Shri Balasaheb Mane Shikshan Prasarak Mandal's,

ASHOKRAO MANE GROUP OF INSTITUTIONS

NH – 4, Vathar Tarf Vadgaon, Tal: -Hatkanangale, Dist: - Kolhapur-416112

Website: www.amgoi.edu.in

An Autonomous Institute

Curriculum Structure

and

Evaluation Scheme for

Second Year B.Tech.

Department of Electrical Engineering

Semester: I & II

With Effect from Academic Year 2026-27

Head of Department	Dean Academics	Director
Dr. V. S. Wadkar	Dr. S. S. Patil	Dr. S. R. Chougule

HOD
DEPT. OF ELECTRICAL ENGINEERING
SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S
ASHOKRAO MANE GROUP OF INSTITUTIONS

DIRECTOR
SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S
ASHOKRAO MANE GROUP OF INSTITUTIONS
Vathar Tarf Vadgaon, Tal. Hatkanangale, Dist. Kolhapur, M.S. 416112

Shri Balasaheb Mane Shikshan Prasarak Mandal's,
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Website: www.amgoi.edu.in
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Curriculum Structure and Evaluation Scheme for B. Tech. in Electrical Engineering with Honor and Multidisciplinary Minor

(To be implemented for 2025-2029 Batch)

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S
ASHOKRAO MANE GROUP OF INSTITUTIONS
Dept. of Electrical Engg.

ABBREVIATIONS

- **L:** Lecture
- **T:** Tutorial
- **P:** Practical
- **ISE-I:** In Semester Evaluation-I
- **ISE-II:** In Semester Evaluation-II
- **MSE:** Mid Semester Exam
- **ESE:** End Semester Exam
- **BSC** -Basic Science Courses
- **ESC:** Engineering Science Courses
- **AEC:** Ability Enhancement Courses
- **IKS:** Indian Knowledge System
- **VSEC:** Vocational and Skill Enhancement Course
- **PCC**: Program Core Course
- **PEC**: Program Elective Course
- **CC:** Co-curricular Courses

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NH – 4, Vathar Tarf Vadgaon, Tal: -Hatkanangale, Dist: - Kolhapur-416112

Website: www.amgoi.edu.in

An Autonomous Institute

Department: Applied Science & Humanities

Semester: I

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
BSC	25ASH101	Engineering Mathematics- I	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH103	Engineering Chemistry	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH106	Fundamentals of Electronics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH107	Engineering Graphics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
IKS	25ASH109	Architecture and Town Planning	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ASH111C	Power Plant Engineering	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH113	Engineering Chemistry Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH116	Fundamentals of Electronics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
ESC	25ASH117	Engineering Graphics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
VSEC	25ASH119	Workshop Practices	-	-	2	1	ISE	50	20	
CC	25ASH121	Social Life Skills	1	-	-	1	ISE	50	20	
	Total		**17**	**01**	**08**	**21**		**950**		
Total Contact Hours- 26							**Total Credits- 22**			

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of Electrical Engg.

Shri Balasaheb Mane Shikshan Prasarak Mandal's,

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Website: www.amgoi.edu.in

An Autonomous Institute

Department: Applied Science & Humanities

Semester: II

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
BSC	25ASH201	Engineering Mathematics- II	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH202	Engineering Physics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH204	Basic Electrical Engineering	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH205	Engineering Mechanics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VSEC	25ASH208	Programming in C	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
AEC	25ASH210	Communication Skills	1	-	-	1	ISE-I	5		20
							MSE	15		
							ISE-II	5		
							ESE	25	10	
BSC	25ASH212	Engineering Physics Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH214	Basic Electrical Engineering Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH215	Engineering Mechanics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
VSEC	25ASH218	Programming in C Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
CC	25ASH220	Yoga & Meditation	-	-	2	1	ISE	50	20	
AEC	25ASH222	Communication Skills Laboratory	-	-	2	1	ISE	50	20	
	Total		**15**	**01**	**12**	**22**		**950**		
Total Contact Hours- 28							**Total Credits- 22**			

SHIKSHAN PRASARAK MANDAL'S
ASHOKRAO MANE GROUP OF INSTITUTIONS
Dept. of Electrical Engg.

Department: Department of Electrical Engineering
Semester: III

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25EE301	Electrical & Electronics Instrumentation	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25EE302	Analog and Digital Electronics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25EE303	Engineering Mathematics for Electrical Engineers	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25MDM304	Multidisciplinary Minor – I	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
Entre./ Econo./ Manag	25EE305	Professional Skill Development	2	-	-	2	ISE-I	25		
							ISE-II	25	20	
VEC	25EE306	Universal Human Values	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
CEP/FP	25EE307	Mini Project – I	-	-	2	1	ISE-I	25	20	
							ISE-II	25		
PCC	25EE308	Electrical & Electronics Instrumentation Lab	-	-	2	1	ISE	50	40	
							ESE (POE)	50		
PCC	25EE309	Analog and Digital Electronics Lab	-	-	2	1	ISE	50	40	
							ESE (POE)	50		
	Total		**16**	**01**	**06**	**20**		**800**		
Total Contact Hours- 23							**Total Credits- 20**			

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS
Dept. of Electrical Engg.

Department: Department of Electrical Engineering
Semester: IV

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25EE401	DC Machines and Transformer	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25EE402	Power System - I	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25EE403	Network Analysis	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25MDM404	Multidisciplinary Minor – II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	25OE405D	Open Elective – I	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
Entre./ Econo./ Manag	25EE406	Entrepreneurship Development	1	-	-	1	ISE-I	25	20	
							ISE-II	25		
AEC	25EE407	Quantitative Aptitude and Logical Reasoning - I	1	-	-	1	ISE-I	25	20	
							ISE-II	25		
VEC	25EE408	Constitution of India	2	-	-	2	ISE-I	25	20	
							ISE-II	25		
VSEC	25EE409	Skill Enhancement	-	-	2	1	ISE-I	25	20	
							ISE-II	25		
PCC	25EE410	DC Machines and Transformer Lab	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
PCC	25EE411	Power System - I Lab	-	-	2	1	ISE	50	40	
							ESE (POE)	50		
	Total		**18**	**01**	**06**	**22**		**900**		
Total Contact Hours- 25							**Total Credits- 22**			

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of Electrical Engg.

Department: Department of Electrical Engineering
Semester: V

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25EE501	AC Machines	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25EE502	Power Electronics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25EE503	Power System - II	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25EE504	Program Elective - I	4	-	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25MDM505	Multidisciplinary Minor – III	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	25OE506D	Open Elective – II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
AEC	25EE507	Quantitative Aptitude and Logical Reasoning - II	1	-	-	1	ISE-I	25	20	
							ISE-II	25		
CEP/FP	25EE508	Mini Project – II	-	-	2	1	ISE-I	25	20	
							ISE-II	25		
PCC	25EE509	AC Machines Lab	-	-	2	1	ISE	50	40	
							ESE (POE)	50		
PCC	25EE510	Power Electronics Lab	-	-	2	1	ISE	50	40	
							ESE (POE)	50		
	Total		**19**	**-**	**06**	**22**		**900**		
Total Contact Hours- 25							**Total Credits- 22**			

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of Electrical Engg.

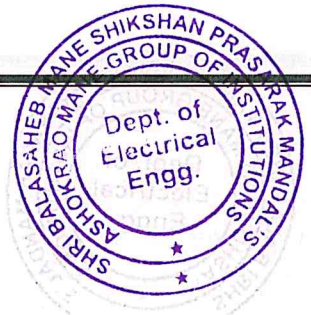
Department: Department of Electrical Engineering
Semester: VI

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25EE601	Control Systems	2	1	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25EE602	Power System - III	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25EE603	Program Elective - II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25EE604	Program Elective - III	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25MDM605	Multidisciplinary Minor – IV	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	25OE606D	Open Elective – III	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VSEC	25EE607	Project Phase-I	-	-	4	2	ISE-I	25	20	
							ISE-II	25		
PCC	25EE608	Power System - III Lab	-	-	2	1	ISE	50	40	
							ESE (POE)	50		
PEC	25EE609	Program Elective - II Lab	-	-	2	1	ISE-I	25	20	
							ISE-II	25		
	Total		**17**	**01**	**08**	**22**		**800**		
Total Contact Hours- 26							**Total Credits- 22**			

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of Electrical Engg.

Department: Department of Electrical Engineering
Semester: VII

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25EE701	Electric Drives and Control	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25EE702	Microcontrollers and Applications	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25EE703	Program Elective - IV	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25EE704	Program Elective - V	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25EE705	Multidisciplinary Minor – V	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25EE706	Electric Drives and Control Lab	-	-	2	1	ISE	50	40	
							ESE	50		
PCC	25EE707	Microcontrollers and Applications Lab	-	-	2	1	ISE	50	40	
							ESE (POE)	50		
Project	25EE708	Project Phase-II	-	-	8	4	ISE	50	20	60
							ESE (POE)	100	40	
	Total		**14**	**-**	**12**	**20**		**850**		
Total Contact Hours- 26							**Total Credits- 20**			



Department: Department of Electrical Engineering
Semester: VIII

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25EE801	Smart Grid and Automation	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25EE802	Program Elective – VI	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
RM	25EE803	Research Methodology	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
Intern./ OJT	25EE804	Internship/On Job Training	-	-	-	12	ISE	100	40	80
							ESE	100	40	
	Total		**9**	**1**	**-**	**22**		**500**		
Total Contact Hours- 10							**Total Credits- 22**			

* Internship/On Job Training – Student is expected to be in the industry for 24 weeks.

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS
Dept. of Electrical Engg.

MULTIDISCIPLINARY MINOR (MDM) BASKET

Important Note:

1. Students should select **any one basket** for the award of Minor Degree of their interest from the table below.
2. The student must complete **all five courses under the selected MDM Basket** to qualify for the Minor.
3. The credits earned under the Multidisciplinary Minor shall form part of the total **172 Credits** required for award of the degree.

MDM Basket Name	Sr. No.	Course Code	Course Name	Semester	Offered by the Department
Data Analyst	1	25MDM304A	Data Structure	III	**Artificial Intelligence & Machine Learning** (To all UG Programs except UG AIML, AIDS, CSE, E&C Engg.)
	2	25MDM404A	R-programming	IV	
	3	25MDM505A	DBMS	V	
	4	25MDM605A	Big Data Technologies	VI	
	5	25MDM705A	Introduction to Machine Learning	VII	
Prompt Engineering	1	25MDM304B	R-programming	III	**Artificial Intelligence & Machine Learning** (To all UG Programs except UG AIML, AIDS, CSE, E&C Engg.)
	2	25MDM404B	Introduction to AI and ML	IV	
	3	25MDM505B	IOT	V	
	4	25MDM605B	Introduction to Blockchain Technology	VI	
	5	25MDM705B	Prompt Engineering	VII	
Intelligent Data Systems	1	25MDM304C	Computer Organization Architecture	III	**Artificial Intelligence & Data Science** (To all UG Programs except UG AIDS, AIML CSE, E&C Engg.)
	2	25MDM404C	R-programming	IV	
	3	25MDM505C	Data Manipulation, Analysis and Visualization	V	
	4	25MDM605C	DBMS	VI	
	5	25MDM705C	Big Data Technologies	VII	
Cognitive Computing	1	25MDM304D	Computer Organization Architecture	III	**Artificial Intelligence & Data Science** (To all UG Programs except UG AIDS, AIML
	2	25MDM404D	Introduction to Data Science	IV	
	3	25MDM505D	Introduction to Machine Learning	V	
	4	25MDM605D	Social Network Analysis	VI	

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Dept. of Electrical Engg.

	5	25MDM705D	Natural Language Processing	VII	CSE, E&C Engg.)
Essentials of Software Development	1	25MDM304E	Data Structures	III	**Computer Science & Engineering** (To all UG Programs except UG CSE, AIML, AIDS, E&C Engg.)
	2	25MDM404E	Python Programming	IV	
	3	25MDM505E	Computer Algorithms	V	
	4	25MDM605E	Database Management System	VI	
	5	25MDM705E	Software Engineering	VII	
Modern Computing Systems	1	25MDM304F	Data Structures	III	**Computer Science & Engineering** (To all UG Programs except UG CSE, AIML, AIDS, E&C Engg.)
	2	25MDM404F	Python Programming	IV	
	3	25MDM505F	Java Programming	V	
	4	25MDM605F	Artificial Intelligence & Machine Learning	VI	
	5	25MDM705F	Cloud Computing	VII	
Smart Energy Systems and Sustainability	1	25MDM304G	Fundamentals of Energy Systems	III	**Electrical Engineering** (To all UG Programs except UG Electrical Engg.)
	2	25MDM404G	Solar and Wind Energy Technologies	IV	
	3	25MDM505G	Fundamentals of Energy Management Systems	V	
	4	25MDM605G	Energy Storage Systems	VI	
	5	25MDM705G	Renewable Energy Integration in Smart Grids	VII	
Intelligent Electrical Systems	1	25MDM304H	Introduction to Intelligent Electrical Systems	III	**Electrical Engineering** (To all UG Programs except UG Electrical Engg.)
	2	25MDM404H	IoT and IOV for Electrical Systems	IV	
	3	25MDM505H	AI Applications in Electrical Systems	V	
	4	25MDM605H	Automation and Control in Energy Systems	VI	
	5	25MDM705H	Smart Grid and Intelligent Monitoring Systems	VII	
Communication System	1	25 MDM304I	Principles of Communication	III	**Electronics & Computer Engineering** (To all UG Programs except UG E&C & E&TC Engg.)
	2	25 MDM404I	Wireless and Mobile Communication	IV	
	3	25 MDM505I	Wireless Sensor Networks	V	
	4	25 MDM605I	Information theory and Coding	VI	
	5	25MDM705I	Satellite and Radar Communication	VII	

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS
Dept. of Electrical Engg.

Computing Solutions for Industry	1	25MDM304J	Python programming	III	**Electronics & Computer Engineering** (To all UG Programs except UG E&C, AIML, AIDS, CSE Engg.)
	2	25MDM404J	Industry Analytics	IV	
	3	25MDM505J	Cloud Computing	V	
	4	25MDM605J	Industrial Internet of Things (IIoT)	VI	
	5	25MDM705J	Power BI	VII	
Internet of Things (IoT)	1	25MDM304K	Fundamentals of IoT	III	**Electronics & Telecommunication Engineering** (To all UG Programs except UG E&TC Engg.)
	2	25MDM404K	Technologies Enabling IoT	IV	
	3	25MDM505K	IoT System Design	V	
	4	25MDM605K	Industrial IoT	VI	
	5	25MDM705K	IoT Security and Privacy	VII	
Embedded Systems	1	25MDM304L	Digital Design	III	**Electronics & Telecommunication Engineering** (To all UG Programs except UG E&TC Engg.)
	2	25MDM 404L	Microcontroller & Interfacing Techniques	IV	
	3	25MDM 505L	Embedded Systems Design	V	
	4	25MDM 605L	Real-Time Operating Systems	VI	
	5	25MDM 705L	Advanced Embedded Systems & Product Development	VII	
Product Development	1	25MDM 304M	Design Thinking Approach	III	**Mechanical Engineering** (To all UG Programs except UG Mech Engg.)
	2	25MDM 404M	Engineering Design Process	IV	
	3	25MDM 505M	Rapid Prototyping and Testing	V	
	4	25MDM 605M	Product Development	VI	
	5	25MDM 705M	Commercialization and Sustainability	VII	
Refrigeration and Air Conditioning	1	25MDM 304N	Fundamentals of Refrigeration	III	**Mechanical Engineering** (To all UG Programs except UG Mech Engg.)
	2	25MDM 404N	Refrigeration Components and Low Temperature Cycles	IV	
	3	25MDM 505N	Psychrometry and Air Conditioning Process	V	
	4	25MDM 605N	HVAC Systems and Emerging Technologies	VI	

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of Electrical Engg.

	5	25MDM705N	Application Based System Design	VII	
Planning and Execution of Projects	1	25MDM304P	Building Construction Materials	III	**Civil Engineering** (To all UG Programs except UG Civil Engg.)
	2	25MDM404P	Engineering Management	IV	
	3	25MDM505P	Resource Management	V	
	4	25MDM605P	Optimization Technique	VI	
	5	25MDM705P	Engineering Economics	VII	
Building Interior Design and Home Automation	1	25MDM304R	Introduction to Buildings and Spaces	III	**Civil Engineering** (To all UG Programs except UG Civil Engg.)
	2	25MDM404R	Basics of Interior Building Design	IV	
	3	25MDM505R	Building Interior Materials and Finishes	V	
	4	25MDM605R	Smart Devices and Sensors for Home Automation	VI	
	5	25MDM705R	Recent Techniques for Home Automation	VII	

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS
Dept. of Electrical Engg.

OPEN ELECTIVE COURSES

(Students have to select any one Open Elective course, for each applicable semester, of their interest (other than open electives offered by his/her department) from the table below)

Open Elective – I

Sr. No.	Course Code	Course Name	Offered by Department
1	25OE405A	E Commerce	Artificial Intelligence & Machine Learning & Artificial Intelligence & Data Science
2	25OE405B	Environmental Science	Civil Engineering
3	25OE405C	Human Computer Interaction (HCI)	Computer Science & Engineering
4	25OE405D	Electrical Safety & Standards	Electrical Engineering
5	25OE405E	Sensor Technology	Electronics & Computer Engineering & Electronics & Telecommunication Engineering
6	25OE405F	Project Management	Mechanical Engineering

Open Elective – II

Sr. No.	Course Code	Course Name	Offered by Department
1	25OE506A	Design Thinking	Artificial Intelligence & Machine Learning & Artificial Intelligence & Data Science
2	25OE506B	Disaster Management	Civil Engineering
3	25OE506C	Cyber Security	Computer Science & Engineering
4	25OE506D	Energy Audit	Electrical Engineering
5	25OE506E	Drone Technology	Electronics & Computer Engineering & Electronics & Telecommunication Engineering
6	25OE506F	Startup and Business Strategy	Mechanical Engineering

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Open Elective – III

Sr. No.	Course Code	Course Name	Offered by Department
1	25OE606A	Recommender System	Artificial Intelligence & Machine Learning & Artificial Intelligence & Data Science
2	25OE606B	Environmental Impact Assessment	Civil Engineering
3	25OE606C	Cyber Laws	Computer Science & Engineering
4	25OE606D	E-Mobility	Electrical Engineering
5	25OE606E	Engineering Economics	Electronics & Computer Engineering & Electronics & Telecommunication Engineering
6	25OE606F	Industrial Automation	Mechanical Engineering

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PROGRAM ELECTIVE CORE

(Students have to select any one Program Elective Core course out of 03, for each applicable semester, of their interest, offered by the Department from the table below)

Program Elective Core - I

Sr.	Course Code	Domain	Course Name	Semester
1	25EE504A	Power Systems and Smart Grids	Electrical Installation, Testing and Maintenance	V
2	25EE504B	Control Systems and Automation	Digital Signal Systems	
3	25EE504C	Power Electronics and Drives	Linear Integrated Circuits	

Program Elective - II

Sr.	Course Code	Domain	Course Name	Semester
1	25EE603A	Power Systems and Smart Grids	Advanced Switchgear & Protection	VI
2	25EE603B	Control Systems and Automation	Advanced Control Systems	
3	25EE603C	Power Electronics and Drives	Modeling and Simulation of Electrical Systems	

Program Elective - III

Sr.	Course Code	Domain	Course Name	Semester
1	25EE604A	Power Systems and Smart Grids	Renewable Energy Systems	VI
2	25EE604B	Control Systems and Automation	Robotics and Automation	
3	25EE604C	Power Electronics and Drives	Advanced Power Electronics	

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Program Elective – IV

Sr.	Course Code	Domain	Course Name	Semester
1	25EE703A	Power Systems and Smart Grids	Electrical Power Quality	VII
2	25EE703B	Control Systems and Automation	Industrial Automation using PLC & SCADA	
3	25EE703C	Electric Drives and Power Electronics	Electric Vehicle Systems	

Program Elective – V

Sr.	Course Code	Domain	Course Name	Semester
1	25EE704A	Power Systems and Smart Grids	Cyber Security in Smart Grid	VII
2	25EE704B	Control Systems and Automation	Intelligent Control Systems	
3	25EE704C	Electric Drives and Power Electronics	AI Applications in Electrical Engineering	

Program Elective – VI

Sr.	Course Code	Domain	Course Name	Semester
1	25EE802A	Power Systems and Smart Grids	Energy Management Systems	VIII
2	25EE802B	Control Systems and Automation	Embedded Systems	
3	25EE802C	Electric Drives and Power Electronics	Battery Technology and Applications	

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B.Tech. (Hons) in Smart Electric Systems and Emerging Technologies

Department: Electrical Engineering

Course Code	Name of the Course	Credit
25EE3H	Introduction to Internet of Things	3
25EE4H	Introduction to Embedded Systems	3
25EE5H	Control Engineering for Robotics	3
25EE6H	Smart Grid: Basics to Advanced Technologies	3
25EE7H	Introduction to Machine Learning	3
25EE8H	Digital Signal Processing and its Applications	3
	Total	**18**

Guidelines for Honor Certification Courses

1. Students are required to complete six courses (each carrying 3 credits) through an online platform to earn a total of 18 credits under the Honor Certification scheme.
2. All six courses must be completed starting from the Second Year First Semester (Semester III) to the Final Year Second Semester (Semester VIII).
3. The student has to obtain all 18 credits by the last semester of the program.
4. While selecting the course platform, first preference must be given to SWAYAM/NPTEL.
5. Registration on platforms such as Coursera or Udemy is permitted only under the following conditions:
   a. The SWAYAM/NPTEL course schedule does not align with the academic calendar.
   b. The subsequent course in the learning sequence is not available on SWAYAM/NPTEL.
   c. Any other unavoidable circumstances arise.
   d. About 80% of the contents of the course should match with the SWAYAM/NPTEL courses.
6. Course selection must strictly adhere to the recommendations of the Chairman of Board of Studies (BOS).
7. Credits for the respective Honor courses will be awarded under the following conditions:
   a. For NPTEL courses, students must complete all assignments on time, pass the examination, and obtain the certificate.
   b. For Coursera or Udemy courses, students must obtain the course certificate and appear for

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the Online examination which will be conducted under the supervision of the Institute by Examination Cell

8. While selecting an online course, the following criteria must be ensured:
   a. The course should be of an advanced level, not basic or introductory.
   b. The course content must not overlap with subjects already included in the regular curriculum or listed under elective courses.
   c. The duration of each course must be:
      - Minimum 8/12 weeks for SWAYAM/NPTEL courses
      - At least 30+ hours for Coursera/Udemy courses

Course Code	Name of the Course and SWAYAM/NPTEL Links	Credit
25EE3H	Introduction to Internet of Things 1. https://onlinecourses.nptel.ac.in/noc25_cs44	3
25EE4H	Introduction to Embedded Systems 1. https://onlinecourses.nptel.ac.in/noc26_cs22	3
25EE5H	Control Engineering for Robotics 1. https://onlinecourses.nptel.ac.in/noc26_ee02	3
25EE6H	Smart Grid: Basics to Advanced Technologies 1. https://onlinecourses.nptel.ac.in/noc26_ee84	3
25EE7H	Introduction to Machine Learning 1. https://onlinecourses.nptel.ac.in/noc26_cs74	3
25EE8H	Digital Signal Processing and its Applications 1. https://onlinecourses.nptel.ac.in/noc25_ee23	3
	Total	**18**

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Exit Courses for Electrical Engineering (As per NEP Guidelines)

A. After First Year:

The candidate should pass following skill-based courses to qualify for Certification.

Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
		L	T	P	Cr	Components	Max	Min for Passing	
25EE225	Repair and Maintenance of Domestic Appliances	3	-	-	3	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25EE226	Arduino Based Systems	3	-	-	3	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25EE227	Industrial Training	-	-	4	2	ISE	50		40
						ESE	50	20	
Total		**6**	**-**	**4**	**8**		**300**		
Total Contact Hours- 10						**Total Credits- 8**			

B. After Second Year:

The candidate should pass following skill-based courses to qualify for Diploma.

Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
		L	T	P	Cr	Components	Max	Min for Passing	
25EE412	Power Electronics Applications	3	-	-	3	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25EE413	Electrical Machine Maintenance	3	-	-	3	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25EE414	Internship	-	-	4	2	ISE	50		40
						ESE	50	20	
Total		**6**	**-**	**4**	**8**		**300**		
Total Contact Hours- 10						**Total Credits- 8**			

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C. After Third Year:

The candidate should pass following skill-based courses to qualify for B. Voc.

Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
		L	T	P	Cr	Components	Max	Min for Passing	
25EE610	SCADA and Automation	3	-	-	3	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25EE611	Smart Grid Technology	3	-	-	3	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25EE612	Internship	-	-	4	2	ISE	50		40
						ESE	50	20	
Total		**6**	**-**	**4**	**8**		**300**		
Total Contact Hours- 10						**Total Credits- 8**			

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Electrical & Electronics Instrumentation

Course Name: **Electrical & Electronics Instrumentation** Course Code: **25EE301**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic Electrical Engineering

Course Objective: The course aims to:	
1	Understand the principles, construction and working of electrical and electronic measuring instruments.
2	Learn measurement techniques for resistance, inductance, capacitance, power and energy.
3	Analyze errors, torque equations and performance characteristics of measuring instruments.
4	Apply electronic instruments and transducers for accurate measurement of electrical and physical quantities.
5	Familiarize with modern measurement techniques and recent developments in instrumentation.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Analyze the construction, working principles and errors of electrical measuring instruments.
CO2	Apply bridges and instruments to measure resistance, inductance and capacitance.
CO3	Evaluate power and energy measurement techniques in DC and AC single and three phase systems.
CO4	Select and apply electronic instruments, transducers and modern measurement techniques.

CO-PO Mapping:

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

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Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Principle of Measuring Instruments** Types of errors in measurement, Absolute and secondary instruments, Types of secondary instruments: indicating and integrating instruments, Difference between indicating and integrating instruments, Construction, working principle, torque equation, advantages and disadvantages of Moving Iron (MI) instruments (attraction and repulsion types), Permanent Magnet Moving Coil (PMMC) instruments and dynamometer type instruments; Shunts and multipliers (numerical problems expected).	8
2	**Measurement of Resistance, Inductance & Capacitance:** Measurement of low, medium and high resistance using the Wheatstone bridge, Kelvin's double bridge, Megger and earth tester. Measurement of inductance and capacitance using Maxwell's inductance bridge, Hay's bridge, Anderson's bridge, Campbell's bridge, Owen's bridge and Schering bridge.	8
3	**Measurement of Power** Power and its types, Power measurement in DC and AC circuits, Power factor, Construction, working principle, torque equation, errors and their compensation, advantages and disadvantages of dynamometer-type wattmeter, low power factor wattmeter and polyphase wattmeter; Measurement of active and reactive power in three-phase systems (balanced and unbalanced loads) using one-wattmeter, two-wattmeter and three-wattmeter methods. (Numerical expected).	7
4	**Measurement of Energy** Energy meters construction, working principle, torque equation, errors and adjustments of single-phase induction type energy meter, Calibration of energy meter, Digital energy meter block diagram and operation, Three-phase energy meters; Testing of energy meters	7
5	**Electronic Measuring Instruments and Transducers** Construction and working principle of CRO and DSO, Advantages and disadvantages of DSO over CRO, Transducers: introduction, classification, basic requirements, Selection of transducers, Displacement measurement using LVDT and RVDT construction, working, applications, advantages and disadvantages.	6
6	**Recent Development in Measurements** Wave analyzers and harmonic distortion measurement, Power analyzer; Computer-aided measurements; Spectrum analyzer, Digital frequency analyser, IC based sensors	6

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Text books:

1. A. K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, 9th Edition, Dhanpat Rai& Co., 2014.
2. J. B. Gupta, A Course in Electronics and Electrical Measurements and Instrumentation, 8th Edition, S. K. Kataria & Sons, 2012.

Reference books:

1. E. W. Golding and F. C. Widdis, Electrical Measurements and Measuring Instruments,
   3rd Edition, Reem Publications, 2011.
2. R. S. Sirohi and Radhakrishnan, Electrical Measurement and Instrumentation, 3rd Edition, New Age International Publishers.

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Analog and Digital Electronics

Course Name: **Analog and Digital Electronics** Course Code: **25EE302**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic concepts of Mathematics, Physics, and Boolean algebra.

Course Objective: The course aims to:	
1	Understand the basics and operation of MOSFETs and OPAMPs.
2	Analyze voltage regulators and SMPS for power supply applications.
3	Learn digital fundamentals, Boolean logic, and logic circuit design.
4	Introduce digital memories and programmable logic devices for modern systems.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain the construction, operation and characteristics of MOSFETs and operational amplifiers.
CO2	Analyze and design basic OPAMP-based circuits and voltage regulation systems including SMPS.
CO3	Apply Boolean algebra, number systems and logic principles to design combinational and sequential circuits.
CO4	Compare and select appropriate digital memories and programmable logic devices for given applications.

CO-PO Mapping:

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

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Course Content		
Unit No.	**Unit title and Content**	**Hrs.**
1	**Metal Oxide Semiconductor Field Effect Transistor (MOSFET)** Introduction to MOSFET and its significance, Construction and operation of MOSFET, N-channel and P-channel MOSFET, Enhancement-type and Depletion-type MOSFET, Threshold voltage and its effect on operation, Modes of operation: Cut-off, Triode (Linear) and Saturation regions, Drain (V–I) characteristics of MOSFET, Transfer characteristics of MOSFET, Applications of MOSFET.	7
2	**Operational Amplifiers and Linear Integrated Circuits** Basics of OPAMP, characteristics of OPAMP, OPAMP as Inverting amplifier, non-inverting amplifier, summing amplifier, Difference amplifier, Integrator, Differentiator, Zero Crossing Detector.	7
3	**Voltage Regulation Techniques and Switched Mode Power Supplies** Concept and classification of voltage regulators, Adjustable three-terminal positive and negative voltage regulators (LM317 and LM337), Block diagram and typical connection of LM317 and LM337, Switched Mode Power Supply (SMPS): introduction and need, Block diagram of SMPS, Types of SMPS, Comparison of linear power supply and SMPS	7
4	**Digital Fundamentals and Boolean Logic** Digital signals and logic levels, Number systems: Binary, Octal, Hexadecimal, Binary arithmetic, 1's and 2's complement, Binary codes: BCD, Gray code, Boolean algebra: DE Morgan's theorem, Boolean expression simplification using Karnaugh Maps	7
5	**Combinational and Sequential Logic Circuits** Half adder and Full adder, Binary to Gray code converter and Gray to Binary converter, Multiplexer (MUX) and Demultiplexer (DEMUX), Latch circuits, Flip-flops: S-R flip-flop and D flip-flop, Asynchronous counters, Shift registers	7
6	**Modern Digital Memory and Logic Technologies Digital Memories** Static Random Access Memory (SRAM), Dynamic Random Access Memory (DRAM), Read Only Memory (ROM), Erasable Programmable Read Only Memory (EPROM) – basic concept, block diagram and applications. **Digital Logic Families** Programmable Array Logic (PAL), Programmable Logic Array (PLA), Complex Programmable Logic Device (CPLD), Field Programmable Gate Array (FPGA) – Introduction, Basic architecture and applications.	7

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Text books:

1. Floyd and Jain, "Digital Fundamentals", Pearson Education.
2. R. P. Jain, "Digital Electronics", Tata McGraw Hill, New Delhi.
3. Gaikwad R., "Operational Amplifier", PHI New Delhi.
4. Floyd, "Electronics Devices", Pearson Education.

Reference books:

1. Tokheim, "Digital Electronics-Principles and Application", 6th edition, Tata McGraw Hill, New Delhi
2. A Jaico and Charles H. Roth, "Fundamentals of Logic Design" Jr. Fourth Edition.
3. K. R. Botkar, "Integrated Circuits", Khanna Publication, New Delhi.
4. James, "Operational Amplifier and Linear Integrated Circuits Theory and Application."
5. P John Paul, "Electronics Devices and circuits", New Age international Publications.
6. P. S. Bimbra, "Power Electronics", Khanna Publications.

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Engineering Mathematics for Electrical Engineers

Course Name: **Engineering Mathematics for Electrical Engineers** Course Code: **25EE303**	**L**	**T**	**P**	**Credits**
	3	1	--	4
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Knowledge of calculus, differential equations, and basic statistics.

Course Objective: The course aims to:	
1	Understand the fundamental concepts of integral and transform techniques (Laplace, Z-, and Fourier transforms) and their properties.
2	Develop skills in calculating inverse Laplace transforms using different methods such as partial fraction decomposition and the convolution theorem, and to apply them in solving linear differential equations.
3	Analyze correlation and regression techniques for interpreting relationships between variables in engineering data..
4	Apply transform methods and statistical tools to solve practical problems in engineering and applied sciences.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain Laplace Transform and its properties to evaluate integrals and solve linear differential equations arising in engineering problems.
CO2	Apply inverse Laplace Transform, Z-Transform, and inverse Z-Transform techniques to solve differential and difference equations for discrete and continuous systems.
CO3	Apply Fourier integrals and Fourier transforms to analyze functions in the frequency domain and solve related engineering problems.
CO4	Interpret correlation and regression results to model and analyze relationships between engineering data and make informed decisions.

CO-PO Mapping:

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

Course Content

Unit No.	**Unit Title and Content**	**Hrs**
1	**Laplace Transform** Definition – Laplace Transform, conditions for existence; Transforms of	8

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	elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n property, scale change property, transforms of functions divided by t property, Lapalce transforms of derivative, Lapalce transforms of integral, Laplace Transform Of Some Special Functions – Periodic function, Heaviside-unit step function, Dirac delta function and Problems.	
2	**Inverse Laplace Transform** Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations and Problems.	6
3	**Z -Transforms** Introduction, Definitions, Region of convergence, Z – Transform of some standard functions, Properties of Z - Transform – Linearity, Change of scale, Shifting property, Multiplication by k, Division by k; Inverse Z –Transforms - Method of Binomial Expansion, Method of Partial Fractions and Problems.	7
4	**Fourier Transform** Definitions – Integral transforms; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals; Fourier Transform or Complex Fourier transform; Inverse Fourier transform or Complex Fourier transform; Fourier sine and cosine transforms; Inverse Fourier sine and cosine transforms Properties of Fourier transforms; Parseval's identity for Fourier transform and Problems.	9
5	**Correlation** Introduction, Types of correlation, correlation and causation, Methods of studying correlation, Karl Pearson's correlation coefficient and problems, Spearman's rank correlation and problems & Probable Error.	6
6	**Linear Regression Analysis** Introduction, Linear and non-linear regression, Lines of regression, Derivative of regression lines of y on x and x on y, Regression coefficients, Angle between the regression lines, Coefficients of regression and Problems.	6

Text books:

1. B.S. Grewal – Higher Engineering Mathematics (Khanna Publishers).
2. Erwin Kreyszig – Advanced Engineering Mathematics (Wiley).
3. R.K. Jain & S.R.K. Iyengar – Advanced Engineering Mathematics.

Reference books:

1. H.K. Dass – Advanced Engineering Mathematics (S. Chand)
2. P. V. Rao / P. N. Wartikar& J. N. Wartikar – Statistics and Numerical Methods.
3. Dr. M.R. Spiegal – Fourier Analysis with Applications.
4. Z.R. Bhatti – Laplace, Fourier & Z-Transforms with Applications.

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Fundamentals of Energy Systems

Course Name: **Fundamentals of Energy Systems** Course Code: **25MDM304G**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Physics, Fundamentals of Thermodynamics

Course Objective: The course aims to:	
1	Learn Energy Scenarios & Fundamentals.
2	Learn Principles of Thermodynamics & energy Transfer.
3	Study the Conventional Energy Sources & Systems.
4	Study the Renewable energy technology.
5	Learn Energy Storage & Conversion Materials.
6	Learn Energy Management, Audit & Economics.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain energy development, energy sources and its units.
CO2	Explain energy transfer and conversion principles & thermodynamics.
CO3	Analyze Conventional Energy Sources, Renewable energy source & Systems.
CO4	Explain Energy Storage & Conversion Materials, Energy Auditing, Energy Economics and policy.

CO-PO Mapping:

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

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Energy Scenarios & Fundamentals** Evolution of Grid (Past, Present and Future), Share of all generations in total energy, Role of energy in GDP/GNP and social transformation, Classification into	**6**

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	conventional (fossil fuels) and non-conventional (renewable) sources, Standard units of energy and power; conversion factors, World energy reserves, Indian energy scenario and international treaties like the Paris Agreement or Kyoto Protocol.	
2	**Core Concepts & Thermodynamics** Energy Forms (Electrical, Thermal, Mechanical, Chemical, Nuclear),Energy Conversion & Transfer Principles, Thermodynamics, Entropy, Work and Energy Balance, Energy System Modeling (Continuum, Stochastic, Network)	**5**
3	**Conventional Energy Sources & Systems** Fossil Fuels & Combustion, Nuclear Energy (Fission, Fusion),Hydroelectric Power & Turbomachinery, Electrical Machines (Generators, Motors, Transformers)	**5**
4	**Renewable Energy Technologies** Introduction to renewable energy terms and Grid Integration, Solar Energy: Solar radiation geometry, flat plate collectors and photovoltaic (PV) cell physics (p-n junctions, I-V characteristics and MPPT). Wind Energy: Principles of wind conversion, Betz limit, aerodynamic theories and site selection for wind farms.	**7**
5	**Energy Conversion & Storage** Principles of electric machines (generators, motors), power electronics, transformers and energy storage solutions (batteries, pumped hydro, hydrogen).	**6**
6	**Energy Management, Audit & Economics** Energy Auditing: Methodology for thermal and electrical utilities; monitoring and targeting energy use. Energy Economics: Pricing, taxation, life cycle analysis (LCA) and financial evaluation of energy projects. Policy & Sustainability: Energy Conservation Act, carbon footprint mitigation and environmental impact assessments.	**7**

Text books:

1. D. Mukherjee: "Fundamentals of Renewable Energy Systems" 1st Edition, 2018
2. Chetan Singh Solanki: "Akshay Urja Prodyogiki: Ek Vyavaharik Gyan:"2011
3. Tangellapalli Srinivas R :"Modelling of Energy Systems" (1st Edition) 2026

Reference books:

1. S. P. Sukhatme & J. K. Nayak, "Solar Energy: Principles of Thermal Collection and Storage, 2009 (Indian edition).
2. N. L. Panwar, Sunil L. Narnaware, Swati Narnaware:" Renewable Energy Sources",2023

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Introduction to Intelligent Electrical Systems

Course Name: **Introduction to Intelligent Electrical Systems** Course Code: **25MDM304H**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic knowledge of electrical engineering fundamentals and introductory concepts of power systems.

Course Objective: The course aims to:	
1	Introduce the fundamentals of intelligent and smart electrical systems.
2	Familiarize students with sensing, communication, and automation in electrical networks.
3	Understand the role of data, intelligence, and control in modern power systems.
4	Prepare students for advanced courses in smart grids and AI applications.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain the concept and components of intelligent electrical systems.
CO2	Understand sensing, communication, and data acquisition in electrical systems.
CO3	Analyze intelligent control and automation techniques.
CO4	Identify applications of intelligent electrical systems.

CO-PO Mapping:

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

Course Content

Unit No.	Unit title and Content	Hrs
1	**Fundamentals of Power Systems** Evolution of power systems, basic structure of power systems including generation, transmission, and distribution, overview of the Indian power system, concepts of regional grid and national grid, conventional energy sources, renewable energy sources, fundamentals of real power, reactive power, apparent power, power factor, and introduction to per-unit system.	7

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2	**Introduction to Intelligent and Smart Electrical Systems** Basic idea of renewable energy integration into power systems, introduction to smart grid concept, introduction to microgrid concept, basics of distributed generation (DG), simple overview of electric vehicles (EVs) and their impact on power systems, role of intelligence in modern electrical networks, need for smart and intelligent electrical systems.	7
3	**Sensors, Transducers, and Data Acquisition** Role of sensors in intelligent systems, classification of sensors, electrical sensors (current, voltage, power, energy), environmental sensors (temperature, humidity, light), smart meters, data acquisition systems (DAQ), signal conditioning, sampling and quantization, basics of data logging.	7
4	**Communication Technologies for Intelligent Systems** Conventional control vs intelligent control, overview of automation systems, programmable logic controllers (PLC) basics, supervisory control and data acquisition (SCADA) overview, introduction to artificial intelligence in electrical systems, rule-based systems, fuzzy logic basics, expert systems overview.	7
5	**Intelligent Power and Energy Systems** Smart grids concept, intelligent substations, distribution automation, integration of renewable energy sources, role of energy storage, electric vehicles and charging infrastructure, demand response, energy management systems, microgrids overview.	
6	**Applications and Case Studies of Intelligent Electrical Systems** Intelligent buildings and smart homes, industrial automation and Industry 4.0 overview, intelligent transportation systems, condition monitoring and predictive maintenance, fault detection and diagnostics, future trends in intelligent electrical systems.	7

Text books:

1. Stuart Borlase, "Smart Grids", CRC Press, 2nd Edition, 2017.Janaka Ekanayake, Nick
2. Jenkins, Kithsiri Liyanage and Jianzhong Wu, "Smart Grid: Technology and Applications", Wiley, 1st Edition, 2012.
3. Momoh, James A., "Smart Grid: Fundamentals of Design and Analysis", Wiley-IEEE Press, 1st Edition, 2012.

Reference books:

1. S. Mishra and P. K. Dash, "Artificial Intelligence Techniques in Power Systems", IET, 1st Edition, 2017.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 3rd Edition, 2016.
3. P. Siano, "Demand Response and Smart Grids", Elsevier, 1st Edition, 2014.
4. IEC and IEEE, "Standards and Technical Reports on Smart Grids, SCADA, and Intelligent Electrical Systems", Latest Editions.

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Professional Skill Development

Course Name: **Professional Skill Development** Course Code: **25EE305**	**L**	**T**	**P**	**Credits**
	2	--	--	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	--

Course Objective: The course aims to:	
1	Students learn to acknowledge themselves, develop confidence and take action without fear.
2	Students understand that dreams are realized through process, not talent or luck.
3	Acquiring Practical Task Management Skills.
4	Students learn how to break goals into tasks, manage time and sustain effort.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Demonstrate self-awareness, self-esteem and confidence through reflection and inner dialogue practices.
CO2	Formulate a clear personal vision and long-term goals by converting abstract dreams into structured plans.
CO3	Apply goal-setting, task breakdown and time management techniques to plan and execute personal and academic tasks effectively.
CO4	Evaluate personal progress through reflection, feedback and process improvement methods to develop resilience and continuous improvement habits.

CO-PO Mapping:

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

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Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Self-Esteem and Inner Dialogue** What is self-esteem, and why does it matter? The power of writing and reflection (core philosophy of KAMI-MEMO) Self-awareness and value clarification exercises	5
2	**Visualizing the Future** Designing a personal vision (5-year / 10-year future) Turning abstract dreams into concrete descriptions	5
3	**Goal Setting and Task Breakdown** Translating dreams into goals SMART goals and milestone design Weekly planning and prioritization	5
4	**Execution and Reflection** Monitoring progress through written reflection Understanding success and failure as data Peer feedback and discussion	5
5	**Process Improvement** Reviewing and redesigning action plans Strengthening problem-solving and resilience Creating a personal improvement cycle (PDCA)	5
6	**Final Presentation** Presentation of personal growth portfolio Reflection on mindset, behavior, and outcomes	5

Text books:

1. Kunio Hara, "KAMI-MEMO: Successful Future Will Be Ahead for You with the Method of Writing Notes on a Piece of Paper", English Edition, Kindle Edition, Amazon, 2019.

Reference books:

1. Stephen R. Covey, "The 7 Habits of Highly Effective People", Free Press, 25th Anniversary Edition, 2014.

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Universal Human Values

Title of the Course Name: **Universal Human Values** Course Code: **25EE306**	**L**	**T**	**P**	**Credits**
	2	--	--	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic knowledge of management, Communication Skill

Course Objectives: The course aims:
1. Develop clarity of human values to enable students to understand harmony at individual, family, society and nature levels.
2. Help students identify their aspirations related to happiness and prosperity.
3. Enable students to evaluate ethical and moral issues in personal and professional life.
4. Promote responsible behavior, social commitment and holistic development among engineering students.

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

CO1	Understand the concept of human values and the need for value-based education.
CO2	Analyze the relationship between self, family, society and nature for achieving harmony.
CO3	Apply universal human values in personal, social and professional decision-making.
CO4	Demonstrate ethical conduct, social responsibility and sustainable thinking as an engineer.

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

Course Content		
Unit No.	**Contents**	**Hrs.**
1	**Introduction to Universal Human Values** Introduction to Value Education, Need and importance of Universal Human	05

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	Values, Self-exploration and self-awareness, Natural acceptance, Right understanding, Relationship between values, skills and knowledge.	
2	**Understanding Happiness and Prosperity** Concept of happiness and prosperity, Difference between happiness and pleasure, Short-term vs long-term happiness, Continuous happiness and prosperity, Role of values in achieving sustainable happiness.	05
3	**Harmony in the Individual** Human aspirations, Co-existence of self and body, Understanding needs of self and body, Right utilization of physical facilities, Holistic development of individual.	05
4	**Harmony in Family and Society** Family as a basic unit of society, Values in family: trust, respect, affection, care, guidance, Reverence, Social harmony, Justice, equality and mutual cooperation, Ethical human conduct.	05
5	**Harmony in Nature and Existence** Relationship between human beings and nature, Mutual enrichment, Sustainable development, Environmental responsibility, Concept of co-existence, Role of engineers in environmental protection.	04
6	**Professional Ethics and Value-Based Engineering** Ethical responsibilities of engineers, Professional ethics, Social accountability, Case studies related to ethical dilemmas in engineering practice, Value-based decision making.	04

Text Books:

1. Gaur, R. R., Sangal, R., and Bagaria, G. P., A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi.
2. Tripathi, A. N., Human Values, New Age International Publishers.

Reference Books:

1. Universal Human Values, AICTE Model Curriculum.
2. Ethics in Engineering, Mike Martin and Roland Schinzinger, McGraw Hill.
3. Professional Ethics and Human Values, R. Subramanian, Oxford University Press.

MOOC/NPTEL Platform:

1. Sharma, A. K., Exploring Human Values: Visions of Happiness and Perfect Society, NPTEL, IIT Kanpur. https://nptel.ac.in/courses/109104068
2. Kapur, N. S., and Sreesailam, V., Applied Ethics, SWAYAM. https://onlinecourses.swayam2.ac.in/nou26_ge38/preview
3. Pandey, A., Essential Values and Ethics: Cultivating Professional Excellence and Career Advancement, SWAYAM. https://onlinecourses.swayam2.ac.in/imb26_mg88/preview

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Mini Project-I

Title of the Course Name: **Mini Project-I** Course Code:**25EE307**	**L**	**T**	**P**	**Credits**
	--	--	2	1
Evaluation Scheme:	ISE 1	MSE	ISE 2	ESE
Marks:	25	–	25	–

Pre-Requisite: Awareness of social, community or environmental issues relevant to engineering solutions

Course Objectives: The course aims:

1. To develop awareness of social responsibility and community challenges.
2. To enable students to identify real-life problems and design practical solutions.
3. To promote teamwork, leadership, and communication skills.
4. To enhance ethical conduct and professional documentation practices.

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

CO	Course Outcomes
CO1	Identify community needs through interaction and field surveys.
CO2	Analyze societal problems and design feasible intervention strategies.
CO3	Implement community-based projects using participatory methods.
CO4	Evaluate project outcomes and prepare professional technical documentation.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1	–	3	2	2	1	2	–	–	–	–
CO2	1	3	3	2	1	2	2	2	2	2	1	–	–	–
CO3	–	2	3	2	2	3	3	2	3	3	2	–	–	–
CO4	–	2	2	2	1	2	2	3	2	3	3	–	–	–

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Course Overview: The Community Engagement Project is designed to instill social responsibility among students and strengthen the connection between academic institutions and local communities. The project encourages students to apply their academic knowledge to solve real-life societal challenges and contribute towards sustainable development.

The guiding motto of this initiative is:

"Campus to Community"

Students are expected to identify socially relevant issues under the guidance of faculty mentors and propose or implement practical solutions. These projects promote collaboration, empathy, leadership skills and civic responsibility, enabling students to gain real-world experience while benefiting society.

Community engagement activities may cover diverse sectors such as:

- **Health**: Free health check-up camps, mental health awareness programs
- **Livelihood**: Skill development workshops, micro-entrepreneurship support
- **Education**: Digital literacy programs, mobile libraries, career guidance camps
- **Environment**: Rainwater harvesting awareness, solar lighting initiatives
- **Cultural Heritage**: Documentation of local history, cultural exchange programs

Through such initiatives, communities become active partners in development, creating a more inclusive and resilient society.

Sr.No.	Guidlines
1	**Project Overview:** Students will engage with a local community or a specific group within the community, such as schools, women's groups, farmers, etc., to identify challenges and collaboratively develop solutions. This hands-on project allows students to apply their knowledge and skills while fostering social responsibility. **Key Components of the Project:** **1. Community Selection & Understanding:** • **Community Identification:** Choose a community in need of support, whether it's based on location (urban, rural) or a demographic group (youth, elderly, marginalized populations). • **Problem Identification:** Engage with community members to identify pressing issues or challenges, such as education, health, environment or livelihoods. • **Cultural Sensitivity:** Understand the cultural, social and economic background of the community before engaging.

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2. Engagement Approach:

- **Participatory Method:**
  Involve the community at every stage—from identifying problems to developing and implementing solutions.
- **Partnership with Local Leaders:**
  Collaborate with community leaders, NGOs or local government representatives to ensure the project's effectiveness. Capacity Building: Focus on empowering community members with knowledge and skills that promote self-reliance.

3. Community Engagement Methodology:

A. Pre-Engagement Research:
Conduct preliminary research on the community to understand its demographics, socio-economic conditions, and existing services or infrastructure.
Review similar case studies or projects to gain insights into best practices.

B. Initial Field Visits:
Arrange field visits to meet with key stakeholders and community members. Hold informal meetings to build rapport and trust.

C. Needs Assessment:
Use surveys, interviews or focus group discussions (FGDs) to gather information about the community's needs.
Assess both short-term and long-term needs related to areas such as education, healthcare, sanitation, livelihoods and environment.

D. Project Design:
Based on the findings from the needs assessment, propose actionable solutions.
Ensure that the proposed interventions are feasible, sustainable and culturally appropriate.
Examples of interventions could include awareness campaigns, skill development workshops, environmental conservation activities or infrastructure improvements.

4. Implementation Plan:

A. Action Plan:

- **Timeline:** Create a clear timeline for implementing the project, with specific milestones.

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- **Roles & Responsibilities:** Assign specific tasks to team members and involve community members in the implementation process.
- **Resource Management:** Identify the resources (financial, material, human) needed to implement the project and create a budget.

B. Pilot Project (if applicable):

- Consider implementing a pilot phase to test the intervention on a smaller scale and make necessary adjustments before full-scale implementation.

C. Community Participation:

- Encourage community ownership by involving them in the execution phase (e.g., labor, materials, decision-making).
- Provide opportunities for community members to gain skills during the implementation, such as through training sessions or workshops.

5. Monitoring & Evaluation:

A. Monitoring Progress:

- Regularly assess the progress of the project against the action plan.
- Identify any challenges or delays and address them promptly in collaboration with the community.

B. Evaluation:

- Measure the impact of the project by comparing pre-project and post-project conditions.
- Use both qualitative and quantitative methods to evaluate success (e.g., improvements in literacy rates, health outcomes, or income levels).

C. Community Feedback:

- Gather feedback from the community on the effectiveness of the intervention.
- Hold feedback sessions with community leaders and participants to assess whether the project has met their expectations and addressed their needs.

6. Reporting & Documentation:

A. Final Report:

- Prepare a comprehensive report documenting the entire project process, from the initial engagement to implementation and evaluation.
- Include sections on:
  - Introduction and community background
  - Needs assessment findings
  - Project design and implementation strategy

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- Challenges and lessons learned
- Outcomes and impact analysis
- Recommendations for future engagement

B. Visual Documentation:

- Include photographs, videos or other visual media to document the process and outcomes.
- Create infographics or presentations that highlight key results and impact.

7. Reflection & Learning:

A. Team Reflection:

- Hold a reflection session with your project team to discuss the experiences, challenges and personal growth resulting from the project.
- Identify what worked well and what could be improved for future community engagement efforts.

B. Community Reflection:

- Engage the community in a reflective discussion about their experience with the project and the changes they've observed or experienced.

8. Ethical Considerations:

A. Informed Consent:

- Ensure that community members give informed consent before participating in the project, especially in data collection activities (e.g., interviews, surveys).
- Maintain transparency about the project's goals and the expected outcomes.

B. Respect for Cultural Norms:

- Respect the community's cultural practices, beliefs and social norms throughout the project.
- Avoid imposing external solutions that may not align with the community's values.

C. Confidentiality:

- Ensure confidentiality and privacy when dealing with sensitive information, especially personal or demographic data.

9. Submission Guidelines:

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	A. Final Report: • Submit a well-organized report that includes all phases of the project. **B. Presentation:** • Prepare a final presentation summarizing the project, including key results, challenges and recommendations. • Use visual aids, such as photos, videos or maps to illustrate the community engagement process and outcomes. **10. Evaluation Criteria:** • **Community Involvement (25%):** Extent of community participation in the project. • **Problem-Solution Match (25%):** Appropriateness of the solution developed for the identified community needs. • **Implementation Effectiveness (20%):** How effectively the project was executed, including timeliness and resource use. • **Impact (20%):** Tangible improvements or changes in the community. • **Reflection & Learning (10%):** Depth of insight gained through reflection on the process and outcomes. **11. Timeline:** • Week 1-2: Community research and selection. • Week 3-4: Field visits and needs assessment. • Week 5-6: Project design and planning. • Week 7-10: Implementation and monitoring. • Week 11-12: Evaluation and reporting.
2	**Deliverables** • Mini Project Proposal (Hard copy & Soft copy – before implementation) • Weekly Progress Logbook duly signed by the project guide • Final Project Report (Hard copy & PDF) • Working Model / Simulation Output (if applicable) • Presentation Slides (PPT) • Final Viva-Voce • Source Code / Design Files (CD / Pen Drive / Cloud Link) if any

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Electrical & Electronics Instrumentation Lab

Title of the Course Name: **Electrical & Electronics Instrumentation Lab** Course Code: **25EE308**	**L**	**T**	**P**	**Credits**
	--	--	2	1
Evaluation Scheme:	**ISE**		**ESE**	
Marks:	50		50	

Pre-Requisite: Basic Electrical engineering

Course Objective: The course aims to:	
1	Demonstrate working of analog measuring instruments (MI, PMMC and Dynamometer).
2	Measure and analyze active, reactive and apparent power.
3	Calibrate and test single-phase and three-phase energy meters.
4	Measure resistance, inductance and capacitance using bridge circuits.
5	Apply transducers, CRO, DSO and LVDT for accurate measurements.
6	Understand modern measurement systems, power analyzers and instrument transformers.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Demonstrate the operation and applications of analog measuring instruments such as MI, PMMC and dynamometer types.
CO2	Measure power and energy in single-phase and three-phase circuits using wattmeters, energy meters and calibration techniques.
CO3	Determine electrical quantities (resistance, inductance, capacitance) using bridge circuits and ammeter voltmeter methods
CO4	Apply modern measurement devices, transducers and instrument transformers for accurate electrical and physical measurements.

CO-PO Mapping:

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

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Course Content		
Experiment No.	**Experiment Title**	**Hrs**
1	Demonstration of various analog measuring instruments (MI, PMMC, Dynamometer type).	2
2	Measurement of active power in a three-phase circuit by using the two-wattmeter method.	2
3	Measurement of reactive power in a three-phase circuit by using the one-wattmeter method.	2
4	Calibration of a single-phase induction-type energy meter.	2
5	Measurement of resistance by the ammeter-voltmeter method.	2
6	Measurement of resistance using Wheatstone's / Kelvin's bridge.	2
7	Measurement of inductance using Maxwell's / Hay's / Anderson's bridge.	2
8	Measurement of capacitance using Schering's bridge.	2
9	Measurement of earth resistance using earth tester.	2
10	Measurement of displacement using LVDT & RVDT.	2
11	Measurement of temperature using RTD and thermistor.	2
12	Case Study/Demo of digital meters and oscilloscopes (CRO & DSO).	2
13	Case Study/Demo of power analyzers.	2
14	Case Study/Demo of the current transformer (CT) and potential transformer (PT).	2
Note:	*Minimum 10 practical/experiments will be completed.	

Text books:

1. A. K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, 9th Edition, Dhanpat Rai& Co., 2014.
2. J. B. Gupta, A Course in Electronics and Electrical Measurements and Instrumentation, 8th Edition, S. K. Kataria & Sons, 2012.

Reference books:

1. E. W. Golding and F. C. Widdis, Electrical Measurements and Measuring Instruments, 3rd Edition, Reem Publications, 2011.
2. R. S. Sirohi and Radhakrishnan, Electrical Measurement and Instrumentation, 3rd Edition, New Age International Publishers.

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Analog and Digital Electronics Lab

Title of the Course Name: **Analog and Digital Electronics Lab** Course Code: **25EE309**	**L**	**T**	**P**	**Credits**
	--	--	2	1
Evaluation Scheme:	**ISE**		**ESE**	
Marks:	50		50	

Pre-Requisite: Basic knowledge of electronic components, circuit theory, and Boolean algebra.

Course Objective: The course aims to:	
1	Understand the practical operation and characteristics of semiconductor devices and analog circuits such as MOSFETs, operational amplifiers and voltage regulators.
2	Design, implement and analyse analog electronic circuits including amplifiers, Schmitt triggers and regulated power supplies
3	Apply the principles of digital electronics for designing and verifying logic circuits such as code converters, multiplexers, flip-flops and logic gates.
4	Develop experimental skills, data interpretation ability and proper use of laboratory instruments while following standard safety and documentation practices.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Analyze the V–I and transfer characteristics of MOSFETs and determine key parameters such as threshold voltage.
CO2	Design and test analog circuits using operational amplifiers and voltage regulators for desired performance.
CO3	Design, implement, and verify digital logic circuits including code converters, multiplexers and flip-flops.
CO4	Perform laboratory experiments using standard instruments, interpret results and document observations systematically.

CO-PO Mapping:

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

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Course Content		
Experiment No.	**Experiment Title**	**Hrs**
1.	Analyze Drain (V–I) Characteristics of N-Channel MOSFET and Determine Threshold Voltage in Common-source configuration.	2
2.	Analyze Transfer Characteristics of MOSFET (ID–VGS)	2
3.	Design Inverting and Non inverting amplifier using OPAMP	2
4.	Evaluate Static and Dynamic Characteristics of Operational Amplifier	2
5.	Analyze Schmitt trigger.	
6.	Analyze Adjustable Voltage Regulation Using LM317 / LM337	2
7.	Design and Implement Binary to Gray Code and Gray to Binary Code Converter	2
8.	Analyze Adjustable Voltage Regulation Using LM317 / LM337	2
9.	Design and build Multiplexer and Demultiplexer	2
10.	Design Flip-flops using logic gates (S-R, D)	2
11.	Verify De Morgan's Theorem Using Logic Gates	2
12.	Analyze different digital logic families.	2
13.	To measure Slew rate and bandwidth of an Op-Amp	2
14.	To measure input bias current, input offset current and input offset voltage of an Op-Amp.	2
Note:	*Minimum 10 practical/experiments will be completed.	

Text books:

1. Boylestad, Robert & Louis, Nashelsky, Electronics Devices and Circuit Theory, Pearson.
2. Ramakant Gaikwad, Op-Amps and Linear Integrated Circuits, Pearson.
3. R. P. Jai, Modern Digital Electronics, Tata McGraw Hill Publication.

Reference books:

1. Donald Neamen, Electronic Circuits: Analysis and Design, Tata McGraw Hill.
2. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Tata McGraw Hill.
3. Anandkumar, Digital Circuits, PHI.

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DC Machines and Transformer

Course Name: **DC Machines and Transformer** Course Code: **25EE401**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Physics, Basic Electrical Engineering

Course Objective: The course aims to:	
1	Understand the principles of electromechanical energy conversion.
2	Analyze the construction, operation, characteristics, control, testing and applications of DC generators and motors.
3	Analyze the working operation of single-phase transformers.
4	Evaluate construction, working principles three-phase transformer and special transformer.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Identify energy conversion principles, torque production, MMF and EMF concepts related to rotating electrical machines.
CO2	Analyze construction, EMF generation, armature reaction, commutation and performance of DC generators and Motor.
CO3	Analyze the performance of single-phase transformers.
CO4	Evaluate construction, working principles three-phase transformer and special transformer.

CO-PO Mapping:

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

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Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Fundamentals of DC Machines** Singly Excited Magnetic System and Doubly Excited Magnetic system. Physical concept of torque production; Electromagnetic torque and Reluctance torque. Concept of General terms pertaining to Rotating Machines: Electrical & Mechanical degree, Pole pitch, Coil, Generated EMF in full pitched coil, Generated EMF in a short pitched coil, Distribution factor, Pitch factor.	6
2	**DC Generator** Construction of D.C. machines, commutator and brush arrangement, EMF equation, torque equation, armature winding and its types, armature reaction: Demagnetization and cross magnetization ampere turns, principle of compensation, compensating winding, methods to minimize the effect of armature reaction, Process of commutation, Methods to improve commutation.Application of Generator	8
3	**DC Motor** Concept of Motoring, types of motor, Concept of back emf, characteristics of DC motors, Method of speed controls, concept of braking of DC separately excited motors (Rheostatic, Regenerative and plugging). Parallel and series operation of motor, starter for shunt and series motor, Design of grading of resistance of starters, testing: Losses and efficiency, Brake load test, Swinburne test, Hopkinson's test, Retardation test, field test, Application of Motor.	8
4	**Single Phase Transformer** Review of EMF equation, Equivalent Circuit and Phasor diagram of Transformer. Voltage Regulation of Transformer: - Voltage Regulation, Condition for Zero Voltage Regulation, Condition for Maximum Voltage Regulation. Transformer Losses and Efficiency - Losses, Efficiency, Condition for Maximum Efficiency, Energy Efficiency, All day Efficiency, Separation of Hysteresis and Eddy current losses Testing of Transformer: - Polarity Test, Load Test, Review of OC and SC test, Sumpner's Test.	8
5	**3-Phase Transformer** Determination of polarity and connections (star/star, star/delta, delta/star, star/zigzag, delta/zigzag, open delta), Phasor group's performance of transformers: sumpners test, Equivalent delta. Effect of unbalanced loading, Production of Harmonics in Transformer and its suppression, 3 phase to 2 phase transformation, Scott connection 3 phase to 6 phase connections, Parallel operation of Transformers, Introduction to Tap changing transformer and its function.	8
6	**Special Transformers** Potential transformer, Current transformer, Pulse transformer, Audio frequency transformer, Grounding transformer, Pulse transformer	4

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Text books:
1. Bimbhra P.S., Electric Machinery , Khanna Publisher, 2. Kothari D.P, Nagrath I.J., Electric Machines, TMH Publications 3. Umanand L, Bhat S.R., "Design of Magnetic Components for Switched mode Power Converters", Wiley Eastern Ltd.

Reference books:
1. Ashfaq Husain, Electric Machines, Dhanpat Rai and co. publications. 2. M.G. Say and E. O. Taylor, Direct current machines, Pitman publication

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Power System - I

Course Name: **Power System - I** Course Code: **25EE402**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Physics

Course Objective: The course aims to:	
1	Understand the structure and operation of electrical power systems in the Indian context.
2	Analyze electrical and mechanical characteristics of transmission lines.
3	Introduce AC & DC distribution systems and voltage control techniques.
4	Familiarize students with switchgear, grounding, and basic protection schemes.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Discuss grounding, and basic protection schemes.
CO2	Analyze transmission line parameters and performance
CO3	Evaluate mechanical design aspects of overhead lines and underground cables.
CO4	Explain circuit breakers, grounding techniques and basic protection schemes.

CO-PO Mapping:

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

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Power Systems** Evolution of power systems, structure of power systems (generation, transmission, distribution), Indian power system scenario, regional grid and national grid, conventional energy sources, renewable energy sources, integration of renewable energy, concept of smart grid, concept of microgrid, distributed generation (DG), impact of electric vehicles (EVs) on power system, real power, reactive power, apparent power, power factor, per-unit system.	7

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2	**Transmission Line Parameters** Transmission line resistance, inductance of transmission lines, capacitance of transmission lines, single-phase transmission lines, three-phase transmission lines, symmetrical and unsymmetrical spacing, concept of geometric mean radius (GMR), concept of geometric mean distance (GMD), skin effect, proximity effect, effect of earth on capacitance, Numericals.	7
3	**Transmission Line Models & Performance** Classification of transmission lines (short, medium, long), transmission line equivalent circuits, ABCD parameters, voltage regulation of transmission lines, transmission efficiency, Ferranti effect, corona phenomenon (causes, effects, reduction methods), surge impedance loading (SIL), power transmission capability, methods of voltage control in transmission systems, Numericals.	7
4	**Mechanical Design of Transmission Lines** Types of conductors (AAC, ACSR), selection of conductor materials, types of insulators, applications of insulators, voltage distribution across insulator string, string efficiency, sag and tension calculations for equal level supports, sag and tension calculations for unequal level supports, effect of wind loading, effect of ice loading on transmission lines, Numericals.	7
5	**Switchgear and Grounding** Circuit breakers and arc phenomenon, methods of arc interruption, types of circuit breakers (oil, air, SF_6, vacuum), ratings of circuit breakers, selection criteria of circuit breakers, neutral grounding: solid grounding, resistance grounding, reactance grounding, introduction to auto-reclosing schemes, Numericals.	7
6	**AC & DC Distribution System** Classification of distribution systems, requirements of distribution systems, design considerations of distribution systems, AC distribution systems, AC distribution calculations, DC distribution systems, DC distribution calculations, three-wire DC distribution system, Numericals.	7

Text books:

1. V.K. Mehta and Rohit Mehta, "Basic Electrical Engineering", S. Chand and Company Ltd, 6th Edition, 2012.
2. B. L. Theraja, "A Textbook of Electrical Technology – Volume I", S. Chand and Company Ltd, 23rd Edition, 2024.
3. D. P. Kothari, I. J. Nagrath," Basic Electrical Engineering" S Tata McGraw Hill,4th Edition, 2019.

Reference books:

1. J.B. Gupta, "Basic Electrical Engineering", S.K. Kataria & Sons,1st Edition, 2024.
2. S.K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson, 2nd Edition, 2017.
3. Dr. Vivekananda Mukherjee & Dr. Aparajita Mukherjee, "Basic Electrical Engineering", Khanna Publishers, 2nd Edition, 2022.

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Network Analysis

Course Name: **Network Analysis** Course Code: **25EE403**	**L**	**T**	**P**	**Credits**
	3	1	--	4
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic Electrical Engineering

Course Objective: The course aims to:	
1	Understand and analyse DC and AC electrical circuits.
2	Apply network theorems for circuit simplification.
3	Study the transient response of electrical circuits.
4	Use Laplace, transform techniques in circuit analysis.
5	Understand two-port networks and network functions.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Apply KCL, KVL, mesh and nodal analysis techniques to solve DC electrical circuits.
CO2	Analyze steady-state AC circuits to determine impedance, power, power factor and resonance characteristics.
CO3	Evaluate transient responses of RL, RC and RLC circuits using differential equation and Laplace transform methods.
CO4	Analyze two-port networks and network functions in terms of parameters, poles and zeros.

CO-PO Mapping:

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

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Analysis of DC Circuits** Introduction to electrical networks, Types of sources (independent and dependent),	**10**

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	Source transformation, Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL), Mesh and nodal analysis of DC networks with independent and dependent sources, Concept of supermesh and supernode, Star–Delta (Δ–Y) transformations, Linearity and duality concepts.	
2	**Circuit Theorems** Introduction to network theorems, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem.	7
3	**Analysis of AC Circuits** Sinusoidal waveforms and phasor representation, Impedance and admittance concepts, Analysis of R-L, R-C and R-L-C circuits (series and parallel), AC power relations: real, reactive and apparent power; Power factor; Resonance: series and parallel resonance; Bandwidth, Q-factor and selectivity.	7
4	**Transient Analysis** Transient response of RL, RC, and RLC circuits under DC excitation; Evaluation of initial and final conditions; Solution of first-order and second-order differential equations.	7
5	**Laplace Transform** Introduction and definition of Laplace transform; Properties of Laplace transforms; Inverse Laplace transform; Application of Laplace transform to integrodifferential equations; Circuit analysis using Laplace transform.	7
6	**Two-Port Networks** Single-port and two-port networks; Z-parameters, Y-parameters, h-parameters, and ABCD parameters; Interrelation among two-port parameters; Driving-point functions and transfer functions; Poles and zeros of network functions.	7

Text books:

1. M. E. Van Valkenburg, Network Analysis, 3rd Edition, Prentice Hall of India.
2. William H. Hayt Jr., Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, 8th Edition, McGraw-Hill Education.
3. D. Roy Choudhury, Networks and Systems, New Age International Publishers.

Reference books:

1. A. Chakrabarti, Circuit Theory: Analysis and Synthesis, Dhanpat Rai& Co.
2. C. L. Wadhwa, Electrical Network Analysis, New Age International Publishers.
3. Joseph A. Edminister and Mahmood Nahvi, Schaum's Outline of Electric Circuits, McGraw-Hill Education.
4. M. E. Van Valkenburg, Network Analysis, PHI Learning (Additional reference).

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Solar & Wind Energy Technologies

Course Name: **Solar & Wind Energy Technologies** Course Code: **25MDM404G**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Physics, Fundamentals of Electrical Engineering, Renewable Energy Basics

Course Objective: The course aims to:	
1	Understand fundamentals, classification, benefits of renewable energy.
2	Learn solar radiation principles and basic solar technologies.
3	Analyze solar technologies, systems, performance and applications.
4	Study wind energy principles, turbines, systems, applications.
5	Understand wind energy systems, control, applications and impacts.
6	Learn hybrid systems, storage concepts, and future trends.
Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain renewable energy concepts, sources, benefits and global significance.
CO2	Illustrate solar radiation principles, energy technologies, systems, applications, limitations.
CO3	Explain wind energy fundamentals, technologies, applications, impacts, future trends.
CO4	Discuss hybrid renewable energy systems, applications, integration and future scope.

CO-PO Mapping:

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

Course Content

Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Renewable Energy** Types of Grid, Energy Basics & Global Energy Scenario-Definition, Present Energy Scenario, Problems with Conventional Energy, Renewable Energy-	**6**

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	Definition, Need for Renewable Energy, Advantages & Limitations of Renewable Energy, Classification of Renewable Energy Sources-Based on Origin, Based on Availability, Basics of solar and wind energy, Environmental and economic benefits.	
2	**Solar Radiation & Solar Energy Fundamentals** Introduction to solar energy, Direct & Diffused Radiation, Extra-terrestrial& Terrestrial radiations, Interaction of Solar Radiation with Atmosphere, Types of Solar Radiation, Factors Affecting Solar Radiation, Solar cell fundamentals, Solar cell, Module, Panel & Array construction, Statistics of Solar farms in India & Abroad, Numericals	**6**
3	**Solar Energy Technologies & Applications** Introduction to Solar Thermal Systems, Flat Plate Collectors (FPC), Applications of Solar Thermal Systems, Components of Solar PV Systems, Types of Solar PV Systems, Applications of Solar PV, Factors Affecting Solar System Performance, Advantages & Limitations of Solar Energy Technologies, Statistics of Wind farms, Numericals	**6**
4	**Wind Energy Fundamentals** Introduction to wind energy, role & potential of wind energy, advantages and disadvantages of wind energy conversion system, site selection, Classification of wind turbines & generation-Horizontal axis wind mills, Vertical axis wind mills, sub-system horizontal axis wind turbine generator, sub-system vertical axis wind mills.	**6**
5	**Wind Energy Technology & Applications** Concept of Wind Energy Conversion Systems (WECS),Types of WECS, Need for Control in Wind Turbines, Control Methods, Safety Systems, Wind Farm Planning, Modes of wind power generation-standalone mode, Backup mode like wind-diesel hybrid system, Environmental & Social Impact, Future Trends in Wind Energy.	**6**
6	**Hybrid Systems, Storage & Future Trends** Hybrid Renewable Energy Systems, Types of Hybrid Renewable Energy Systems, Advantages of Hybrid Systems, Working Principle of Solar–Wind Hybrid System, Applications of Hybrid Systems, Standalone vs Grid-Connected Hybrid Systems, Future Trends in Hybrid Systems-Emerging Technologies, Policy, Career Scope & Industry Outlook.	**6**

Text books:

1. B. R. Gupta, "Generation of Electrical Energy", S. Chand and Company Ltd, 7th Edition, 2017.
2. S. L. Uppal, " Electrical Power", Khanna Publishers,10th Edition, 1980.
3. Gaurav Gadage," Electrical Power Generating Systems" Electrotech Publication,3rd Edition, 2023.

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Reference books:

1. Soni, Gupta, Bhatnagar "Electrical Power", Dhanpat Rai& Sons, 9th Edition, 2024.
2. Earnest, Joshua, "Wind Power Technologies", PHI Learning, New Delhi, 3rd Edition, 2019.
3. B. H. Khan, "Non-Conventional energy resources", Tata McGraw-Hill Publication Company Limites, 4th Edition, 2022.

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IoT and IoV for Electrical Systems

Course Name: **IoT and IoV for Electrical Systems** Course Code:**25MDM404H**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Fundamentals of Electrical Engineering, Basic Electronics

Course Objective: The course aims to:	
1	Introduce basic concepts and architectures of IoT and IoV for electrical systems.
2	Explain sensors, embedded platforms and communication technologies used in electrical applications.
3	Apply IoT and IoV concepts to smart grids, power systems and electric mobility.
4	Understand cybersecurity, ethical and sustainability issues in IoT and IoV-based electrical systems.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain the basic concepts, architecture and components of IoT and IoV used in electrical systems.
CO2	Explain sensors, embedded platforms and communication technologies for monitoring and control of electrical systems.
CO3	Apply IoT and IoV concepts to smart grids, substations, power system monitoring and electric mobility applications.
CO4	Discuss cybersecurity, ethical, safety and sustainability aspects of IoT and IoV enabled electrical systems.

CO-PO Mapping:

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

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Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to IoT and IoV** Definition, evolution and scope of Internet of Things (IoT), Basic architecture (Perception, network, middleware and application layers), Introduction to Internet of Vehicles (IoV), Role of IoT and IoV in modern electrical systems, Comparison of traditional electrical systems vs IoT-enabled systems, Applications overview (smart grids, substations, EVs and energy management)	7
2	**Sensors, Actuators and Embedded Platforms** Sensors used in electrical systems (voltage, current, temperature, vibration), Actuators and control elements, Signal conditioning basics, Embedded platforms (Arduino, Raspberry Pi, ESP-based systems), Interfacing sensors with embedded controllers, Power requirements and reliability considerations	7
3	**Communication Technologies for IoT and IoV** Wired vs wireless communication in electrical systems, IoT communication protocols (MQTT, HTTP, CoAP), Wireless technologies(Wi-Fi, Bluetooth, ZigBee, LoRaWAN), Vehicle communication concepts (V2V, V2I, V2G), Data transmission challenges in power and vehicular environments, Role of communication standards in smart electrical infrastructure	7
4	**IoT Applications in Electrical Power Systems** IoT-based smart metering and energy monitoring, Substation automation using IoT concepts, Condition monitoring of transformers and machines, Fault detection and predictive maintenance, Role of cloud and edge computing in power systems, Case studies on IoT-enabled electrical utilities	7
5	**IoV and Electric Mobility Applications** IoV architecture for electric vehicles, EV charging infrastructure and IoT integration, Vehicle-to-Grid (V2G) concept, Intelligent traffic-energy coordination, Data analytics for EV fleet management, Role of IoV in sustainable transportation	7
6	**Cybersecurity, Ethics and Sustainability** Cyber threats in IoT-based electrical systems, Data privacy and security challenges, Ethical issues in data-driven electrical networks, Safety and legal considerations, Sustainability and energy efficiency through IoT/IoV, Future trends in intelligent electrical systems	7

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Text books:

1. Rajkumar Buyya and Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Morgan Kaufmann (Elsevier), 2016.
2. Hlaing, W. and Thi, N., "Smart Grid Systems: Modeling, Control and Optimization", Springer, 2019.
3. Larson, E. and Kirschen, D., "Electric Power Systems: A Conceptual Introduction", Wiley, 2018.

Reference books:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Fang, X., "Smart Grid - The New and Improved Power Grid", IEEE Power & Energy Magazine, 2012.
3. Chen, S. and Hu, J., "Internet of Vehicles and Its Applications in Electric Vehicle Systems", Springer, 2020.
4. William Stallings, Foundations of Modern Networking: SDN, NFV, QoS, IoT and Cloud, Pearson, 2016.

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Open Elective–I: Electrical Safety & Standards

Course Name: **Open Elective–I: Electrical Safety & Standards** Course Code: **25OE405D**	**L**	**T**	**P**	**Credits**
	2	--	--	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic Electrical Engineering

Course Objective: The course aims to:	
1	Create awareness about electrical hazards and safety practices in domestic, industrial and commercial installations.
2	Introduce national and international electrical safety standards and regulatory frameworks.
3	Enable students to identify unsafe electrical conditions and recommend preventive measures.
4	Develop an understanding of inspection, testing, earthing and protection systems for safe electrical operation.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain electrical hazards and safety principles applicable to electrical systems.
CO2	Identify and select appropriate electrical safety devices and protection methods.
CO3	Interpret electrical standards and regulations for safe installation and operation.
CO4	Analyze electrical installations for safety, sustainability and regulatory compliance.

CO-PO Mapping:

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

Course Content

Unit No.	Unit title and Content	Hrs
1	**Fundamentals of Electrical Safety:** Nature of electrical hazards: shock, burns, arc flash, fire, Effects of electric current on human body, Factors influencing severity of electrical accidents, Safety terminology and classifications, Overview of electrical accidents and case studies.	5

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2	**Electrical Safety Devices and Protection Systems :** Fuses: types, characteristics, selection, Circuit breakers: MCB, MCCB, ELCB, RCCB, RCBO, Overcurrent and earth fault protection, Insulation and isolation techniques, Role of protective relays (introductory).	5
3	**Earthing and Bonding Standards** Purpose and importance of earthing, Types of earthing: plate, pipe, rod, strip, Earth resistance measurement methods, Bonding practices, Earthing standards as per IS and IEEE	5
4	**Electrical Installation Safety and Inspection** Safety in residential, commercial, and industrial installations, Wiring practices and color codes, Inspection procedures and safety checklists, Electrical testing: insulation resistance, continuity, polarity, Maintenance safety practices	5
5	**Electrical Standards and Regulatory Framework** Indian Electricity Rules (IER), National Electrical Code (NEC – India), Bureau of Indian Standards (BIS), IEC and IEEE standards overview, Safety certification and compliance	5
6	**Emerging Safety Challenges and Sustainability** Electrical safety in renewable energy systems, EV charging safety standards, Safety in smart grids and IoT-based electrical systems, Environmental and sustainability considerations, Electrical safety management systems	5

Text books:

1. John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel, "Electrical Safety Handbook", McGraw-Hill Education
2. S. Rao, "Electrical Safety, Fire Safety and Risk Management", Khanna Publishers, New Delhi
3. H. Cotton, "Electrical Technology – Safety and Protection", CBS Publishers

Reference books:

1. Bureau of Indian Standards (BIS), National Electrical Code (NEC) of India, SP 30
2. Bureau of Indian Standards (BIS), IS 3043: Code of Practice for Earthing
3. IEC (International Electrotechnical Commission), IEC 60364 – Electrical Installations of Buildings

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Entrepreneurship Development

Title of the Course Name: **Entrepreneurship Development** Course Code:**25EE406**	**L**	**T**	**P**	**Credits**
	1	--	--	1
Evaluation Scheme-	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks-	25	--	25	--

Pre-Requisite: Basic knowledge of management

Course Objectives: The course aims:
1. To introduce the concept of entrepreneurship and its significance in economic development.
2. To develop entrepreneurial competencies and motivation.
3. To familiarize with business planning and project management.
4. To create awareness about start-up ecosystem, government schemes, and legal frameworks.

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

CO	Course Outcomes
CO1	Understand entrepreneurship concepts, startup ecosystem and ethical responsibilities in engineering enterprises.
CO2	Analyze market opportunities and feasibility of technology-driven business ideas.
CO3	Develop a basic business plan considering sustainability, project planning and teamwork.

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	–	–	–	–	–	2	–	3	–	–	2	–	2
CO2	–	3	2	–	–	–	–	–	–	–	–	–	2
CO3	–	–	3	–	–	–	2	–	2	2	–	–	3

Course Content		
Unit No.	**Contents**	**Hrs.**
1	**Introduction to Entrepreneurship:** Definition, Importance, Entrepreneur vs. Manager, Entrepreneurial motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, Concept of Entrepreneurship.	3

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2	**Corporate Entrepreneurship**: Introduction, Flavors of corporate entrepreneurship, Corporate venturing, Entrepreneurship, organizational transformation, Industry rule bending, Need for corporate entrepreneurship, domain of corporate entrepreneurship	4
3	**Business Plan and Project Management:** Idea generation, Screening and Project Identification, Creative Performance, feasibility study, market survey, business plan elements.	4
4	**Family and Non Family Entrepreneur & Women entrepreneurs:** Role of Professionals, Professionalism vs. family entrepreneurs, Role of Woman entrepreneur, Factors influencing women entrepreneur, Challenges for women entrepreneurs, Growth and development of women entrepreneurs in India	4

Text Books:

1. Vasant Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing.
2. S.S. Khanka, Entrepreneurial Development, S. Chand.
3. P. Saravanavel, Entrepreneurship Development, Ess Pee Kay Publishing House.

Reference Books:

1. C.B. Gupta & N.P. Srinivasan, Entrepreneurial Development, Sultan Chand & Sons.
2. Hisrich, Peters & Shepherd, Entrepreneurship, McGraw Hill.
3. David H. Holt, Entrepreneurship: New Venture Creation, Prentice Hall of India.

MOOC/NPTEL Platform:

1. **Entrepreneurship Prof. S. S. S. Kumar (IIT Madras)**
   https://nptel.ac.in/courses/110106141
2. **Entrepreneurship and Innovation Prof. V. Gopal (IIT Roorkee)**
   https://nptel.ac.in/courses/110107094
3. **Developing Soft Skills and Personality Prof. T. Ravichandran (IIT Kanpur)**
   https://nptel.ac.in/courses/109104115

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Quantitative Aptitude and Logical Reasoning - I

Course Name: **Quantitative Aptitude and Logical Reasoning - I** Course Code: **25EE407**	**L**	**T**	**P**	**Credits**
	1	--	--	1
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	--

Course Description:
This course builds essential skills in arithmetic, percentages, ratios, profit & loss, and interest, alongside problem-solving methods like LCM-HCF, time-rate-work, and SI-CI. It also covers logical reasoning topics—blood relations, coding-decoding, direction sense, and series—to sharpen analytical thinking. Learners gain speed, accuracy, and adaptability for exams, recruitment, and entrepreneurial decisions.

Pre-Requisite: Basic concepts of

Basic Mathematical Knowledge, Language Proficiency and Analytical Readiness

Course Objective: The course aims to:	
1	Develop the ability to recall and explain fundamental principles, enabling learners to build a strong conceptual foundation for quantitative and reasoning skills.
2	Gain proficiency in applying methods and techniques to solve structured problems and practical scenarios with accuracy and confidence.
3	Cultivate analytical thinking by examining relationships, patterns, and logical structures, thereby enhancing decision-making and problem validation skills.
4	Integrate diverse approaches and create effective strategies, supporting innovation and adaptability in academic, professional, and real-world contexts.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Recall key concepts of Mathematics for placements and business applications.
CO2	Apply quantitative methods to solve structured numerical problems in exams and entrepreneurial contexts.
CO3	Analyse logical reasoning problems to identify patterns and enhance reasoning skills.
CO4	Evaluate alternative solution approaches for efficiency and create integrated solutions supporting innovation and adaptability.

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CO-PO Mapping :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	3	-	-	-	-	3	-	-	-	-	-
CO4	-	-	3	-	1	-	2	-	-	1	-	-	-	-

Course Content

Unit No.	Description	Hrs
1	**Foundations of Quantitative Aptitude :** **Number Systems-** Basics, Base System, Exponents,Numerical Analogy-Basics, Relation between two numbers. **Percentage-** numerical Percentage Understand Conversion, Single change, Successive change, Product Stability, Applications of percentage. **Ratios and Fractions-** Comparison of Ratio & fraction, Properties of Ratio & Proportion, Mean Proportion, Joint ratio.	3
2	**Averages, Profit & Loss, and Interest Calculations:** **Average -** Average, Allegations Weighted average, Concept of average speed & allegation, Applications of Average & mixture allegation. **Profit & Loss -** Same selling price different Cost Price, Same cost price different selling price, Concept of false scale. **Simple and Compound Interest-** Basics, Difference between SI CI, Conversion Periods, Depreciation.	3
3	**Advanced Quantitative Methods :** **LCM and HCF -** LCM and HCF, Factors, Cyclicity, Different Methods to find LCM-HCF, HCF-LCM relation, Applications of HCF-LCM. **TRW-** Time, Rate and Work-Unitary Method, LCM Method, Calculation of remuneration. **Pipes & Cisterns-**Concept of negative work, LCM Method.	3
4	**Logical Reasoning Essentials :** **Blood Relations** -Symbols, generation of tree diagram, types of questions-pointing towards person, tree based, coded blood relation.	3

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	Coding Decoding - Letter-Letter, Letter- Number, Number-Number, Letter-Symbol, Mixed Coding. **Direction Sense and Time Numericals -** Basics, shadow-based concept, Concept of local time zone (IST, GMT, Longitude, Latitude), Problems on local time difference, Coded direction sense.	
5	**Pattern Recognition and Analytical Series :** **Series Completion -** Types of series, Number series pattern, Letter series, Alphanumeric series. **Pattern, Step Completion -** Image completion, Mirror images, Water images, input-Output. **Syllogism-** Basics, Types of Statements, Different diagram for different statements, Types of Questions-Based on Conclusion, Based on Statements.	**3**

Reference books:

1. R. S. Aggarwal, "Quantitative Aptitude", S Chand Publishing, New Delhi.
2. R. S. Aggarwal, "Logical Reasoning", S Chand Publishing, New Delhi.
3. Arun Sharma, "Quantitative Aptitude", McGraw Hill Publishing, New Delhi.
4. Arun Sharma, "Logical Reasoning", McGraw Hill Publishing, New Delhi.

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Constitution of India

Course Name: **Constitution of India**	**L**	**T**	**P**	**Credits**
Course Code: **25EE408**	2	-	-	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	--

Course Description:

This course provides an overview of the Indian Constitution, focusing on its historical background, structure, and key features. It covers fundamental rights, directive principles, duties, and the functioning of the Union, State, and local governments. The course also explains constitutional bodies, amendment processes, emergency provisions, and Centre–State relations. It promotes active citizenship and highlights the role of engineers in democratic governance and nation-building.

Pre-Requisite: Basic knowledge of Indian History

Course Objective: The course aims to:	
1	Introduction to the historical and legal foundations of the Indian Constitution and its key features.
2	Understanding of the structure and functioning of Union, State and local governments.
3	Familiarization with fundamental rights, duties, directive principles and constitutional bodies.
4	Promotion of responsible citizenship and active participation in a democratic society.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Understand and explain the historical and legal foundations of the Indian Constitution along with its key features.
CO2	Describe the structure, functions, and governance mechanisms of Union, State and local governments, including the roles of constitutional bodies, Fundamental Rights, Duties and Directive Principles.
CO3	Demonstrate an understanding of responsible citizenship and actively participate in a democratic society through constitutional values and practices.

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CO-PO Mapping:												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	–	–	–	–	–	2	2	–	1	–	1	–	–
CO2	–	–	–	–	–	2	2	–	1	–	1	–	–
CO3	–	–	–	–	–	2	2	–	1	–	1	–	–

Course Content		
Unit No.	**Contents**	**Hrs**
1	**Introduction to the Constitution** Historical background of the Indian Constitution, Framing of the Constitution and the Constituent Assembly, Features of the Indian Constitution, Preamble and its significance, Citizenship: Types and constitutional provisions.	5
2	**Fundamental Rights and Duties** Fundamental Rights: Definition, types and limitations, Directive Principles of State Policy (DPSP), Fundamental Duties of Indian citizens, Relationship between Fundamental Rights and DPSP.	5
3	**Union Government Structure** Parliament: LokSabha and RajyaSabha – composition and functions President: Powers, election and role, Prime Minister and Council of Ministers, Judiciary: Supreme Court – structure, powers and independence.	5
4	**State Government and Local Governance** State legislature and Governor, Chief Minister and State Council of Ministers, High Courts and Subordinate Courts, Panchayati Raj System and Municipalities – 73rd & 74th Amendments.	5
5	**Constitutional Bodies and Amendments** Different types of Constitutional Bodies, Constitutional amendment process (Article 368), Major constitutional amendments (42nd, 44th, 73rd, 74th, 86th).	5
6	**Important Provisions and Current Developments** Emergency provisions: National, State and Financial, Official language and special provisions, Center-State relations: Legislative, administrative, financial, Recent constitutional and legal developments, Role of citizens and engineers in democracy and governance.	5

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Text Books:

1. M. Laxmikanth, Indian Polity, McGraw-Hill Education
2. D.D. Basu, Introduction to the Constitution of India, LexisNexis
3. J.N. Pandey, Constitutional Law of India, Central Law Agency

Reference Books:

1. Subhash C. Kashyap ,Our Constitution: An Introduction to India's Constitution and Constitutional Law, National Book Trust
2. V.N. Shukla ,Constitution of India, Eastern Book Company
3. Brij Kishore Sharma, Introduction to the Constitution of India, Pearson Education

MOOC/NPTEL Platform:

1. NPTEL Course: Constitution of India, Prof. M.K. Bhandari (Rajasthan Technical University)
   https://nptel.ac.in/courses/109/104/109104074
2. Indian Government and Politics, Prof. R. Sudarshan (IIT Delhi)
   https://nptel.ac.in/courses/109/104/109104068

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Skill Enhancement

Title of the Course Name: **Skill Enhancement** Course Code: **25EE409**	**L**	**T**	**P**	**Credits**
	--	--	2	1
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	--

Pre-Requisite: Fundamentals of Electrical Engineering, Basic Mathematics, Computer Awareness

Course Objectives: The course aims to:	
1	Introduce MATLAB/PSpice as an intuitive software tool for modeling and simulation of electrical systems.
2	Enable students to visualize and analyze electrical quantities such as voltage, current and power without advanced programming.
3	Develop conceptual understanding of DC, AC and three-phase circuit behavior using simulation-based learning.
4	Apply software tools to simple smart electrical applications and develop technical reporting and presentation skills.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Use MATLAB/PSpiceto model and simulate basic electrical systems.
CO2	Analyze voltage, current and power characteristics of electrical circuits using simulation results.
CO3	Model and simulate DC, AC and three-phase electrical circuits under different operating conditions.
CO4	Apply simulation tools to simple smart electrical applications and communicate results effectively.

CO-PO Mapping:

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

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Course Content		
Experiment No.	**Experiment Title**	**Hrs**
1	Explore the MATLAB//PSpice for Electrical System Modeling.	2
2	Create and Simulate Simple MATLAB/PSpice for Electrical Calculations.	2
3	Simulate DC Electrical Circuits and Visualize Voltage and Current Waveforms.	2
4	Generate and Analyze AC Voltage and Current Waveforms.	2
5	Compute and Interpret Instantaneous, Average and RMS Power.	2
6	Model and Analyze R, RL and RLC Circuits in Time Domain.	2
7	Evaluate Frequency Response and Identify Resonance in RLC Circuits.	2
8	Model and Analyze a Single-Phase Transformer under Load Conditions.	2
9	Simulate and Analyze Three-Phase Balanced Electrical Systems.	2
10	Investigate the Effect of Load Variation on Electrical System Performance.	2
11	Simulate Short-Circuit Conditions and Observe System Response.	2
12	Develop and Simulate a Basic Smart Energy Meter Model.	2
13	Analyze Electrical Load Profiles for Energy Monitoring Applications.	2
14	Assess the Impact of EV Charging or Battery Storage on Electrical Load.	2
Note:	* Minimum 10 practical/experiments will be completed.	

Text books:

1. MathWorks, MATLAB and Simulink User Documentation, The MathWorks Inc.
2. Ashfaq Husain, Electrical Power Systems, CBS Publishers (for modeling concepts).

Reference books:

1. Hadi Saadat, Power System Analysis, McGraw-Hill.
2. Ned Mohan, Power Electronics: Converters, Applications and Design, Wiley.
3. Stephen J. Chapman, MATLAB Programming for Engineers, Cengage Learning.
4. MathWorks Tutorials and Simulink Onramp (Online Resources).

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DC Machines and Transformer Lab

Title of the Course Name: **DC Machines and Transformer Lab** Course Code: **25EE410**	**L**	**T**	**P**	**Credits**
	--	--	2	1
Evaluation Scheme:	**ISE**			**ESE**
Marks:	50			50

Pre-Requisite: Fundamentals of Physics, Basic Electrical Engineering

Course Objective: The course aims to:	
1	Understand the operating characteristics and performance of DC generators and DC motors.
2	Study different testing methods for DC machines.
3	Analyze the performance, voltage regulation, and efficiency of single-phase and three-phase transformers.
4	Develop practical skills in parallel operation and safe handling of electrical machines and transformers.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Analyze performance tests on DC generators and motors.
CO2	Evaluate losses, efficiency, voltage regulation and characteristics of single-phase transformers.
CO3	Analyze the operation and performance of three-phase transformers.
CO4	Demonstrate practical skills in parallel operation of transformers and interpret experimental results.

CO-PO Mapping:

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

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Course Content		
Experiment No.	**Experiment Title**	**Hrs**
1	Determination of Open Circuit Characteristics (O.C.C.) of a Separately Excited DC Generator	2
2	Performance Evaluation of DC Shunt Motor by Direct Load Test	2
3	Performance Evaluation of DC Series Motor by Direct Load Test	2
4	Speed Control of DC Shunt Motor by Armature Voltage Control and Field Flux Control Methods	2
5	Efficiency Determination of DC Shunt Motor by Swinburne's Test	2
6	Efficiency Determination of DC Shunt Motor by Hopkinson's Test (Regenerative Test)	2
7	Determination of Equivalent Circuit Parameters of Single-Phase Transformer by Open Circuit and Short Circuit Tests	2
8	Efficiency and Temperature Rise Test on Single-Phase Transformer by Sumpner's Test (Back-to-Back Test)	2
9	Performance Evaluation of Single-Phase and Three-Phase Transformer by Direct Load Test	2
10	Parallel Operation of Single-Phase Transformers and Load Sharing Characteristics	2
11	Phase Conversion from Three-Phase to Two-Phase Supply Using Scott Connection	2
12	Determination of Voltage Regulation of Single-Phase Transformer by Direct Loading Method	2
13	Performance Evaluation of Three-Phase Transformer by Direct Load Test	2
Note:	*Minimum 10 practical/experiments will be completed.	

Text books:

1. Bimbhra P.S., Electric Machinery , Khanna Publisher
2. Kothari D.P, Nagrath I.J., Electric Machines, TMH Publications

Reference books:

1. J. B. Gupta," Laboratory Manual for Basic Electrical Engineering", S. K. Kataria & Sons, 6th Edition, 2019.
2. S. K. Bhattachary, "Experiments in Basic Electrical Engineering", Pearson, 8th Edition, 2017.

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Power System – I Lab

Title of the Course Name: **Power System – I Lab** Course Code: **25EE411**	**L**	**T**	**P**	**Credits**
	--	--	2	1
Evaluation Scheme:	**ISE**			**ESE**
Marks:	50			50

Pre-Requisite: Basic Electrical, AC and DC circuits Fundamentals

Course Objective: The course aims to:	
1	Provide practical understanding of power system structure and components.
2	Analyze transmission line parameters and performance using simulation and experimental methods.
3	Study mechanical design aspects of overhead transmission lines.
4	Familiarize students with switchgear, grounding, and protection concepts.
5	Reinforce AC & DC distribution system analysis through practical problems

Course Outcomes: At the end of the course, students will be able to:	
CO1	Analyze power system structure and transmission line parameter.
CO2	Evaluate transmission line performance characteristics.
CO3	Analyze mechanical design aspects of overhead transmission lines.
CO4	Discuss operation of switchgear, grounding, and distribution systems.

CO-PO Mapping:

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

Course Content

Experiment No.	Experiment Title	Hrs
1	Study the structure of electrical power systems (generation, transmission, distribution) using single-line diagrams	2
2	Describe the Indian power system structure including regional and national grids	2

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3	Calculate resistance, inductance, and capacitance of a single-phase transmission line	2
4	Determine inductance and capacitance of a three-phase transmission line with symmetrical spacing	2
5	Analyze transmission line parameters using GMR and GMD concepts	2
6	Analyze the performance of a short transmission line in terms of voltage regulation and efficiency	2
7	Analyze the performance of a medium transmission line using the nominal π model	2
8	Examine the Ferranti effect in long transmission lines	2
9	Evaluate the corona phenomenon and factors affecting corona loss in transmission lines	2
10	Apply sag and tension calculations for overhead transmission lines with equal level supports	2
11	Analyze sag and tension of overhead transmission lines with unequal level supports	2
12	Explain construction, ratings, and arc-interruption methods of circuit breakers	2
13	Apply neutral grounding methods used in power systems	2
14	Analyze AC and DC distribution systems including the three-wire DC distribution system	2
Note:	*Minimum 10 practical/experiments will be completed.	

Text books:

1. P. Kothari and I. J. Nagrath, "Power System Engineering", Tata McGraw-Hill Education, 2nd Edition.
2. C. L. Wadhwa, "Electrical Power Systems", New Age International Publishers, 10th Edition.

Reference books:

1. J. J. Grainger and W. D. Stevenson Jr., "Power System Analysis", McGraw-Hill Education.
2. Sunil S. Rao, "Switchgear and Protection", Khanna Publishers.
3. Y. G. Paithankar and S. R. Bhide, "Fundamentals of Power System Protection", PHI Learning.

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