.
7. Design and development of electrically powered smart agricultural tools or systems

General Guidelines (Domains):

1. Power Distribution Systems and Loss Reduction
2. Renewable Energy Applications
3. Agri-Electrical Mechanization
4. Electrical Safety Systems
5. Automation using Arduino/ IoT in Electrical Applications
6. Energy Conservation
7. Green Energy Initiatives
8. Power Quality Improvement

Project Report Format:

The Project Report shall contain the following sections:

1. Title, Certificate, and Index
2. Objectives
3. Introduction
4. Literature Survey
5. Methodology (Experimental Method, Data Collection & Analysis, Case Study, Survey Method, Research Method)
6. Analysis (Graphical Representation / Simulation / Experimentation / Survey / Testing)
7. Problem Identification
8. Probable Solution
9. Conclusion
10. References

E-Resources:

1. https://instrumentationtools.com/renewable-energy-projects/
2. https://innovatorsguru.com/category/engineering-projects/
3. https://in.pinterest.com/innovatorsguru/electrical-engineering-projects/
4. https://ece-eee.final-year-projects.in/renewable-green-energy-saving-project-ideas-project-topics
5. https://www.arelectroprojects.com/projects

Course Plan:

Lecture No.	Module Title	Topic	Hours
1	Module 1: Orientation & Sensitization	NEP 2020: Community Engagement & Role of Electrical Engineers, Ethics, Social Responsibility & SDGs for Electrical Engineers, Overview of Community Electrical and Renewable	4

		Energy Needs, Identification of Community Institutions and Stakeholders, Electrical Safety, Team Formation, Area & Theme Allocation, Reorganization	
2	Module 2: Field Visits & Problem Identification	Pre-Visit Study, Permissions & Planning	28
3		Site Identification and Electrical System / Energy Infrastructure Documentation	
4		Field Data Collection and Technical Observation	
5		Electrical Measurements, Energy Audit and System Data Recording	
6		Analysis of Collected Data and Comparison with Relevant Standards	
7		Problem Identification and Development of Electrical Engineering Solutions	
8	Module 3: Engineering Problem–Solution Design & Implementation	Analysis of Collected Field Data and Identification of Electrical / Renewable Energy Problems	16
9		Preparation of Simple Single-Line Diagrams, Layout Sketches or System Models and Development of a Basic Improvement Plan	
10		Identification of Electrical Engineering Deficiencies Related to Energy Use, Safety, Power Quality, Renewable Energy or Community Infrastructure	
11		Design, Simulation, Fabrication or Configuration of the Proposed Electrical Engineering Solution	
12		Performance Evaluation, Feasibility Assessment and Analysis of Expected Community Benefits	
13	Module 4: Documentation, Presentation & Reflection	Data Analysis and Graphical Representation; Writing Methodology and Analysis Sections; Results, Discussion and Conclusion	12
14		Project Report Structure and Guidelines, Report Finalization and Presentation Preparation	
15		Evaluation and Viva	

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3EE400FP1.1	3	3	-	-	-	-	-	2	3	-	3	3	3	-
3EE400FP1.2	3	3	3	3	3	-	-	-	3	3	3	3	3	-
3EE400FP1.3	3	3	-	3	3	3	3	-	3	3	3	3	3	3
3EE400FP1CO	3	3	1	2	3	2	1	1	3	2	3	3	3	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code:	**3AL001NC1**		Course Category:	**NC**
Course Name	**Disaster Management and Preparedness**				
Credits	--	Total L:T:P Hours	2:0:0 **30 Hrs**	Total SL Hours	--
Total Credit Hours	--				
SEE Marks	--	SEE Time	--	CIA Marks	--
EE Marks	--	PA Marks	--	Total Marks	--

Course Description:

Subject Code 3AL001NC1 Disaster Management and Preparedness is a Compulsory Non-Credit course for Second Year B. Tech all disciplines.

Course Objectives:

The objective of this course is to provide students with a comprehensive understanding of disasters, their types, impacts, the complete disaster management cycle, and the roles of various agencies in Disaster Risk Reduction.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3CE001NC1.1	Identify the concepts of disaster, hazard, vulnerability and risk, and classify disasters to understand the basic nature, causes and profiles of disasters in India.	C-2
3CE001NC1.2	Analyze the disaster management cycle for risk assessment, mitigation, preparedness, response, recovery, and international disaster management frameworks.	C-4
3CE001NC1.3	Apply disaster management practices, including stakeholder roles, national policies, engineers' responsibilities, and preparedness measures for effective disaster risk reduction.	C-3

Course Contents:

Unit 1	**Introduction to Disaster Management:** Concepts and definitions – disaster, hazard, vulnerability, risk, severity, frequency, exposure, capacity, and impact; classification of disasters- Natural disasters: earthquakes, tsunami, landslides, mining, Hydro-Meteorological Disasters: floods, draught, cyclones, coastal erosion. Biological Disaster: epidemics, pest attacks, forest fire, Manmade disasters: Industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical	10 hrs

	spills, transportation accidents, vulnerability profile of India, ecological fragility; principles of disaster prevention and mitigation	
Unit 2	**Disaster Management Cycle and Framework:** Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development. Awareness During Disaster – Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation. Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action Phases of disaster management; vulnerability and capacity assessment, post-disaster environmental response	12 hrs
Unit 3	**Disaster Management practices:** Roles and responsibilities of government, community, local bodies, NGOs, and other stakeholders, National Policy on Disaster Management Act 2005 Mega Disasters of India and Lessons Learnt, Disaster Management practices at working and residential places. Key responsibility of engineers in disaster reduction techniques, medical preparedness aspect of disaster.	8 hrs

Textbooks:

1. Sharma, S. C. (2022). Disaster Management, Khanna Publication.
2. Subramanian, R. (2024). Disaster Management. Vikas Publication.

Reference Books:

1. Gaur, R. C. (2018). Environmental Engineering and Disaster Management. New Age International.
2. Pradeep Sahni, 2024, Disaster Risk Reduction in South Asia, Prentice Hall.
3. Mondal, D. (2022). Disaster Management. New Delhi: CBS Publishers & Distributors
4. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
5. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
6. Natural Disaster Management Policy , 2009,GOI
7. H.N. Shrivastava & G.D. Gupta, Management of Natural Disasters in developing Countries, Daya Publishers , Delhi
8. S.L. Goyal, Encyclopedia of disaster Management, Vol I,II & III Disaster Management Policy and administration, Deep & Deep, New Delhi,2006
9. Coppola D P, Introduction to International Disaster Management, Elsevier Science (B/H), London, 2007

10. Disaster Mitigation in Asia & Pacific, Asian Development Bank

Course Assignments

Internal Assessment at Institute level will be based on following assignments:

1. Study of Recent Disasters (at local, state and national level)
2. Preparation of Disaster Risk Management Plan of an Area or Sector
3. A Case study on Disaster Management

E Recourses:

1. https://onlinecourses.swayam2.ac.in/ntr25_ed61/preview

Mapping of COs with POs & PSOs

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
3CE001NC1.1	3	2	-	-	-	3	2	-	-	-	3	-	-	-
3CE001NC1.2	3	3	-	-	-	3	3	-	-	-	3	2	2	-
3CE001NC1.3	3	3	-	-	-	3	3	-	-	3	3	1	2	2
3CE001NC1.CO	3	3	-	-	-	3	3	-	-	1	3	1	2	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	**5.0**	Course Code:	**3EE211DH1**	Course Category:	**DH**
Course Name	**Futuristic Power Systems**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 3EE211DH1Futuristic Power Systems is a Double Minor / Honors offered by the department of Electrical Engineering for Second Year B. Tech, of all disciplines.

Course Objectives:

The Objective of this course is to explore the state of the art and future trends in power systems, understand the technical, economic and social challenges in power system evolution and realize the role and importance of Microgrids in futuristic power systems.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE211DH1.1	Explain the present global scenario of electricity generation, transmission, and distribution, and understand the need for resilient and secure energy infrastructure to address social, technical, and economic challenges in modern power systems.	C-3
3EE211DH1.2	Analyze various renewable energy resources and technologies, and evaluate their role in reducing dependence on conventional energy sources and promoting sustainable power generation.	C-3
3EE211DH1.3	Interpret the concepts and challenges of renewable energy integration, including hybrid systems and forecasting, to ensure reliable, stable, and efficient large-scale power system operation.	C-3
3EE211DH1.4	Compare different energy storage technologies and their characteristics, and assess their role in enhancing grid stability, reliability, and continuity of renewable energy supply.	C-3
3EE211DH1.5	Describe smart grid and microgrid concepts, architectures, and control strategies, and	C-4

	understand their significance in enabling intelligent, flexible, and decentralized power systems.	
3EE211DH1.6	Examine microgrid implementation in India through rural electrification and case studies, and evaluate their contribution to achieving inclusive, reliable, and sustainable energy access considering technical, economic, and social factors.	C-5

Course Contents:

Unit 1	**Introduction:** Present status of worldwide scenario of electricity generation, transmission and distribution; Energy infrastructure-Resilience and Security; Social, Technical and economic challenges; Major trends driving power system evolution; State of the art technologies in power system.	7 Hrs
Unit 2	**Renewable Energy Resources:** Review of renewable energy (RE) resources and systems: Solar-PV, Solar Thermal, Wind, Biomass, Micro-hydro and Fuel Cell, comparison of various RE resources; Renewable Energy Policies and present status of integration with existing grid.	7 Hrs
Unit 3	**Renewable Energy Integration:** Renewable Energy Integration- Concept, Classification of hybrid energy systems; Large scale integration of renewable energy-Technical challenges, enabling technologies, International requirements; Renewable energy forecasting.	7 Hrs
Unit 4	**Energy Storage Systems:** Review of energy storage components: Battery, VRB, Ultra-capacitor, Fuel Cells, Pumped Hydro-Storage and flywheels, comparison of ESS technologies; Importance of ESS in futuristic power systems.	8 Hrs
Unit 5	**Micro-grid Evolution:** Smart-grid concept, Smart Grid versus conventional electrical networks, Smart-grid infrastructure. Micro-grid concept, importance in futuristic power system, basic architectures and control, objectives and state of the art technologies; Microgrid as a building block of Smart-grid.	8 Hrs
Unit 6	**Microgrids in India:** Microgrids for Rural Electrification, Review of Microgrid Best Practices through Case Studies: Strategic Planning, Operations: Commercial and Financial Considerations; Technical and Social Context.	8 Hrs

Text Books:

1. Microgrids Architectures and Control Edited by Nikos Hatziargyriou, IEEE and Wiley, 2014
2. Energy Storage for Sustainable Microgrid by David Wenzhong Gao, Elsevier, 2015
3. Introduction to the Smart Grid- Concepts, Technologies and Evolution by Salman K. Salman, IET, 2017
4. Energy Storage Systems and Components by Alfred Rufer, CRC Press, 2018

Reference Books:

1. Energy Efficiency and Renewable Energy Handbook Edited by D. Yogi Goswami and Frank Kreith, 2nd Edition-2016, CRC
2. Clean Energy Microgrids, Edited by Shin'ya Obara and Jorge Morel IET, 2017
3. Hybrid-Renewable Energy Systems in Microgrids- Integration, Developments and Control edited by Hina Fathimaby et al., Elsevier WoodHead Publishing, 2018
4. Smart Microgrids: Lessons from Campus Microgrid Design and Implementation edited by Hassan Farhangi, CRC Press 2017

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc25_ee79/preview
2. https://onlinecourses.nptel.ac.in/noc21_ee68/preview.
3. https://onlinecourses.nptel.ac.in/noc22_ee82/preview.
4. https://onlinecourses.swayam2.ac.in/arp19_ap60/preview

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3EE211DH1.1	3	2	1	1	1	1	–	–	-	-	-	3	2	1
3EE211DH1.2	3	3	2	2	3	1	–	–	-	-	-	2	3	2
3EE211DH1.3	3	3	2	1	3	2	–	–	-	-	-	2	2	2
3EE211DH1.4	3	3	2	2	3	3	1	-	-	-	-	3	2	2
3EE211DH1.5	3	3	3	2	3	3	1	-	-	-	-	3	3	2
3EE211DH1.6	3	3	3	1	3	2	1	-	-	-	-	2	2	2
3EE211DH1CO	3	3	2	2	3	2	1	-	-	-	-	3	2	2

Correlation levels- 1: Slight (Low),2: Moderate (Medium), 3: Substantial (High)

Level:	**5.0**	Course Code:	**3EE211DH2**	Course Category:	**DH**
Course Name	**Fundamentals of EVs: Technology & Economics**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 3EE211DH2 Fundamentals of EVs: Technology & Economics is a Double Minor / Honors offered by the department of Electrical Engineering for Second Year B. Tech, of all disciplines.

Course Objectives:

The objective of this course is to provide fundamental knowledge of electric vehicle technologies, powertrain systems, global trends, and challenges to understand their role in sustainable and efficient transportation.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
3EE211DH2.1	Explain the evolution of electric vehicles, including early developments, comparison with ICE vehicles, and technological advancements, to understand the transition toward sustainable and energy-efficient transportation systems.	C-3
3EE211DH2.2	Describe the fundamentals of electric vehicles, their types, electric machines, and transmission systems to develop foundational knowledge of EV architecture and current technological trends.	C-3
3EE211DH2.3	Analyze hybrid electric vehicle configurations, operating modes, and degrees of hybridization to understand their role in improving fuel efficiency and reducing emissions in modern transportation.	C-3
3EE211DH2.4	Interpret EV powertrain components, motor selection, transmission systems, and regenerative braking to understand performance characteristics and design considerations of efficient propulsion systems.	C-3
3EE211DH2.5	Examine global and Indian EV scenarios, including adoption trends, key players, and	C-4

	policies to understand market dynamics and regulatory frameworks influencing EV growth.	
3EE211DH2.6	Evaluate environmental, economic aspects, and challenges of EV adoption to understand sustainability benefits, cost implications, and barriers affecting large-scale implementation of electric mobility.	C-4

Course Contents:

Unit 1	**Evolution of Electric Vehicles:** History of EVs (19th century to early 20th century) Comparison with Internal Combustion Engine (ICE) vehicles - energy efficiency, performance, and emissions. Reasons for decline of early EVs, Energy crisis and environmental concerns, Advances in battery technology.	7 Hrs
Unit 2	**Electric Vehicles:** Basics of Electric Vehicles, Current Status and Trends for EVs, Battery Electric Vehicles (BEVs), Fuel-Cell Electric Vehicles (FCEVs), Electric Machines for EV applications, EV Transmission: Single-Speed EV Transmission, Multiple Ratio EV Transmissions.	8 Hrs
Unit 3	**Hybrid Powertrain:** Emergence of hybrid electric vehicles (HEVs), Types (HEV, PHEV, BEV, FCEV). Series HEVs, Parallel HEVs, Series–Parallel HEVs, Complex HEVs, Operating Modes, Degree of Hybridization, Comparison of HEVs, Plug-in Hybrid Electric Vehicles (PHEVs); Real Life examples of HEVs.	8 Hrs
Unit 4	**EV Powertrain and Propulsion Systems:** EV powertrain components and configurations. Electric motors for EVs: BLDC, PMSM, Induction motors – working and selection criteria. Transmission systems and regenerative braking. Performance characteristics and vehicle dynamics basics.	7 Hrs
Unit 5	**Global and Indian EV Scenario:** Global EV Scenario: Trends in worldwide EV adoption; major markets like China, USA, Europe, and Norway; key growth drivers including technology, environmental concerns, and policies, Global Policies and Initiatives. Indian EV Scenario: Current adoption status, market trends, major industry players, and key opportunities and challenges in India. Government Policies in India.	8 Hrs

Unit 6	**Environmental and Economic Aspects and Challenges:** Reduction in greenhouse gas emissions, Lifecycle emissions (basic concept), Cost comparison: EV vs ICE vehicles, Role of renewable energy in EV ecosystem. Challenges in Global EV Adoption: Battery cost and raw materials, Range anxiety, Charging time and infrastructure gaps, Grid readiness and energy supply issues.	7 hrs

Text Books:

1. James Larminie & John Lowry, Electric Vehicle Technology Explained, Wiley.
2. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press.
3. Mehrdad Ehsani, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press.

Reference Books:

1. Electric Vehicle Machines and Drives: Design, Analysis and Application, K. T. Chau, Wiley.
2. Modern Electric Vehicle Technology, C.C. Chan, Oxford University Press.
3. Energy Efficiency Services Limited (EESL), MNRE, NITI Aayog Reports on EV Policies.

E-Resources:

1. https://nptel.ac.in/courses/108106183
2. https://www.ieee.org/ev
3. https://www.energy.gov/eere/vehicles
4. https://www.beeindia.gov.in
5. https://evreporter.com

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3EE211DH1.1	3	2	1	1	–	1	-	1	–	-	–	3	1	2
3EE211DH1.2	3	3	3	2	2	1	-	–	–	-	–	2	3	2
3EE211DH1.3	3	2	2	3	2	1	-	–	–	-	–	2	3	3
3EE211DH1.4	3	3	3	2	3	1	-	–	–	-	2	3	3	2
3EE211DH1.5	2	3	2	2	–	2	-	2	–	1	2	2	2	3
3EE211DH1.6	2	3	3	3	2	1	-	2	–	1	2	2	2	3
3EE211DH1CO	3	3	2	2	2	1	-	1	-	1	2	2	2	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substa ntial (High)

Level:	**5.0**	Course Code:	**4EE212PC1**	Course Category:	**PCC**
Course Name	**Analog and Digital Circuits**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours:	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 4EE212PC1 Analog and Digital Circuits is a compulsory Program Core Course for Second Year B. Tech Electrical Engineering.

Course Objectives:

The Objective of this course is to provide a foundational understanding of both analog and digital electronics, focusing on the operation, analysis, and design of fundamental circuits using diodes, transistors, and logic gates, while introducing basic concepts of feedback and conversion.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4EE212PC1.1	Apply knowledge of operational amplifiers and their internal circuits to analyze IC-based circuits and measure op-amp parameters.	C-3
4EE212PC1.2	Design and analyze operational amplifier (Op-Amp) circuits for practical applications like summing, integrating, and filtering.	C-4
4EE212PC1.3	Illustrate the concepts of linear ICs, SMPS, and IC 555 to analyze and implement regulator and timer-based electronic circuits.	C-4
4EE212PC1.4	Use Boolean algebra and Karnaugh Maps (K-Maps) to simplify and implement combinational logic circuits.	C-3
4EE212PC1.5	Demonstrate the operation of sequential logic circuits, including flip-flops, counters, and registers.	C-4
4EE212PC1.6	Evaluate the principles and architecture of Analog-to-Digital (ADC) and Digital-to-Analog (DAC) converters to understand the concept of ADC and DAC	C-4

Course Contents:

Unit 1	**Introduction to ICs:** Operational amplifier, Block schematic internal circuits, Level shifting, overload protection, study of IC Op-amp, Measurement of op-amp parameter.	7 Hrs
Unit 2	**Operational Amplifiers (Op-Amps):** Op-Amp characteristics (ideal and practical). Basic Op-Amp circuits: Inverting and Non-inverting amplifiers. Applications: Adder, Subtractor, Integrator, Differentiator, and Comparators. Introduction to positive and negative feedback.	7 Hrs
Unit 3	**Other linear ICs:** Block schematic of regulator IC 723 and its applications, study of 78XX, 79XX and its applications, SMPS, Block schematic of timer IC 555 and its applications as a timer, a stable, mono-stable, bi-stable multi-vibrator and other applications.	7 Hrs
Unit 4	**Combinational Digital Logic:** Number systems, Boolean algebra, and De Morgan's theorems. Logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR). Karnaugh Map (K-Map) simplification (up to 4 variables). Design and analysis of standard combinational circuits: Multiplexers, Demultiplexers, Encoders, and Decoders.	8 Hrs
Unit 5	**Sequential Digital Logic:** Latches and Flip-Flops (SR, JK, D, T). Conversion between flip-flops. Analysis of Synchronous and Asynchronous Counters (Ripple and Johnson). Shift Registers (SISO, SIPO, PISO, PIPO).	8 Hrs
Unit 6	**Data Conversion and Logic Families:** Digital-to-Analog Converters (DACs): R-2R ladder and weighted resistor types. Analog-to-Digital Converters (ADCs): Successive Approximation and Flash types. Introduction to logic families (TTL, CMOS) characteristics (Fan-out, Noise Margin, Propagation Delay).	8 Hrs

Text Books:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson.
2. M. Morris Mano, Digital Logic and Computer Design, Pearson.
3. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, Prentice Hall.

Reference Books:

1. Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman and Christos C. Halkias, McGraw-Hill.
2. Fundamentals of Digital Circuits, Anand Kumar, Prentice Hall India Learning Private Limited.

E-Resources:

1. https://nptel.ac.in/courses/108/102/108102113
2. https://nptel.ac.in/courses/117/105/117105080
3. https://nptel.ac.in/courses/117/103/117103063
4. https://nptel.ac.in/courses/108/101/108101005

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4EE212PC1.1	3	2	1	2	1	-	-	-	-	-	-	1	2	1
4EE212PC1.2	3	3	2	2	2	1	-	-	-	-	-	1	2	1
4EE212PC1.3	3	3	2	2	2	3	-	-	1	-	-	1	2	1
4EE212PC1.4	2	3	2	1	3	2	-	-	1	-	-	-	2	1
4EE212PC1.5	2	3	2	2	3	2	-	1	1	-	-	-	1	1
4EE212PC1.6	2	2	2	1	3	1	-	-	-	-	-	1	2	1
4EE212PC1CO	3	3	2	2	2	2	-	-	1	-	-	1	2	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**4EE213PC1**	Course Category:	**PCC**
Course Name	**Electrical Measurement & Instrumentation**			
Credits	**02**	Total L:T:P etc. Hours	2:0:0 **30 Hrs**	Total SL Hours : **30Hrs**
Total Credit Hours	**60 Hrs**			
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 4EE213PC1 Electrical Measurement & Instrumentation is a compulsory Program Core Course for Second Year B. Tech Electrical Engineering.

Course Objectives:

The objective of this course is to enable learners with electrical measuring instruments and transducers, and to develop skills for accurate measurement and analysis of electrical quantities.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4EE213PC1.1	Classify suitable measuring instruments (PMMC, MI, Electrodynamometer, Induction types) to select the correct device for accurate practical electrical measurements.	C-4
4EE213PC1.2	Demonstrate the construction, working principle, and torque equation of wattmeters and energy meters to understand their operation and ensure correct power and energy measurement.	C-3
4EE213PC1.3	Demonstrate the construction and working of Instrument Transformers and special purpose meters to ensure safe, isolated, and precise measurement in high-voltage and specialized applications.	C-3
4EE213PC1.4	Analyze AC/DC bridge techniques for measuring resistance, inductance, and capacitance to apply accurate testing methods in practical laboratory scenarios.	C-4
4EE213PC1.5	Demonstrate digital measuring instruments to achieve accurate, fast, and real-time electrical measurement in modern applications.	C-3

4EE213PC1.6	Illustrate instrumentation systems and transducers to understand how physical parameters are sensed, measured, and controlled in practical engineering systems.	C-3

Course Contents:

Unit 1	**Analog Instruments:** Classification of measuring instruments, Construction and theory of operation, Different torques in measuring instruments, Torque equation, Errors, Merits and demerits of Analog Ammeter, Voltmeter (PMMC, MI instruments) and Electro-dynamic type meter, Extension of ranges for ammeter & voltmeter	6 Hrs
Unit 2	**Analysis of Three Phase Balanced Load:** Blondell's theorem, Measurement of active and reactive power in single phase and three phase circuits.	4 Hrs
Unit 3	**Instrument Transformers:** Importance of C.T. and P.T., Theory and construction, Phasor diagram, Errors and applications. Special Instruments- Phase sequence indicator, Power factor meter, Synchroscope and Stroboscope.	5 Hrs
Unit 4	**Measurement of Circuit Parameters:** Different methods of measurement of low, medium, high value of resistance. **AC and DC Bridges:** Wheat-stone, Kelvin, Maxwell, Hay, De-Sauty, Schering, Anderson's bridge.	5 Hrs
Unit 5	**Digital Methods of Measurements:** Introduction to A/D, D/A conversion techniques, F/V and V/F conversion techniques, Digital voltmeter, ammeter, wattmeter, errors in digital meters.	5 Hrs
Unit 6	**Generalized Instrumentation System:** Characteristics of measurement and Instrumentation system. Transducers: Definition, classification, Specification, selection, loading effect, Displacement, velocity transducers, Resistive, inductive, Capacitive, strain gauge transducers, Piezoelectric, current and voltage transducers.	5 Hrs

Text-Books:

1. A.K. Sawhney, Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai & Co (P) Ltd.
2. R.K. Rajput, Electrical & Electronic Measurement and Instrumentation, S. Chand Publishing.
3. D. V. S. Murthy, Transducers and Instrumentation, New Delhi Prentice Hall of India.

4. Ernest O. Doebelin, Measurement Systems: Application and Design, Tata McGraw-Hill.
5. David A. Bell, Electronic Instrumentation & Measurements, Oxford University.

Reference Books:

1. E.W.Golding & F.C.Widdis, Electrical Measurements & Measuring Instruments, A.H.Wheeler & Co.
2. Albert D. Helfrick & William D. Cooper, Modern Electronic Instrumentation & Measurement Techniques, Prentice Hall of India.
3. Joseph. J. Carr, Elements of Electronic Instrumentation & Measurements, III edition, Pearson Education.
4. A.J. Bouwens, Digital Instrumentation, McGraw Hill Publications.

E-Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108105064
3. https://egyankosh.ac.in/
4. https://swayam.gov.in/

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4EE213PC1.1	3	2	2	1	2	1	-	-	-	-	1	2	2	-
4EE213PC1.2	3	2	2	2	2	1	-	-	-	-	-	2	2	-
4EE213PC1.3	3	2	2	2	2	1	-	-	-	-	1	2	1	-
4EE213PC1.4	2	3	3	2	2	1	-	-	-	-	1	1	1	-
4EE213PC1.5	2	3	2	2	3	1	-	-	-	-	-	-	2	1
4EE213PC1.6	2	3	3	2	3	2	-	-	-	-	-	1	1	1
4EE213PC1CO	3	2	2	2	2	1	-	-	-	-	1	2	2	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**4EE214PC1**		Course Category:	**PCC**
Course Name	**Power Systems - I**				
Credits	**02**	Total L:T:P etc. Hours	2:0:0 **30 Hrs**	Total SL Hours	**30 Hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 4EE214PC1 Power Systems - I is a compulsory Program Core Course for Second Year B.Tech. Electrical Engineering.

Course Objectives:

The objective of this course is to build fundamental knowledge of power system structure, transmission line modelling, and line design, while developing analytical skills essential for reliable power transfer in modern networks.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4EE214PC1.1	Examine the structure and standards of modern power systems to explain the role of smart grids and microgrids.	C-3
4EE214PC1.2	Analyse transmission line inductance and capacitance to evaluate effects of conductor configuration and earth return.	C-3, C-5
4EE214PC1.3	Determine ABCD constants and assess voltage regulation, efficiency, and SIL to evaluate transmission line performance.	C-3
4EE214PC1.4	Apply sag–tension, loading, corona, and insulator concepts to ensure reliable and safe overhead line design.	C-3
4EE214PC1.5	Explain construction, insulation, and dielectric stress for analysing performance and suitability of different underground cable types.	C-4
4EE214PC1.6	Use per-unit representation and Y-Bus formation to analyse distribution networks and basic load-flow behaviour.	C-3

Course Contents:

Unit 1	**Introduction to Power Systems Restructuring:** Structure of modern power systems, Generation–Transmission–Distribution overview, Electrical supply standards (voltage levels,	3 Hrs

	frequency in Indian grid), Introduction to Smart Grids and Micro-grids.	
Unit 2	**Transmission Line Parameters:** Derivation for Inductance of single-phase & three-phase lines, Concept of GMR, GMD, transposition of lines, Skin effect, Proximity effect, Bundled conductors and its advantages, Derivation for Capacitance of single-phase & three-phase lines, Effect of earth return on line inductance & capacitance	7 Hrs
Unit 3	**Transmission Line Performance:** Classification of short, medium (nominal T and nominal) and long lines, Determination of ABCD constants & their applications, Voltage regulation & transmission efficiency, Ferranti effect, Surge impedance & surge impedance loading (SIL)	5 Hrs
Unit 4	**Mechanical Design of Overhead Transmission Lines:** Line supports, conductor types, Sag & tension calculations, Effect of wind and ice loading, Corona: critical voltages, power loss, factors affecting corona, Insulators: types, string efficiency, Methods to improve string efficiency.	5 Hrs
Unit 5	**Underground Cables:** Types of cables: single-core, three-core, Cable construction & insulation materials, Capacitance of cables, dielectric stress & grading, Overhead vs. underground comparison	4 Hrs.
Unit 6	**Per Unit System, Distribution systems and load flow Analysis:** Introduction & advantages of per unit systems, Representation of power system elements, PU conversion of impedances and single line impedance diagram. Types of distribution systems, comparison, Feeders and distributors, DC and AC distribution, Introduction to load flow studies, Y_{Bus} formation.	6 Hrs

Text Books:

1. V. K. Mehta, Rohit Mehta, Principles of Power System, First Multicolour edition S. Chand Publication (Reprint 2015).
2. Ashfaq Hussain, Electric Power System, 5th edition, CBS Publication.
3. I. J. Nagrath and D. P. Kothari, Modern Power System Analysis, 3rd edition, Tata McGraw Hill.

Reference Books:

1. W. D. Stevenson, Elements of Power System Analysis, 4th edition, MGH Publication.
2. C. L Wadhwa, Electrical Power system, 3rd edition, New Age International Publication.

E-Resources:

1. https://nptel.ac.in/courses/108102047
2. https://nptel.ac.in/courses/117105140

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4EE214PC1.1	3	2	1	-	-	-	-	1	-	-	-	3	-	2
4EE214PC1.2	3	3	2	1	-	-	-	-	-	-	1	3	1	1
4EE214PC1.3	3	3	2	2	3	-	-	-	-	-	-	3	1	1
4EE214PC1.4	3	2	3	2	2	-	-	1	-	-	-	3	1	1
4EE214PC1.5	3	2	2	1	1	-	-	-	-	-	-	3	-	1
4EE214PC1.6	3	3	2	2	-	-	-	1	-	-	1	3	1	2
4EE214PC1CO	3	3	2	2	1	-	-	1	-	-	1	3	1	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**4EE215MD2**		Course Category:	**MDM**
Course Name	**Renewable Energy Systems**				
Credits	**02**	Total L: T:P etc. Hours	2:0:0 **30Hrs**	Total SL Hours	**30 Hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	**30**	SEE Time	**02 Hrs**	CIA Marks	**20**
EE Marks	**--**	PA Marks	**--**	Total Marks	**50**

Course Description:

Subject Code 4EE215MD2 Renewable Energy Systems is a compulsory Multidisciplinary Minor Course offered by the department of Electrical Engineering for other Second Year B. Tech, major disciplines.

Course Objectives:

The objective of this course is to introduce primary renewable energy sources and develop analytical skills to assess their performance and grid integration.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4EE215MD2.1	Classify energy sources and analyze global energy trends to understand the need for renewable energy and sustainable development.	C-4
4EE215MD2.2	Explain the working and components of geothermal and tidal power plants to evaluate their feasibility and applications.	C-3
4EE215MD2.3	Explain the working principles, components, types and policies of hydrogen fuel, solar, and wind power systems to evaluate their role in sustainable and clean power generation.	C-4

Course Contents:

Unit 1	**Energy Fundamentals and Renewable Energy in India:** Energy Classification: Primary, Secondary, Commercial, Non-Commercial, Conventional, Non-Conventional energy Sources, Early Initiatives and Foundations, Policy and Development in the field of renewable energy. Global Energy Scenario: Overview of global primary energy reserves, Consumption trends, Necessity for a shift towards renewable sources.	06 Hrs

Unit 2	**Geothermal power plant**: Layout of Geothermal Power Plant, Working Principle, Types of Geothermal Power Plants, Components and Their Functions, Site Selection Criteria, Advantages and dis-advantages of Geothermal Power Plant, Applications and Examples of Geothermal Power Plants. **Tidal Power Plant:** Layout of Tidal Power Plant, Working Principle, Types of Tidal Power Plants, Site Selection Criteria, Advantages of Tidal Power Plant, Disadvantages of Tidal Power Plant, Applications, Examples of Tidal Power Plants.	10 Hrs
Unit 3	**Hydrogen Fuel Power Generation Plant:** Layout of Hydrogen Fuel Power Plant, Working Principle, Types of Hydrogen Power Generation Systems, Components and Their Functions, Hydrogen Production Methods, Advantages of Hydrogen Power Plant, Applications and examples of Hydrogen Fuel Power Generation Plant. **Solar Energy:** Solar cell and its types, Solar cell to module — series and parallel connections, Module to array — configuration and sizing , Principle of solar energy conversion into heat, Types of solar collectors, Solar energy policies and incentives in India (MNRE) **Wind Energy:** Wind Energy Conversion Principle, Wind Turbine Types and Components, Site Selection and Wind Farm Design. Wind energy policies and incentives in India (MNRE)	14 Hrs

Text Books:

1. D.P. Kothari, K. C. Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, Delhi PHI Learning.
2. V. V. N. Kishore, Renewable Energy Engineering and Technology, Khanna Publishers.
3. G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers.

Reference Books:

1. L. L. Freris, David Infield, Renewable Energy Integration (Challenges and Solutions), Springer.
2. Mukund R. Patel, Wind and Solar Power Systems (Design, Analysis, and Operation), CRC Press.
3. M. Kathiresh (Editor), et al, Integration of Renewable Energy Sources with Smart Grid (Smart Grid technologies, Energy Storage Systems), Wiley.

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc25_ee79/preview
2. https://onlinecourses.nptel.ac.in/noc22_ee18/preview

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
4EE215MD2.1	3	2	1	-	1	2	2	-	-	-	1	2	1	2
4EE215MD2.2	3	2	1	-	3	2	3	2	-	-	1	2	1	2
4EE215MD2.3	3	3	2	-	3	3	3	2	-	1	1	2	1	2
4EE215MD2CO	3	2	2	-	2	2	2	1	-	1	1	2	1	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	**5**	Course Code:	**4SH216OE1**	Course Category:	**OE**
Course Name	**Quantitative and Logical Reasoning**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 4SH216OE1Quantitative and Logical Reasoning is a compulsory Open Elective Course for Second Year B. Tech All Branch Students.

Course Objectives:

The Objective of the Course is to develop quantitative aptitude, logical reasoning, problem-solving efficiency, and decision-making skills for placements, competitive exams, and real-life applications

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4SH216OE1.1	Apply arithmetic and numerical techniques to solve quantitative problems accurately.	C-3
4SH216OE1.2	Solve algebraic and equation-based problems using simplification and approximation methods to improve problem-solving efficiency.	C-3
4SH216OE1.3	Analyze logical reasoning problems using structured and critical thinking approaches to improve decision-making skills.	C-4
4SH216OE1.4	Interpret and analyze data using graphical and tabular methods for decision making for strategic planning.	C-4
4SH216OE1.5	Solve complex logical puzzles and advanced reasoning problems efficiently for competitive examination success.	C-3
4SH216OE1.6	Demonstrate effective aptitude test strategies integrating quantitative and logical reasoning skills for career advancement opportunities.	C-3

Course Contents:

Unit 1	**Number System & Arithmetic Foundations:** Number system fundamentals; LCM and HCF applications; divisibility rules; percentage calculations; ratio and proportion; averages; profit and loss; simple and compound interest; speed mathematics and shortcut techniques.	7Hrs
Unit 2	**Algebra, Equations & Simplification Techniques:** Linear and quadratic equations; algebraic expressions; simplification and approximation; indices and surds; inequalities; time and work; pipes and cisterns; time, speed and distance; mixtures and alligation.	7 Hrs
Unit 3	**Logical Reasoning: Analytical & Critical Thinking:** Coding–decoding; blood relations; direction sense; series and pattern recognition; analogies; ranking and ordering; syllogisms; statement and assumption; statement and conclusion; cause–effect reasoning.	7 Hrs
Unit 4	**Data Interpretation & Analytical Aptitude:** Tables; pie charts; line graphs; bar graphs; caselets; data sufficiency; DI shortcut techniques; approximation in data interpretation; comparative and predictive data analysis.	8Hrs
Unit 5	**Advanced Logical Reasoning & Puzzle Solving:** Seating arrangements (linear, circular, and complex); floor-based puzzles; scheduling puzzles; selection-based puzzles; Venn diagrams; logical grouping; critical reasoning frameworks	8 Hrs
Unit 6	**Placement Aptitude Mastery & Test Strategies:** Integrated quantitative and logical reasoning practice; decision-making and elimination strategies; speed improvement techniques; mock placement aptitude patterns (TCS, Infosys, Wipro, Accenture, Capgemini); common error analysis; test-taking strategies; aptitude and reasoning simulations.	8 Hrs

Text Books:

1. R. S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publishing
2. Arun Sharma, Logical Reasoning and Data Interpretation, McGraw Hill

Reference Books:

1. Arun Sharma, How to Prepare for Quantitative Aptitude, published by McGraw Hill Education.
2. R.S. Aggarwal, A Modern Approach to Logical Reasoning, published by S. Chand Publishing
3. M.K. Pandey, Analytical Reasoning, published by BSC Publishing Co. Pvt. Ltd.

4. Rajesh Verma, Fast Track Objective Arithmetic, published by Arihant Publications

E Resources:

1. NPTEL – Quantitative Aptitude & Logical Reasoning Courses
2. IndiaBIX – Quantitative and Logical Reasoning Practice
3. CareerRide – Aptitude Preparation Modules
4. PrepInsta / HackerEarth – Placement Aptitude Practice Platforms

Mapping of COs with POs & PSO

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
4SH216OE1.1	3	3	2	–	–	–	–	–	–	–	–			
4SH216OE1.2	3	3	2	–	–	–	–	–	–	–	–			
4SH216OE1.3	–	3	3	–	–	–	–	–	–	–	–			
4SH216OE1.4	–	3	2	–	–	–	–	–	–	–	–			
4SH216OE1.5	–	3	3	–	–	–	–	–	–	–	–			
4SH216OE1.6	–	3	2	–	–	–	–	–	–	2	3			
4SH216OE1 CO	1	3	3	–	–	–	–	–	–	1	1			

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	**5**	Course Code:	**4SH216OE2**	Course Category:	**OE**
Course Name	**Critical Thinking & Decision Making**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 4SH216OE2 Critical Thinking & Decision Making is a compulsory Open Elective Course for Second Year B. Tech All Branch Students.

Course Objectives:

The objective of this course is to develop critical thinking and decision-making competencies by strengthening analytical reasoning and structured problem-solving skills applicable to professional and real-world situations.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4SH216OE2.1	Apply critical thinking frameworks to analyze problems systematically.	C-3
4SH216OE2.2	Evaluate information, assumptions, and arguments for logical consistency and validity.	C-5
4SH216OE2.3	Analyze complex situations and identify feasible alternatives for decision making.	C-4
4SH216OE2.4	Design rational and ethical decision-making strategies under uncertainty to ensure sustainable organizational outcomes.	C-6 A-3
4SH216OE2.5	Apply quantitative and qualitative tools to support decision-making processes.	C-3
4SH216OE2.6	Demonstrate effective decision making in simulated professional and team-based scenarios to resolve workplace challenges effectively	C-3 P-3 A-3

Course Contents:

Unit 1	**Foundations of Critical Thinking:** Concept of critical thinking; elements of reasoning; logical vs illogical thinking; assumptions and inferences; inductive and deductive reasoning; common cognitive biases; barriers to critical thinking.	7 Hrs

Unit 2	**Analytical Reasoning & Problem Framing:** Problem identification and structuring; root cause analysis; issue trees; questioning techniques; systems thinking; analytical reasoning models.	7 Hrs
Unit 3	**Decision Making Models & Techniques:** Rational decision-making model; intuitive decision making; bounded rationality; decision trees; cost–benefit analysis; risk and uncertainty; heuristics.	7 Hrs
Unit 4	**Data-Driven & Ethical Decision Making:** Use of data in decision making; qualitative vs. quantitative data; basic decision matrices; ethical frameworks; professional ethics; social and environmental considerations in decisions.	8 Hrs
Unit 5	**Creativity, Innovation & Strategic Thinking:** Creative thinking techniques; lateral thinking; design thinking approach; scenario planning; strategic decision making; innovation in problem solving.	8 Hrs
Unit 6	**Applied Decision Making & Case Analysis:** Case studies from industry and management; individual and group decision simulations; conflict resolution through decision frameworks; decision-making under pressure; reflection and feedback	8 Hrs

Text Books:

1. Alec Fisher, Critical Thinking, published by Cambridge University Press.
2. John Adair, Decision Making and Problem Solving, published by Kogan Page.

Reference Books:

1. Daniel Kahneman, Thinking, Fast and Slow published by Farrar, Straus and Giroux.
2. Rolf Dobelli, The Art of Thinking Clearly, published by Sceptre.
3. John S. Hammond, Ralph L. Keeney, Howard Raiffa, Smart Choices, published by Harvard Business School Press.
4. Ken Watanabe, Problem Solving 101, published by Portfolio.

E Resources:

1. NPTEL – Critical Thinking & Decision Making Courses
2. Coursera – Critical Thinking and Decision-Making Modules
3. Harvard Business Review – Decision Making Articles
4. MIT Open CourseWare – Decision Analysis

Mapping of COs with POs & PSO

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
4SH216OE2.1	2	3	2	–	–	–	–	–	–	–	–	2	1	2
4SH216OE2.2	–	3	3	–	–	–	–	–	–	–	–	–	1	3
4SH216OE2.3	–	3	2	–	–	–	–	–	–	–	–	–	1	2
4SH216OE2.4	–	3	3	–	–	2	3	–	–	–	–	–	1	3
4SH216OE2.5	–	2	2	–	2	–	–	–	–	–	–	–	1	2
4SH216OE2.6	–	2	2	–	–	2	–	2	2	–	2	–	2	2
4SH216OE2. CO	1	3	3	-	1	1	1	1	1	-	1	1	1	3

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**4EE217PC1**		Course Category:	**PCC**
Course Name	**Electrical Measurement & Instrumentation Lab**				
Credits	**01**	Total L:T:P etc. Hours	0:0:2 **30 Hrs**	Total SL Hours: 00	--
Total Credit Hours	**30 Hrs**				
SEE Marks	--	SEE Time	--	CIA Marks	--
EE Marks	**25**	PA Marks	**25**	Total Marks	**50**

Course Description:

Subject Code 4EE217PC1 Electrical Measurement & Instrumentation Lab is a Program Core Course for Second Year B. Tech Electrical Engineering.

Course Objectives:

The objective of this course is to enable learners to provide hands-on experience in measuring electrical quantities using various instruments and transducers and to develop practical skills in calibration, testing, and analysis of measurement systems for accurate and reliable results.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4EE217PC1.1	Demonstrate the working principles and characteristics of various electrical measuring instruments and transducers used for measurement of electrical and physical quantities.	C-3, P-5
4EE217PC1.2	Perform accurate measurement of resistance, inductance, power, energy, pressure, force, displacement, and speed using appropriate bridges and electronic instruments.	C-4
4EE217PC1.3	Analyze experimental data, identify possible sources of error, and interpret measurement results to ensure reliability and precision in practical applications.	C-3, P-4, A-2

List of Practicals:

Minimum eight practicals from the list mentioned below.

1. Determine the value of unknown resistance using Post box office trainer.
2. Determine the value of unknown resistance using Kelvin bridge.
3. Identify the unknown inductance using Maxwell bridge.
4. Determine the value of unknown inductance using Hay's bridge.
5. Measurement of force by using Strain guage.
6. Measurement of high insulation resistance by using Megger.
7. Measurement of a pressure using pressure transducer.

8. Measurement of linear displacement using LVDT.
9. Measurement of Speed using Digital Tachometer.
10. Measurement of Energy using Single-phase Energy Meter
11. Measurement of Power using Wattmeter (2-wattmeter method).

E-Resources:

1. https://elms-iitr.vlabs.ac.in/exp/measuring-instruments/
2. https://elms-iitr.vlabs.ac.in/exp/wheatstone-bridge/
3. https://elms-iitr.vlabs.ac.in/exp/kelvin-sdouble-bridge/
4. https://elms-iitr.vlabs.ac.in/exp/schering-bridge/
5. https://elms-iitr.vlabs.ac.in/exp/three-phase-power/
6. https://elms-iitr.vlabs.ac.in/exp/maxwells-bridge/
7. https://elms-iitr.vlabs.ac.in/exp/energy-meter/

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
4EE217PC1.1	3	2	1	1	1	1	1	1	-	-	-	2	2	-
4EE217PC1.2	3	2	2	3	2	1	1	1	-	-	-	1	2	-
4EE217PC1.3	2	3	2	3	1	1	1	-	-	-	-	1	2	-
4EE217PC1CO	3	2	2	3	1	1	1	1	-	-	-	2	2	-

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	**5.0**	Course Code:	**4EE218PC1**		Course Category:	**PCC**
Course Name		**Power Systems – I Lab**				
Credits		**01**	Total L:T:P etc. Hours	0:0:2 **30Hrs**	Total SL Hours	--
Total Credit Hours		**30Hrs**				
SEE Marks		--	SEE Time	--	CIA Marks	--
EE Marks		**25**	PA Marks	**25**	Total Marks	**50**

Course Description:

Subject Code 4EE218PC1 Power Systems – I Lab is a compulsory Program Core Course for Second Year B.Tech. Electrical Engineering.

Course Objectives:

The objective of this course is to develop students' ability to design, simulate, and analyze transmission and distribution system components using laboratory hardware and utility software tools for understanding real-world power system operation and performance.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4EE218PC1.1	Analyse short and medium transmission line performance using ABCD parameters and Ferranti effect to understand power transfer behaviour.	P-4, A-2
4EE218PC1.2	Simulate insulators, overhead lines, and cables using utility software to compare characteristics and suitability under varying operating conditions.	P-5, P-7
4EE218PC1.3	Interpret distribution configurations and load flow results using software to understand system behaviour and enhance network operational efficiency.	P-7

List of Practicals:

Minimum eight practicals from the list mentioned below.

1. Design and Analyse the performance of short Transmission Line using transmission line kit
2. Design and Examine ABCD parameters of the "Pi" model Medium Transmission Line using transmission line kit
3. Design and Analyse the performance of "T" model Medium Transmission Line using transmission line kit

4. Analysis and verification of the Ferranti Effect of Transmission Line using transmission line kit
5. Evaluate the efficiency of the string of insulators with and without using guard ring
6. Create a single line diagram of a power system using utility software and study its application in power system analysis.
7. Simulate different types of insulators (eg; pin, suspension and strain) using utility software
8. Simulate the performance of ring, radial and interconnected distribution systems using utility software.
9. Compare performance of overhead lines and underground cables using utility software
10. Perform load flow analysis using utility software.

E-Resources:

1. https://vp-dei.vlabs.ac.in/Dreamweaver/
2. https://nitsri.ac.in/Department/DisplayDeptPage.aspx?page=magsm&ItemID=kagem&nDeptID=g
3. https://etap.com/demo-download

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
4EE218PC1.1	1	2	-	1	2	1	-	2	2	1	1	3	2	1
4EE218PC1.2	2	2	1	1	3	1	-	2	2	-	1	2	2	1
4EE218PC1.3	1	2	-	1	3	-	-	2	2	1	1	2	2	1
4EE218PC1CO	2	2	2	3	3	-	-	2	2	-	1	2	2	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:		**4EE219VS1**	Course Category:	**VSC**
Course Name	**Electrical CAD**				
Credits	**02**	Total L:T:P etc. Hours	0:0:4 **60 Hrs**	Total SL Hours	**--**
Total Credit Hours	**60 Hrs**				
SEE Marks	**--**	SEE Time	**--**	CIA Marks	**--**
EE Marks	**--**	PA Marks	**50**	Total Marks	**50**

Course Description:

Subject Code 4EE219VS1 Electrical CAD is a Value-Added Skill Course for Second Year B.Tech Electrical Engineering students.

Course Objectives:

The objective of this course is to master the AutoCAD Electrical interface and Project Manager for organizing multi-sheet drawings.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4EE219VS1.1	Apply project management principles and file standards to initialize and organize multi-sheet electrical design projects.	C-3, P-3
4EE219VS1.2	Design professional electrical schematics and panel layouts using modern CAD automation tools and industry symbol libraries.	C-5, P-4
4EE219VS1.3	Generate and verify fabrication documentation (BOM, Wire Lists) adhering to professional ethics and engineering standards.	C-4, A-3

List of Practicals:

Minimum ten practicals from the list mentioned below.

1. Apply basic CAD settings using coordinates, limits, layers, and simple modify tools.
2. Implement standard electrical symbols using approved CAD libraries.
3. Analyze and arrange the wiring layout for a 1 BHK unit, showing load points and earthing.
4. Design the SLD and power layout for a 2 BHK residential unit.
5. Apply drawing standards to show pipe and plate earthing cross-sections.
6. Analyze and organize the layout of a distribution board with MCBs, RCDs, and busbars.
7. Analyze and prepare the LT power distribution SLD for a small workshop.
8. Organize and prepare the power and control circuits for a DOL starter.

9. Design the power and control circuits for a timer-based or manual Star–Delta starter.
10. Apply planning to prepare the floor layout of an Electrical Machine Laboratory with panels and cable routing.
11. Analyze and develop routing, trench sections, and joint box details for an underground cable system.
12. Develop the SLD for an 11 kV / 33 kV substation showing transformer and switchgear.

Text-Books:

1. Prof. Sham Tickoo, AutoCAD Electrical 2024 for Electrical Control Designers, CADCIM Technologies.
2. Gaurav Verma, Matt Weber, AutoCAD Electrical 2024 Black Book, CADCAMCAE Works.
3. AutoCAD Electrical Essentials Training Guide, ASCENT Center for Technical Knowledge.

Reference Books:

1. NFPA 79: Electrical Standard for Industrial Machinery.
2. IEC 60617: Graphical Symbols for Diagrams, International Electrotechnical Commission.
3. Shawna Lockhart, Tutorial Guide to AutoCAD 2024, SDC Publications.
4. K.C. Agrawal, Industrial Power Engineering and Applications Handbook, Elsevier.

E-Resources:

1. https://knowledge.autodesk.com/
2. https://academy.autodesk.com/
3. https://www.linkedin.com/learning/topics/autocad-electrical
4. https://knowledge.autodesk.com/
5. https://nptel.ac.in/courses/108105053
6. https://www.electrical-technology.com/

Mapping of COs with POs& PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4EE219VS1.1	3	-	-	-	3	-	-	-	-	-	-	3	2	1
4EE219VS1.2	3	2	3	-	3	2	-	2	-	-	-	3	3	1
4EE219VS1.3	3	2	3	-	3	-	-	2	-	3	-	2	3	1
4EE219VS1CO	3	2	3	-	3	2	-	2	-	3	-	3	3	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code:	**4SH220AE1**	Course Category:	**AEC**
Course Name	**Technical Writing**			
Credits	**02**	Total L:T:P Hours	1:0:2 **45 Hrs**	Total SL Hours **15 Hrs**
Total Credit Hours	**60 Hrs**			
SEE Marks	--	SEE Time	--	CIA Marks --
EE Marks	--	PA Marks	**50**	Total Marks **50**

Course Description:

Subject Code 4SH220AE1 Technical Writing is common Ability Enhancement Course for Second Year B. Tech.

Course Objectives:

The objective of the course is to enhance students' ability to write effective technical documents, professional correspondence, and research-oriented content with clarity, accuracy, and ethical standards.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4SH220AE1.1	Apply principles of technical writing in engineering documents.	C-3 P-2 A-2
4SH220AE1.2	Apply technical writing skills to prepare professional documents.	C-4 P-2 A-2
4SH220AE1.3	Create ethical, well-structured technical and research documents using IEEE referencing for professional and academic communication.	C-3 P-3 A-3

Course Contents:

Unit 1	**Fundamentals of Technical Writing:** Nature and importance of technical communication, characteristics of technical writing, audience analysis, technical vocabulary, grammar and style, clarity and conciseness, paragraph structure, coherence, technical descriptions, instructions and manuals.	7 Hrs
Unit 2	**Professional and Research Writing:** Technical reports and documentation, structure of reports, abstracts and summaries, research papers, project proposals, resumes and cover letters, business emails, documentation ethics, plagiarism, referencing styles (IEEE), editing and proofreading.	8 Hrs

List of Practicals:

Minimum eight practicals from the list mentioned below.

1. Analysis of Technical Communication to Identify the nature, purpose of given technical documents and evaluate their effectiveness.
2. Editing technical text for clarity and brevity
3. Technical description of an engineering device/system
4. Writing step-by-step technical instructions
5. Preparation of structured technical reports
6. Resume and cover letter drafting
7. Technical report writing based on laboratory work, case study, or project work
8. Abstract and executive summary writing for technical documents
9. Referencing and citation using IEEE format
10. Editing, proofreading, and plagiarism check of technical documents

Text Books:

1. Rizvi A. M. & Patnaik P., Effective Technical Communication, McGraw Hill Education (India), New Delhi (Second Edition).
2. Verma S., Technical Communication for Engineers, Vikas Publishing House Pvt. Ltd., New Delhi (First Edition).
3. Misra P. & Tyagi K., Advanced Technical Communication, PHI Learning Pvt. Ltd., New Delhi (Second Edition).

Reference Books:

1. Chauhan G. S., Kashiramka S. & Thimmesha L., Technical Communication, Cengage Learning India Pvt. Ltd., New Delhi (First Edition).
2. Alred G. J., Brusaw C. T. & Oliu B., Handbook of Technical Communication, Oxford University Press, New Delhi (Second Edition).
3. IEEE Editorial Style Manual, IEEE Standards Association, IEEE, USA (Latest Edition).
4. Joseph G. & Joseph B., Grammar and Usage for Technical Communication, Cambridge University Press India, Delhi (First Edition).

E-Resources :

1. NPTEL–SWAYAM, IIT Roorkee, Technical Communication for Engineers.
2. https://owl.purdue.edu
3. https://ieeeauthorcenter.ieee.org

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4SH220AE1.1	-	-	-	-	-	-	-	-		3	-	1	1	1
4SH220AE1.2	-	-	-	-	-	-	-	-	3	3	-	2	-	2
4SH220AE1.3	-	-	-	-	-	-	-	3		3	3	-	-	2
4SH220AE1 CO	-	-	-	-	-	-	-	1	1	3	1	1	1	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code:	4SH221EM1	Course Category:	**EEM**
Course Name	**Fundamentals of Book Keeping and Accounting**			
Credits	**02**	Total L:T:P Hours	1:0:2 **45 Hrs**	Total SL Hours **15 Hrs**
Total Credit Hours	**60 Hrs**			
SEE Marks	--	SEE Time	--	CIA Marks --
EE Marks	--	PA Marks	**50**	Total Marks **50**

Course Description:

Subject Code 4SH221EM1 Fundamentals of Book Keeping and Accounting is an Ability Enhancement Course for Second Year B. Tech students that introduce basic accounting principles, bookkeeping processes, and financial statements for business applications.

Course Objectives:

The objective of the course is to develop students' skills in recording and analyzing financial transactions and to enable effective use of accounting information for decision-making.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4SH221EM1.1	Apply basic principles of bookkeeping and accounting for recording and maintaining financial transactions accurately.	C-3 P-2 A-2
4SH221EM1.2	Analyze financial statements such as income statement, balance sheet, and cash flow statement for supporting financial understanding and business decision-making.	C-4 P-2 A-2
4SH221EM1.3	Apply accounting tools and techniques for evaluating financial performance and improving business efficiency.	C-3 P-3 A-3

Course Contents:

Unit 1	**Foundation of Book keeping and Accounting** Definition, objectives, and importance of accounting, Difference between accounting and bookkeeping, accounting equation, double entry system, Debit vs credit, accrual vs cash accounting, Terminology- depreciation, armotisation, CapEx vs OpEx.	8 Hrs

	Source of Document (invoice, receipt, Purchase Order), Work Flow (Journal, posting to the ledger), Preparing trial balance, Software Integration- A brief overview of ERP (SAP/ oracle and tools like a tally/ quick book).	
Unit 2	**Financial Statements & Decision Making** Income Statement, Balance Sheet, Cash flow Statement. Ratio Analysis (Current Ratio, Debt to equity, ROI), Cost Accounting (Fixed vs Variable, Break-even), Taxation Basics (Corporate IT)	7 Hrs

List of Practicals:

Minimum eight practicals from the list mentioned below.

1. Categories a list of items (Laptop, Office Rent Deposit, Cash, Bank Loan, Software Licenses) into Assets, Liabilities, or Equity.
2. Use the Double-Entry System to record buying raw materials, paying technician wages, and receiving a client advance.
3. Identify discrepancies like uncashed cheques, bank charges, or direct deposits from clients.
4. Compare the Straight-Line Method vs. the Written Down Value (WDV) method (as per Indian Income Tax rules).
5. Distinguish between Direct Costs (raw materials, factory power) and Indirect Costs (office salary, marketing).
6. Analyze the Annual Report of an Indian tech giant (e.g., L&T or Tata Motors).
7. Calculate the Current Ratio (liquidity), Debt-to-Equity (solvency), and Return on Investment (ROI).
8. Input Fixed Costs (Rent, Machinery) and Variable Costs (Material per unit) into a spreadsheet to find the Break-Even Point.
9. Value the remaining stock after several purchases and sales using the First-In, First-Out (FIFO) method.
10. Enter 5 basic transactions into a trial version of Tally Prime or a cloud-based tool like Zoho Books.

Text Books:

1. S.N. Maheshwari S.K. Maheshwari & S.K. Maheshwari., Financial Accounting, Vikas Publishing House (Eleventh Edition)
2. N. Ramachandran, Ramkumar Kakani., Financial Accounting for Management, McGraw Hill Education (Sixth Edition)

Reference Books:

1. R. L. Gupta & U. K. Gupta., Financial Accounting, Sultan Chand & Sons, (Ninth revised Edition)
2. Dr. Santanu Chakrabarty & Dr. Nilanjan Singha Roy., Accounting & Finance for engineering, Lawpoint Publications (Second Edition)
3. Bhushan Kumar Goyal., Accounting for Everyone, Taxmann Publications Pvt. Ltd (First Edition)

E-Resources:

1. SWAYAM, Financial Accounting / Business Accounting
2. National Digital Library of India, https://ndl.iitkgp.ac.in
3. Tally Education, https://tallyeducation.com

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4SH221EM1.1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
4SH221EM1.2	3	3	-	-	-	-	-	-	-	3	-	-	-	-
4SH221EM1.3	2	3	-	-	3	-	-	-	-	3	-	-	-	-

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code:	**4CE222VE1**		Course Category:	**VEC**
Course Name	**Environmental Science**				
Credits	**02**	Total L:T:P Hours	2:0:0 **30 Hrs**	Total SL Hours	**30 Hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	**30**	SEE Time	**2 Hrs**	CIA Marks	**20**
EE Marks	**--**	PA Marks	**--**	Total Marks	**50**

Course Description:

Subject Code 4CE222VE1 Environmental Science is a Value Education course for Second Year B. Tech Civil Engineering.

Course Objectives:

The objective of this course is to develop understanding of environmental systems, natural resource management, ecological balance, and sustainable development practices to promote awareness and responsibility toward environmental protection and societal well-being.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4CE222VE1.1	Analyze renewable and non-renewable natural resources and associated problems to promote sustainable utilization for future generations.	C-4
4CE222VE1.2	Analyze food chains, webs, and ecological pyramids to evaluate ecological interactions and succession processes.	C-4
4CE222VE1.3	Examine shift from unsustainable to sustainable development to promote responsible resource planning for society.	C-3

Course Contents:

Unit 1	Renewable and non-renewable resources Environmental Science, Definition, scope and importance, Need for public awareness, Renewable and non-renewable resources, Natural resources and associated problems. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable life styles.	10 hrs
Unit 2	**Ecosystem:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the	10 hrs

	ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem.	
Unit 3	**Social Issues & Environment:** From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions, Environment Protection Act. Air (Prevention and Control of Pollution) Act., Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, public awareness.	10 hrs

Text Books:

1. Suresh K. Dhameja, Environmental Studies, Katson Books
2. Benny Joseph, Environmental Studies, McGraw Hill Education

Reference Books:

1. Gilbert M. Masters & Wendell Ela, Introduction to Environmental Engineering and Science, Pearson Education
2. William Cunningham & Mary Cunningham, Environmental Science, McGraw Hill

E Recourses:

1. https://www.vlab.co.in/broad-area-civil-engineering

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4CE222VE1.1	3	2	-	-	-	2	2	-	-	-	-	-	-	-
4CE222VE1.2	3	2	-	-	-	3	2	-	-	-	-	-	1	-
4CE222VE1.3	3	2	-	-	-	3	3	-	-	-	-	-	1	-
4CE222VE1.CO	3	2	-	-	-	3	3	-	-	-	-	-	1	-

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	**5.0**	Course Code:	**4EE223DH1**	Course Category:	**DH**
Course Name	**Microgrid Engineering**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45Hrs**	Total SL Hours:	**45Hrs**
Total Credit Hours	**90Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 4EE223DH1 Microgrid Engineering is a Double Minor / Honors offered by the department of Electrical Engineering for Second Year B. Tech, of all disciplines.

Course Objectives:

The objective of this course is to provide fundamental knowledge of microgrids and smart grids while developing skills to analyze their power converters, control methods, stability, protection, and operation.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4EE223DH2.1	Explain the fundamentals of conventional power systems and the need for transitioning to smart grid technologies to understand the limitations of existing grids and the motivation for modernization.	C-3
4EE223DH2.2	Describe the architecture, components, and key technologies used in smart grid systems to gain insight into their structure and functional operation.	C-4
4EE223DH2.3	Identify and compare communication technologies and standards used for smart grid data exchange and monitoring to ensure effective and reliable information flow within the grid.	C-3
4EE223DH2.4	Analyze the integration of distributed energy resources and microgrids within the smart grid framework to support efficient and sustainable energy utilization.	C-2
4EE223DH2.5	Apply basic concepts of demand-side management, demand response, and energy management in smart grid operation to improve energy efficiency and load management.	C-4

4EE223DH2.6	Discuss applications, cybersecurity concerns, and emerging trends in smart grid technologies at national and global levels to understand future challenges and advancements in power systems.	C-3

Course Contents:

Unit 1	**Fundamentals of Power Systems and Need for Smart Grid:** Structure of conventional power system (generation, transmission, distribution), Limitations of existing grid, Concept and definition of Smart Grid, Evolution of smart grid technologies, Key drivers for smart grid development.	7 Hrs
Unit 2	**Smart Grid Architecture and Components:** Smart grid architecture (NIST model – basic idea), Key components: smart meters, sensors, intelligent electronic devices (IEDs), Advanced Metering Infrastructure (AMI), Wide Area Measurement Systems (WAMS) and PMUs, Role of SCADA and automation.	7 Hrs
Unit 3	**Communication Technologies in Smart Grid:** Need for communication systems in smart grid, Communication technologies: wired and wireless (PLC, fiber optics, Wi-Fi, Zigbee, cellular), Network architecture and data flow, Interoperability and standards (overview), Challenges in communication systems.	7 Hrs
Unit 4	**Distributed Energy Resources and Integration:** Concept of Distributed Generation (DG), Renewable energy integration in smart grid, Role of microgrids, Net metering and grid interconnection, Impact on grid performance.	8 Hrs
Unit 5	**Smart Grid Operation and Management:** Demand Side Management (DSM) and Demand Response (DR), Fundamentals of Load forecasting, Energy management systems (EMS), Power quality and reliability improvement, Outage management systems	8 Hrs
Unit 6	**Applications, Cybersecurity and Future Trends:** Smart homes, smart cities, and electric vehicles, Cybersecurity issues in smart grid, Data analytics and role of AI/IoT (introductory), Smart grid policies and initiatives (India & global), Future trends and challenges	8 Hrs

Text Books:

1. Nikolaos Hatziargyriou, Microgrids: Architecture and Control, IEEE Press / Wiley.
2. James Momoh, Smart Grid: Fundamentals of Design and Analysis
3. Clark W. Gellings, The Smart Grid: Enabling Energy Efficiency and Demand Response
4. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Smart Grid: Technology and Applications, Wiley.

Reference Books:

1. Stuart Borlase, Smart Grids: Infrastructure, Technology, and Solutions, CRC Press.
2. Josep Guerrero, Control and Optimization of Microgrids, Springer.
3. Haitham Abu-Rub, Malinowski, Al-Haddad, Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications, Wiley.

E-Resources:

1. https://nptel.ac.in/courses/108105155
2. https://nptel.ac.in/courses/108104013
3. https://smartgrid.ieee.org
4. https://nsgm.gov.in

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4EE215MD2.1	3	2	1	1	2	-	-	-	-	-	1	3	2	1
4EE215MD2.2	3	3	1	1	3	-	-	-	-	-	1	3	3	1
4EE215MD2.3	3	3	3	1	3	-	-	-	-	-	1	2	3	-
4EE215MD2.4	3	2	1	1	2	-	-	-	-	-	1	3	2	1
4EE215MD2.5	3	2	2	1	3	-	-	-	-	-	1	2	3	1
4EE215MD2.6	3	3	3	1	3	-	-	-	-	-	1	2	3	-
4EE215MD2CO	3	3	2	1	3	-	-	-	-	-	1	3	3	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	**5.0**	Course Code:	**4EE223DH2**	Course Category:	**DH**
Course Name	**Automotive Engineering and Electric Vehicle Systems**				
Credits	**03**	Total L:T:P Hours	4:0:0 **60Hrs**	Total SL Hours	**60Hrs**
Total Credit Hours	**120 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:

Subject Code 4EE223DH2 Automotive Engineering and Electric Vehicle Systems is a Double Minor / Honors offered by the department of Electrical Engineering for Second Year B. Tech, of all disciplines.

Course Objectives:

This course provides students comprehensive knowledge of automotive systems and electric vehicle technologies, enabling students to understand, analyze, and evaluate vehicle mechanics, powertrains, subsystems, energy storage, and control systems for improved performance, efficiency, safety, and sustainable mobility.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
4EE223DH2.1	Explain the evolution, configuration, and structural aspects of automobiles, including body, chassis, and materials, to understand their influence on vehicle design, performance, safety, and durability.	C-3
4EE223DH2.2	Analyze automotive powertrains, suspension, steering, NVH, and various drive configurations (FWD, RWD, AWD, 4WD), to evaluate vehicle motion, ride comfort, and drivability characteristics.	C-3
4EE223DH2.3	Describe and compare transmission systems (MT, AT, AMT, CVT), including gear mechanisms, clutch operation, and power flow, to understand torque transmission, gear ratio selection, and efficiency optimization.	C-3
4EE223DH2.4	Evaluate automotive subsystems such as aerodynamics, braking, tyres, and instrumentation, to assess their impact on vehicle handling, stability, safety, and energy efficiency.	C-3

4EE223DH2.5	Explain the operation and control of electric machines (DC, IM, PMSM, BLDC) and auxiliary electrical systems, to understand electric propulsion and support systems in modern EVs.	C-4
4EE223DH2.6	Analyze battery technologies, charging systems, and automotive sensors (including MEMS), to understand energy management, safety, and intelligent monitoring in electric vehicles.	C-4

Course Contents:

Unit 1	**Vehicle Mechanics:** History of Vehicle Development, General Configuration of Automobile, Body and Chassis Fundamentals: General Packaging, Types of Structural System, Backbone Construction; Body and Chassis Materials. Automotive Powertrain, Mechanical Suspensions system, Steering System, NVH, Control System Integration and Implementation. Front-Wheel Drive (FWD) Powertrains, Rear-Wheel Drive Powertrains (RWD), Multi-Wheel Drive Powertrains (AWD and 4WD)	10 Hrs
Unit 2	**Transmission Systems:** Transmission gears, Manual Transmission (MT), Automatic Transmission (AT), Automated Manual Transmissions (AMT) and Continuously Variable Transmissions (CVT). Manual Transmissions Powertrain Layout and Manual Transmission Structure, Power Flows and Gear Ratios, Manual Transmission Clutch and its structure. Drivetrain and Differential	10 Hrs
Unit 3	**Automotive Subsystems:** Automotive Aero-dynamics, Vehicle Power Demand Analysis; Types of suspension and drive, Braking systems; Tyre Mechanics: Tyres and wheels, Tyre characteristics; Vehicle handling & stability; Automotive instrumentation	8 Hrs
Unit 4	**EV Motor Systems & Auxiliaries:** Electric Machines Used in EVs: DC motors, Induction motors (3-phase concept, torque production), Permanent Magnet Synchronous Motor (PMSM), Brushless DC (BLDC) motors, Torque-speed characteristics and efficiency curves. Motor Connections and Control Basics: Star and delta connections, Basic motor starting methods, Speed control concepts (voltage/frequency control basics). Auxiliary Electrical Systems in EVs:	12 Hrs

	Lighting systems (LED technology), HVAC (Heating, Ventilation, Air Conditioning), Power steering systems (electric assist), Wipers, infotainment, and low-voltage loads.	
Unit 5	**EV Energy Storage & Charging Systems:** Battery types (Lead-acid, Li-ion, Li-Po, solid-state), performance parameters, SoC and SoH. Series/parallel configuration, voltage & capacity scaling, thermal management, packaging and safety. AC (slow/fast) and DC fast charging, On-board chargers vs off-board chargers, standards and connectors. Power flow (grid–battery–motor), charging/discharging cycles, system efficiency losses.	10 Hrs
Unit 6	**Sensors:** Overview of Micro-Electro-Mechanical (MEM) devices and processes. Concepts of MEMs and equations in different domains (electrical-mechanical) Different types of Sensors viz. Pressure, position, temperature, speed, acceleration, ambient light, infrared sensor, gesture, touch screen sensors, etc.	10 Hrs

Text Books:

1. Gregory L. Plett, Battery Management Systems: Design, Artech House.
2. Mohammad Rezvanizaniani, Lithium-Ion Batteries and Battery Management Systems, Engineering Asset Management 2011: Proceedings of the Sixth World Congress
3. Mehrdad Ehsani, Electric and Hybrid Vehicles, CRC Press.

Reference Books:

1. Lithium-Ion Battery Systems, Elsevier
2. Advanced Battery Management Technologies, Springer
3. IEEE and SAE Battery Standards Documents

E-Resources:

1. https://nptel.ac.in/courses/108106170
2. https://batteryuniversity.com
3. https://ieee.org
4. https://sae.org

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4EE223DH2.1	2	2	1	1	1	1	1	-	-	-	-	-	-	1
4EE223DH2.2	1	1	2	2	1	1	1	-	-	-	-	-	-	-
4EE223DH2.3	1	1	2	2	1	1	-	-	-	-	-	-	-	-
4EE223DH2.4	1	1	2	2	1	1	1	-	-	-	-	-	1	-
4EE223DH2.5	1	1	2	2	1	1	-	-	-	-	-	-	1	1
4EE223DH2.6	1	1	2	2	1	1	1	-	-	-	-	-	1	1
4EE223DH1CO	1	1	2	2	1	1	1	-	-	-	-	-	1	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:	**5EE224EC1**	Course Category:	**EC**
Course Name	**Solar Panel Design and Implementation**			
Credits	**04**	Total L:T:P etc. Hours	2:0:4 **90 Hrs**	Total SL Hours **30 Hrs**
Total Credit Hours	**120 Hrs**			
SEE Marks	**30**	SEE Time	**2 Hrs**	CIA Marks **20**
EE Marks	**25**	PA Marks	**25**	Total Marks **100**

Course Description:

Subject Code 5EE224EC1 Solar Panel Design and Implementation is an optional Exit Course for second Year B.Tech. Electrical Engineering.

Course Objectives:

The objective of this course is to develop students with understanding of solar energy fundamentals and PV technology, and to analyze system components and perform design calculations for solar PV systems.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
5E2124EC1.1	Apply principles of solar energy conversion and PV effect to analyse photovoltaic operation.	C-3
5E2124EC1.2	Identify balance of System components to choose appropriate devices like batteries, charge controllers, and inverters and solar system sizing.	C-3
5E2124EC1.3	Analyse site assessment and feasibility to determine suitability for solar PV installation.	C-4

Course Contents:

Unit 1	**Fundamentals of Solar Energy & Photovoltaic Technologies:** Solar radiation: characteristics, spectrum, irradiance, insolation. Solar energy conversion principles. Solar photovoltaic (PV) effect and semiconductor basics. Types of solar cells: Mono-crystalline, Poly-crystalline, Thin-film. PV module construction, I–V and P–V characteristics. Factors affecting performance: temperature, shading, dust, tilt angle, orientation. Standards and ratings of PV modules.	10 Hrs

Unit 2	**Solar PV System Components & Design Calculations:** Classification of PV systems: Grid-tied, Off-grid, Hybrid systems. Balance of System (BoS): Charge controllers (MPPT & PWM), batteries (types, sizing, DoD, cycle life), inverters (types, efficiency, protections), mounting structures, wiring, connectors, safety devices. Solar system sizing: Load calculation and energy estimation, selection of PV modules, tilt angle, array sizing, battery sizing, inverter sizing, cable sizing, protection device selection. Introduction to PV design software (PV*SOL / PVsyst).	10 Hrs
Unit 3	**Installation, Implementation & Maintenance of Solar PV Systems:** Site assessment and feasibility study. Steps in installation of solar PV systems (mechanical and electrical). Earthing, surge protection, safety codes (IEC/IS standards). Commissioning procedures and checklist. Operation & Maintenance (O&M): monitoring, performance evaluation, troubleshooting faults, cleaning and preventive maintenance. Case studies: rooftop solar system, small off-grid system, solar street lighting.	10 Hrs

List of Practicals:

Minimum Ten Practical's from the list mentioned below.

1. Measurement of solar irradiance using a pyranometer or solar meter and observation of variations with time and tilt.
2. Determine mono-crystalline, poly-crystalline, and thin-film PV modules and comparison of their specifications.
3. Plot I–V and P–V curves under different irradiance and temperature conditions.
4. Measurement of PV module output for different tilt angles and orientations.
5. Perform inspection, fault identification, and minor repair/cleaning of washing machine or vacuum cleaner.
6. Demonstrate datasheets, module ratings, efficiency, temperature coefficients, and standards (IEC/IS).
7. Testing battery parameters (SoC, DoD, voltage, AH rating) and performing sizing calculations.
8. Demonstrate inverter specifications, wiring, protections, and efficiency measurements.
9. Calculation of daily energy consumption and designing a small PV system (module, battery, inverter sizing).
10. Practical calculation of cable size, fuse/MCB rating, earthing, and surge protection requirements.

11. Hands-on practice of mounting structure assembly, wiring, connections, and safety checks.
12. Monitoring system output, identifying faults (low generation, wiring issues, inverter faults), and suggesting corrective actions.

Textbooks:

1. N. D. Kaushika, Anuradha Mishra & Anil K. Rai, Solar Photovoltaics: Technology, System Design, Reliability and Viability, Springer.
2. L. Ashok Kumar & K. Mohana Sundaram S.L. Uppal, Solar PV System: Design, Installation, Operation and Maintenance, Electricity and Appliances, Khanna Publishers.

Reference Books:

1. S. P. Sukhatme & J. K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw-Hill Education.
2. Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI Learning Pvt. Ltd.
3. R. Gupta, Handbook of Electrical Installation Practice, Wiley India.
4. V. V. Kishore, Renewable Energy Engineering and Technology: A Knowledge Compendium, TERI (The Energy and Resources Institute).
5. M. P. Agrawal, Integrated Renewable Energy for Rural Development Allied Publishers.

E- Resources:

1. https://nptel.ac.in/courses/115/108/115108081/
2. https://nptel.ac.in/courses/108/104/108104114/
3. https://www.solarenergy.org/resources/
4. https://solarrooftop.gov.in/

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
5E2124EC1.1	3	3	2	2	-	-	2	-	-	-	-	1	3	2
5E2124EC1.2	3	2	3	-	2	-	-	-	-	-	2	1	2	2
5E2124EC1.3	2	3	2	1	2	1	2	-	1	-	1	-	3	2
5E2124EC1CO	3	3	2	2	2	1	2	-	1	-	2	1	3	2

Correlation levels-1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code:		**5EE225EC1**	Course Category:	**EC**
Course Name	**Repairing and Maintenance of Electrical Machines**				
Credits	**02**	Total L:T:P etc. Hours	2:0:4 **90 Hrs**	Total SL Hours :	**30Hrs**
Total Credit Hours	**120 Hrs**				
SEE Marks	**30**	SEE Time	**2 Hrs**	CIA Marks	**20**
EE Marks	**25**	PA Marks	**25**	Total Marks	**100**

Course Description:

Subject Code 5EE225EC1 Repairing and maintenance of Electrical Machines is an optional Exit Course for Second Year B. Tech Electrical Engineering.

Course Objectives:

The objective of this course is to enable learners with Repairing and Maintenance of Electrical Machines to develop skills for accurate testing.

Course Outcomes:

After completing the course students will be able to:

CO	Course Outcome	Domain Level
5EE225EC1.1	Describe the construction, components, and essential testing methods of electrical machines to evaluate their condition and performance in practical applications.	C-3
5EE225EC1.2	Apply the knowledge of electrical machines to solve basic maintenance and repair issues.	C-3
5EE225EC1.3	Analyse the operational parameters of electrical machines to evaluate their performance under different conditions.	C-4

Course Contents:

Unit 1	**Construction and Components of Electrical Machines:** DC Machines: Armature, field winding, commutator, brush assembly, etc. AC Machines: Stator, rotor, slip rings (for synchronous machines), squirrel cage rotor (for induction machines), etc. Transformers: Core, windings, bushings, tap changer. Insulation Resistance Testing: Importance of insulation in electrical machines and how to test it. Testing and Measuring Instruments: Megger, clamp meter, tachometers, etc. Motor Testing: No-load, locked rotor, and full-load tests.	10 Hrs

Unit 2	**Faults in Electrical Machines:** Types of Faults: Open circuits, short circuits, ground faults, and mechanical failures. Diagnosis of Fault: Using instruments like multi-meters, insulation resistance testers, and oscilloscopes. Common Faults in DC/AC Motors and Transformers: Overheating, vibration, electrical imbalance, wear and tear.	10 Hrs
Unit 3	**Maintenance and Repair Techniques:** Preventive and Corrective Maintenance: Regular checks, cleaning, lubrication, and insulation testing. Predictive Maintenance: Vibration analysis, thermal imaging, and other techniques for anticipating failures before they occur. Winding Repair and Rewinding: Understanding the process for rewinding armatures, stators, and transformers. Brush and Commutator Maintenance, Bearings and Shaft Repair.	10 Hrs

List of Practicals:

Minimum ten practicals from the list mentioned below.

1. Study of Tools, Testing Instruments, and Safety Precautions used in machine maintenance.
2. To Measurement of Insulation Resistance of Electrical Machines Using megger.
3. To perform the Testing and Maintenance of Brushes and Commutator in DC Machines.
4. Perform the Troubleshooting of Single-Phase Induction Motor to Identifying faults like overheating, low torque, vibration.
5. To perform the Maintenance and Testing of Three-Phase Induction Motor.
6. Perform the Rewinding of a Small Single-Phase Motor.
7. Study the Maintenance and Testing of Transformer.
8. The Identification and Repair of Common Electrical Machine Faults.
9. To perform Load Testing of a Repaired Electrical Machine.
10. To Prepare maintenance schedule and logbook for electrical machines.
11. Study the vibration analysis and noise diagnosis in rotating machines.
12. Identify and replace damaged windings in a small transformer or motor.

Text-Books:

1. S. K. Sahdev, Electrical Machine Maintenance and Testing, Cambridge University Press & Assessment.
2. Madhvi Gupta, Installation, Maintenance & Repair of Electrical Machines & Equipment, S.K. Kataria & Sons.

Reference Books:

1. A.E. Fitzgerald, Charles Kingsley Jr., and Stephen D. Umans, Electrical Machines and Equipment, McGraw-Hill.

2. Robert Rosenberg, Electric Motor Repair: A Practical Book on the Winding, Repair, and Troubleshooting of A-C and D-C Motors and Controllers, Rinehart & Company, Technical Division, 1960.
3. S. M. Chaudhari, Maintenance of Electrical Machines, Nirali Prakashan.

E-Resources:

1. https://www.electrical4u.com.
2. https://www.automationdirect.com/adc/Overview/Catalog/Motors.
3. https://new.siemens.com/global/en/products/industrial/motion-control/motors/technical-support.html.
4. https://www.fluke.com/en-us/learn/blog/electrical.
5. https://www.practicalmachinist.com

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
5EE225EC1.1	3	2	1	-	3	-	-	-	-	-	-	-	1	-
5EE225EC1.2	2	3	1	-	2	-	-	-	-	-	-	-	1	-
5EE225EC1.3	1	2	3	-	2	-	-	-	-	-	-	-	1	-
5EE225EC1CO	2	2	2	-	2	-	-	-	-	-	-	-	1	-

Correlation levels-1: Slight (Low),2: Moderate (Medium), 3: Substantial (High)