B.Tech.

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

AND

SYLLABI OF FIRST YEAR COURSES

(Applicable from 2023 Admission onwards)

Department of Electrical Engineering
NATIONAL INSTITUTE OF TECHNOLOGY CALICUT
Kozhikode – 673 601, KERALA, INDIA

The Program Educational Objectives (PEOs) of B.Tech. in Electrical and Electronics Engineering

PEO1	To prepare under graduate students to excel in technical profession/ industry and/or higher education by providing a strong foundation in mathematics, science and engineering.
PEO2	To transform engineering students to expert engineers so that they could comprehend, analyse, design and create novel products and solutions to Electrical and Electronics Engineering problems that are technically sound, economically feasible and socially acceptable
PEO3	To train students to exhibit professionalism, keep up ethics in their profession and relate engineering issues to address the technical and social challenges.
PE04	To develop communication skills and team work and to nurture multidisciplinary approach in problem solving

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) of B.Tech. in Electrical and Electronics Engineering

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1	Identify, formulate and analyze real-life electrical and electronics engineering problems by way of utilising the knowledge of mathematics, science and engineering principles.
PSO2	Design and develop sophisticated equipment and experimental systems for carrying out detailed investigation to multifaceted electrical and electronics engineering problems leading to reliable and feasible solutions for the same utilising all the available tools.
PSO3	Work as an electrical or electronics engineer who is capable of identifying solutions to various local and global problems faced by the society, up keeping a pollution free environment without compromising professional ethics and social values.
PSO4	Think independently, take initiative, lead a team of engineers or researchers, communicate orally as well as in writing with others, participate in various professional activities, take up administrative responsibilities and thus maintain lifelong learning process.

CURRICULUM

Total credits for completing B.Tech. in Electrical and Electronics Engineering is 153.

COURSE CATEGORIES AND CREDIT REQUIREMENTS:

The structure of B.Tech. programmes shall have the following Course Categories:

Sl. No.	Course Category	Number of Courses	Minimum Credits
1.	Institute Core (IC)	8	22
2.	Program Core (PC) and Program Electives (PE)	36-37	91
3.	Open Electives (OE)	6	18
4.	Institute Electives (IE) (Entrepreneurship Innovation (EI) + Digital / Automation Technologies (DA) + Humanities, Social Science, Management (HM))	6	18
5.	Activity Credits (AC)	--	4

COURSE REQUIREMENTS

The effort to be put in by the student is indicated in the tables below as follows:
L: Lecture (One unit is of 50-minute duration)
T: Tutorial (One unit is of 50-minute duration)
P: Practical (One unit is of one-hour duration)
O: Outside the class effort / self-study (One unit is of one-hour duration)

1. INSTITUTE CORE (IC)

a) Mathematics

Sl. No.	Course Code	Course Title	L	T	P	O	Credits
1.	MA1001E	Mathematics I	3	1	0	5	3
2.	MA1011E	Mathematics II	3	1	0	5	3
3.	MA2001E	Mathematics III	3	1	0	5	3
4.	MA2011E	Mathematics IV	3	1	0	5	3
		Total	**12**	**4**	**0**	**20**	**12**

b) Basic Sciences and Drawing

Sl. No.	Course Code	Course Title	L	T	P	O	Credits
1.	PH1003E	Electricity and Magnetism	3	0	0	6	3
2.	CE1011E	Engineering Graphics	2	0	2	5	3
		Total	**5**	**0**	**2**	**11**	**6**

c) Professional Communication and Professional Ethics

Sl. No.	Course Code	Course Title	L	T	P	O	Credits
1.	MS1001E	Professional Communication	3	1	0	5	3
2.	EE1004E	Professional Ethics	1	0	0	2	1
		Total	**4**	**0**	**0**	**7**	**4**

2A. PROGRAMME CORE (PC)

Sl. No.	Course Code	Course Title	L	T	P	O	Credits
1.	EE1001E	Introduction to Electrical Engineering	3	1	0	5	3
2.	EE1002E	Electrical Measurements	3	0	0	6	3
3.	EE1003E	Electronic Circuits - I	3	1	0	5	3
4.	EE1091E	Basic Electrical Engineering Lab	0	0	2	1	**1**
5.	EE1011E	Circuits and Networks	3	1	0	5	3
6.	ME1401E	Engineering Mechanics	3	0	0	6	3
7.	EE1012E	Digital Circuits and Systems	3	1	0	5	3
8.	EE1092E	Electrical Measurements Lab	0	0	2	1	1
9.	EE2001E	Signals and Systems	3	1	0	5	3
10.	EE2002E	Microprocessors and Microcontrollers	2	1	2	4	3
11.	EE2003E	Electrical Machines -I	3	1	0	5	3
12.	EE2004E	Electronic Circuits – II	3	1	0	5	3
13.	EE2091E	Electronics Lab – I	0	0	2	1	1
14.	ME2011E	Mechanical Engineering	3	0	0	6	3
15.	EE2011E	Power Systems - I	3	1	0	5	3
16.	EE2012E	Power Electronics	3	1	0	5	3
17.	EE2013E	Electrical Machines -II	3	1	0	5	3
18.	EE2014E	Control Systems -I	3	1	0	5	3
19.	EE2092E	Electrical Machines Lab – I	0	0	2	1	1
20.	EE2093E	Electronics Lab – II	0	0	2	1	1
21.	EE3001E	Digital Signal Processing	3	1	0	5	3
22.	EE3002E	Power Systems - II	3	1	0	5	3
23.	EE3003E	Control Systems - II	3	1	0	5	3
24.	EE3004E	Analog Integrated Circuits	3	0	0	6	3
25.	EE3091E	Power Electronics Lab	0	0	2	1	1
26.	EE3092E	Electrical Machines Lab – II	0	0	2	1	1
27.	EE3011E	Introduction to Communication Systems	3	0	0	6	3
28.	EE3012E	Instrumentation Systems	2	1	2	4	3
29.	EE3093E	Electrical Engineering Drawing	1	0	1	2	2
30.	EE3094E	Project	0	0	0	9	3

31.	EE3095E	Power Systems Lab	0	0	2	1	1
32.	EE3096E	Control Systems Lab	0	0	2	1	1
33.	EE4091E	Summer Internship	0	0	0	6	2
34	EE4092E	Project	0	0	0	9	3

2B. LIST OF ELECTIVES

Following courses may be credited under the categories mentioned in the table below, in addition to the Programme Electives.

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Additional Categories			
								PE	EI	DA	HM
Program Elective- I (PE-I)											
1.	EE4021E	Advanced DC – AC Power Conversion	3	0	0	6	3	Y	N	N	N
2.	EE4022E	Switched-mode Power Supplies	3	0	0	6	3	Y	N	N	N
3.	EE4023E	Power Semiconductor Devices	3	0	0	6	3	Y	N	N	N
4.	EE4024E	Power Electronic Drives	3	0	0	6	3	Y	N	N	N
Program Elective- II and III (PE-II and III)											
1.	EE4021E	Advanced DC – AC Power Conversion	3	0	0	6	3	Y	N	N	N
2.	EE4022E	Switched-mode Power Supplies	3	0	0	6	3	Y	N	N	N
3.	EE4023E	Power Semiconductor Devices	3	0	0	6	3	Y	N	N	N
4.	EE4024E	Power Electronic Drives	3	0	0	6	3	Y	N	N	N
5.	EE4025E	Optimal and Adaptive Control	3	0	0	6	3	Y	N	N	N
6.	EE4026E	Power System Stability and Control	3	0	0	6	3	Y	N	N	N
7.	EE4027E	Flexible AC Transmission	3	0	0	6	3	Y	N	N	N
8.	EE4028E	Switchgear and Protection	3	0	0	6	3	Y	N	N	N
9.	EE4029E	Electricity Markets	3	0	0	6	3	Y	N	N	N
Electives towards OE-I to OE-VI											
1.	EE3021E	Digital Control Systems	3	0	0	6	3	N	N	N	N
2.	EE3022E	Electrical Machine Design	3	0	0	6	3	N	N	N	N
3.	EE3023E	Dynamic Analysis of Electrical Machines	3	0	0	6	3	N	N	N	N
4.	EE3024E	Electrical System Design for Buildings	3	0	0	6	3	N	N	N	N
5.	EE3025E	Digital CMOS Integrated Circuits	3	0	0	6	3	N	N	N	N
6.	EE3026E	Electrical Engineering Materials	3	0	0	6	3	N	N	N	N
7.	EE3027E	Dynamic System Simulation	3	0	0	6	3	N	N	N	N

8.	EE3028E	Network Analysis	3	0	0	6	3	N	N	N	N
9.	EE3029E	Optimization Techniques and Algorithms	3	0	0	6	3	N	N	N	N
10.	EE3030E	Artificial Neural Networks and Fuzzy Logic Systems	3	0	0	6	3	N	N	N	N
11.	EE3031E	Special Machines and Linear Machines	3	0	0	6	3	N	N	N	N
12.	EE3032E	Electric Power Utilization	3	0	0	6	3	N	N	N	N
13.	EE3033E	Biomedical Engineering	3	0	0	6	3	N	N	N	N
14.	EE3034E	Illumination Engineering	3	0	0	6	3	N	N	N	N
15.	EE3035E	Linear System Theory	3	0	0	6	3	N	N	N	N
16.	EE3036E	Data Structures and Algorithms	3	0	0	6	3	N	N	Y	N
17.	EE3037E	LT and HT Distribution Systems	3	0	0	6	3	N	N	N	N
18.	EE3038E	Digital System Design	3	0	0	6	3	N	N	N	N
19.	EE3039E	Advanced Processor Architecture and System Organisation	3	0	0	6	3	N	N	N	N
20.	EE3040E	Electric Vehicle System Engineering	3	0	0	6	3	N	N	N	N
21.	EE3041E	Heuristic Methods for Optimization	3	0	0	6	3	N	N	N	N
22.	EE3042E	Computer Control of Industrial Processes	3	0	0	6	3	N	N	N	N
23.	EE3043E	Bio-Signal Processing	3	0	0	6	3	N	N	N	N
24.	EE3044E	System Identification and Parameter Estimation	3	0	0	6	3	N	N	N	N
25.	EE3045E	High Voltage Engineering	3	0	0	6	3	N	N	N	N
26.	EE3046E	Embedded Systems	3	0	0	6	3	N	N	Y	N
27.	EE4021E#	Advanced DC – AC Power Conversion	3	0	0	6	3	Y	N	N	N
28.	EE4022E#	Switched-mode Power Supplies	3	0	0	6	3	Y	N	N	N
29.	EE4023E#	Power Semiconductor Devices	3	0	0	6	3	Y	N	N	N
30.	EE4024E#	Power Electronic Drives	3	0	0	6	3	Y	N	N	N
31.	EE4025E#	Optimal and Adaptive Control	3	0	0	6	3	Y	N	N	N
32.	EE4026E#	Power System Stability and Control	3	0	0	6	3	Y	N	N	N
33.	EE4027E#	Flexible AC Transmission	3	0	0	6	3	Y	N	N	N
34.	EE4028E#	Switchgear and Protection	3	0	0	6	3	Y	N	N	N
35.	EE4029E#	Electricity Markets	3	0	0	6	3	Y	N	N	N
36.	EE4030E#	Power System Operation and Control	3	0	0	6	3	N	N	N	N
37.	EE4031E#	Non-linear System Analysis	3	0	0	6	3	N	N	N	N
38.	EE4032E#	Analog MOS Circuits	3	0	0	6	3	N	N	N	N

39.	EE4033E#	Power Quality	3	0	0	6	3	N	N	N	N
40.	EE4034E#	Static VAR Compensation and Harmonic Filtering	3	0	0	6	3	N	N	N	N
41.	EE4035E#	Smart Grid Engineering	3	0	0	6	3	N	N	N	N
42.	EE4036E#	Advanced Digital Signal Processing	3	0	0	6	3	N	N	N	N
43.	EE4037E#	Control and Guidance Engineering	3	0	0	6	3	N	N	N	N

Available for students who have reached fourth level.

3. OPEN ELECTIVES (OE)

Courses offered by Other Departments/Schools/Centres or Approved Online Platforms, with a limit on the maximum number of courses from such platforms specified as per BTech Ordinances and Regulations. In addition, PE courses offered by the Parent department shall be included in this category for students of the Parent department.

4. INSTITUTE ELECTIVES (IE)

In case of the Institute Electives, courses in the appropriate categories offered by other departments/schools/centres also can be credited instead of the courses offered by the **Department of Electrical Engineering**, subject to the approval from the Course Faculty and Faculty Advisor.

a) Entrepreneurship / Innovation Basket (EI):

Courses proposed by the Departments/Schools/Centres and approved by Institute Innovation Council. Total credits required is 3.

b) **Digital Automation Technologies (DA):**

Courses related to programming / automation tools & techniques / Industry 4.0. Total credits required is 6.

c) Humanities, Social Science, Management (HM):

Courses such as Indian and Foreign languages, Economics, Engineering Management, Financial Management and Design Thinking. Total credits required is 9.

5. ACTIVITY CREDITS (AC)

A minimum of 80 Activity Points are to be acquired for obtaining the 4 Activity Credits required in the curriculum.

Activity points acquired should be a minimum of 20 at the end of S4.
Activity points acquired should be a minimum of 40 at the end of S6.

Details of AC will be finalized later.

Curriculum for B. Tech
in Electrical and Electronics Engineering

PROGRAMME STRUCTURE

Semester I

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA1001E	Mathematics I	3	1	0	5	3	IC
2.	CE1011E	Engineering Graphics	2	0	2	5	3	IC
3.	EE1001E	Introduction to Electrical Engineering	3	1	0	5	3	PC
4.	EE1002E	Electrical Measurements	3	0	0	6	3	PC
5.	EE1003E	Electronic Circuits - I	3	1	0	5	3	PC
6.	EE1004E	Professional Ethics	1	0	0	2	1	IC
7.	EE1091E	Basic Electrical Engineering Lab	0	0	2	1	1	PC
		Total	**15**	**3**	**4**	**29**	**17**	**--**

Semester II

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA1011E	Mathematics II	3	1	0	5	3	IC
2.	PH1003E	Electricity and Magnetism	3	0	0	6	3	IC
3.	MS1001E	Professional Communication	3	1	0	5	3	IC
4.	EE1011E	Circuits and Networks	3	1	0	5	3	PC
5.	ME1401E	Engineering Mechanics	3	0	0	6	3	PC
6.	EE1012E	Digital Circuits and Systems	3	1	0	5	3	PC
7.	EE1092E	Electrical Measurements Lab	0	0	2	1	1	PC
		Total	**18**	**4**	**2**	**33**	**19**	**--**

Semester III

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA2001E	Mathematics III	3	1	0	5	3	IC
2.		Digital / Automation Technologies - I	3	0	0	6	3	IE
3.		E /I Elective	3	0	0	6	3	IE
4.	EE2001E	Signals and Systems	3	1	0	5	3	PC
5.	EE2002E	Microprocessors and Microcontrollers	2	1	2	4	3	PC
6.	EE2003E	Electrical Machines -I	3	1	0	5	3	PC
7.	EE2004E	Electronic Circuits – II	3	1	0	5	3	PC
8.	EE2091E	Electronics Lab – I	0	0	2	1	1	PC
		Total	**20**	**5**	**4**	**37**	**22**	

Semester IV

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA2011E	Mathematics IV	3	1	0	5	3	IC
2.	ME2011E	Mechanical Engineering	3	0	0	6	3	PC
3.	EE2011E	Power Systems - I	3	1	0	5	3	PC
4.	EE2012E	Power Electronics	3	1	0	5	3	PC
5.	EE2013E	Electrical Machines -II	3	1	0	5	3	PC
6.	EE2014E	Control Systems -I	3	1	0	5	3	PC
7.	EE2092E	Electrical Machines Lab – I	0	0	2	1	1	PC
8.	EE2093E	Electronics Lab – II	0	0	2	1	1	PC
		Total (Excluding the Minor Courses)	**18**	**5**	**4**	**33**	**20**	

Semester V

Sl. No	Course Code	Course Title	L	T	P	O	Credits	Category
1.	EE3001E	Digital Signal Processing	3	1	0	5	3	PC
2.	EE3002E	Power Systems - II	3	1	0	5	3	PC
3.	EE3003E	Control Systems - II	3	1	0	5	3	PC
4.	EE3004E	Analog Integrated Circuits	3	0	0	6	3	PC
5.		Humanities - I	3	0	0	6	3	IE
6.		Digital / Automation Technologies - II	3	0	0	6	3	IE
7.	EE3091E	Power Electronics Lab	0	0	2	1	1	PC
8.	EE3092E	Electrical Machines Lab – II	0	0	2	1	1	PC
		Total (Excluding the Minor Courses)	**18**	**3**	**4**	**35**	**20**	

Semester VI

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	EE3011E	Introduction to Communication Systems	3	0	0	6	3	PC
2.	EE3012E	Instrumentation Systems	2	1	2	4	3	PC
3.		Open Elective - I (OE-I)	3	0	0	6	3	OE
4.		Open Elective - II (OE-II)	3	0	0	6	3	OE
5.		Humanities - II	3	0	0	6	3	IE
6.	EE3093E	Electrical Engineering Drawing	1	0	2	3	2	PC
7.	EE3094E	Project	0	0	0	9	3	PC
8.	EE3095E	Power Systems Lab	0	0	2	1	1	PC
9.	EE3096E	Control Systems Lab	0	0	2	1	1	PC
		Total (Excluding the Minor Courses)	**15**	**1**	**8**	**42**	**22**	

Semester VII

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.		Humanities -III	3	0	0	6	3	IE
2.	EE40XXE	Program Elective- I (PE-I)	3	0	0	6	3	PE
3.		Open Elective –III (OE-III)	3	0	0	6	3	OE
4.		Open Elective -IV (OE-IV)	3	0	0	6	3	OE
5.		Open Elective -V (OE-V)	3	0	0	6	3	OE
6.	EE4091E	Summer Internship	0	0	0	6	2	PC
7.	EE4092E	Project	0	0	0	9	3	PC
		Total (Excluding the Minor Courses)	**15**	**0**	**0**	**45**	**20**	

Semester VIII

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	EE4093E	Project	0	0	0	18	6	PE
		OR						
1.	EE4094E	Internship	0	0	0	**18**	6	PE
		OR						
1.1	EE40XXE	Programme Elective-II (PE-II)	3	0	0	6	3	PE
1.2	EE40XXE	Programme Elective-III (PE-III)	3	0	0	6	3	PE
		AND						
3		Open Elective -VI (OE-VI)	3	0	0	6	3	OE
4	EE4095E	Activity Credits	0	0	0	12	4	AC
		Total	**9/3**	**0**	**0**	**36/ 30**	**13**	

Total Credits: 153

Curriculum for B. Tech in Electrical & Electronics Engineering with Minor in……………..

PROGRAMME STRUCTURE

Semester I

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA1001E	Mathematics I	3	1	0	5	3	IC
2.	CE1011E	Engineering Graphics	2	0	2	5	3	IC
3.	EE1001E	Introduction to Electrical Engineering	3	1	0	5	3	PC
4.	EE1002E	Electrical Measurements	3	0	0	6	3	PC
5.	EE1003E	Electronic Circuits - I	3	1	0	5	3	PC
6.	EE1004E	Professional Ethics	1	0	0	2	1	IC
7.	EE1091E	Basic Electrical Engineering Lab	0	0	2	1	1	PC
		Total	**15**	**3**	**4**	**29**	**17**	**--**

Semester II

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA1011E	Mathematics II	3	1	0	5	3	IC
2.	PH1003E	Electricity and Magnetism	3	0	0	6	3	IC
3.	MS1001E	Professional Communication	3	1	0	5	3	IC
4.	EE1011E	Circuits and Networks	3	1	0	5	3	PC
5.	ME1401E	Engineering Mechanics	3	0	0	6	3	PC
6.	EE1012E	Digital Circuits and Systems	3	1	0	5	3	PC
7.	EE1092E	Electrical Measurements Lab	0	0	2	1	1	PC
		Total	**18**	**4**	**2**	**33**	**19**	**--**

Semester III

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA2001E	Mathematics III	3	1	0	5	3	IC
2.		Digital / Automation Technologies - I	3	0	0	6	3	IE
3.		E /I Elective	3	0	0	6	3	IE
4.	EE2001E	Signals and Systems	3	1	0	5	3	PC
5.	EE2002E	Microprocessors and Microcontrollers	2	1	2	4	3	PC
6.	EE2003E	Electrical Machines -I	3	1	0	5	3	PC
7.	EE2004E	Electronic Circuits – II	3	1	0	5	3	PC
8.	EE2091E	Electronics Lab – I	0	0	2	1	1	PC
		Total	**20**	**5**	**4**	**37**	**22**	

Semester IV

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	MA2011E	Mathematics IV	3	1	0	5	3	IC
2.	ME2011E	Mechanical Engineering	3	0	0	6	3	PC
3.	EE2011E	Power Systems - I	3	1	0	5	3	PC
4.	EE2012E	Power Electronics	3	1	0	5	3	PC
5.	EE2013E	Electrical Machines -II	3	1	0	5	3	PC
6.	EE2014E	Control Systems -I	3	1	0	5	3	PC
7.	EE2092E	Electrical Machines Lab – I	0	0	2	1	1	PC
8.	EE2093E	Electronics Lab – II	0	0	2	1	1	PC
9.		Minor Course-I	3/4	0	0	6/8	3/4	
		Total (Including the Minor Courses)	**21/22**	**5**	**4**	**39/41**	**23/24**	

Semester V

Sl. No	Course Code	Course Title	L	T	P	O	Credits	Category
1.	EE3001E	Digital Signal Processing	3	1	0	5	3	PC
2.	EE3002E	Power Systems - II	3	1	0	5	3	PC
3.	EE3003E	Control Systems - II	3	1	0	5	3	PC
4.	EE3004E	Analog Integrated Circuits	3	0	0	6	3	PC
5.		Humanities - I	3	0	0	6	3	IE
6.		Digital / Automation Technologies - II	3	0	0	6	3	IE
7.	EE3091E	Power Electronics Lab	0	0	2	1	1	PC
8.	EE3092E	Electrical Machines Lab – II	0	0	2	1	1	PC
9.		Minor Course-II	3/4	0	0	6/8	3/4	
Total (Including the Minor Courses)			**21/22**	**3**	**4**	**41/43**	**23/24**	

Semester VI

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	EE3011E	Introduction to Communication Systems	3	0	0	6	3	PC
2.	EE3012E	Instrumentation Systems	2	1	2	4	3	PC
3.		Open Elective - I (OE-I)	3	0	0	6	3	OE
4.		Open Elective - II (OE-II)	3	0	0	6	3	OE
5.		Humanities - II	3	0	0	6	3	IE
6.	EE3093E	Electrical Engineering Drawing	1	0	2	3	2	PC
7.	EE3094E	Project	0	0	0	9	3	PC
8.	EE3095E	Power Systems Lab	0	0	2	1	1	PC
9.	EE3096E	Control Systems Lab	0	0	2	1	1	PC
10.		Minor Course-III	3/4	0	0	6/8	3/4	
Total (Including the Minor Courses)			**18/19**	**1**	**8**	**48/50**	**25/26**	

Semester VII

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.		Humanities -III	3	0	0	6	3	IE
2.	EE40XXE	Program Elective- I (PE-I)	3	0	0	6	3	PE
3.		Open Elective –III (OE-III)	3	0	0	6	3	OE
4.		Open Elective -IV (OE-IV)	3	0	0	6	3	OE
5.		Open Elective -V (OE-V)	3	0	0	6	3	OE
6.	EE4091E	Summer Internship	0	0	0	6	2	PC
7.	EE4092E	Project	0	0	0	9	3	PC
8.		Minor Course-IV	3/4	0	0	6/8	3/4	
Total (Excluding the Minor Courses)			**18/19**	**0**	**0**	**51/53**	**23/24**	

Semester VIII

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Category
1.	EE4093E	Project	0	0	0	18	6	PE
		OR						
1.	EE4094E	Internship	0	0	0	**18**	6	PE
		OR						
1. 1	EE40XXE	Programme Elective-II (PE-II)	3	0	0	6	3	PE
1. 2	EE40XXE	Programme Elective-III (PE-III)	3	0	0	6	3	PE
		AND						
3		Open Elective -VI (OE-VI)	3	0	0	6	3	OE
4	EE4095E	Activity Credits	0	0	0	12	4	AC
		Total	**9/3**	**0**	**0**	**36/ 30**	**13**	

Total Credits: 165-169

Minor Programme

Sl. No.	Course Code	Course Title	L	T	P	O	Credits
1.		Minor Course-I	3/4	0	0	6/8	3/4
2.		Minor Course-II	3/4	0	0	6/8	3/4
3.		Minor Course -III	3/4	0	0	6/8	3/4
4.		Minor Course- IV	3/4	0	0	6/8	3/4
		Total	**12/16**	**0**	**0**	**24/32**	**12/16**

Syllabus

Semester-I

MA1001E MATHEMATICS I

Pre-requisites: NIL

L	T	P	O	C
3	1	0	5	3

Total Lecture sessions: 39

Course Outcomes:

CO1: Formulate some engineering problems as ODEs and hence solve such problems.
CO2 Solve linear ODEs with constant coefficients.
CO3: Find the limits, check for continuity and differentiability of real valued functions of two variables
CO4: Test for the convergence of sequences and series.
CO5: Find the Fourier series representing periodic functions.

Existence and uniqueness of solution of first order ODE, methods of solutions of first order ODE, linear ODE, orthogonal trajectories, linear homogeneous second order ODEs with constant coefficients, fundamental system of solutions, existence and uniqueness of solutions, Wronskian, method of undetermined coefficients, solution by variation of parameters, Euler-Cauchy equations, applications of first and second order ODEs, system of linear ODEs with constant coefficients.

Function of several variables: Limit, continuity, partial derivatives, partial differentiation of composite functions, directional derivatives, gradient, local maxima and local minima of functions of two variables, critical point, saddle point, Taylor's formula for two variables, hessian, second derivative test, method of Lagrange multipliers. Parameterised curves in space, arc length, tangent and normal vectors, curvature and torsion.

Sequences, Cauchy sequence, convergence of sequences, series, convergence of series, tests for convergence, absolute convergence, sequence of functions, power series, radius of convergence, Taylor series, periodic functions and Fourier series expansions, half-range expansions, Fourier integral, Fourier transforms and their properties.

References:

1. Anton, I. Bivens and S. Davis, *Calculus*, 10th edition, New York: John Wiley & Sons, 2015.
2. G. B. Thomas, M.D. Weirand J. Hass, *Thomas' Calculus*, 12th edition, New Delhi, India: Pearson Education, 2015.
3. E. Kreyszig, *Advanced Engineering Mathematics,* 10th edition, New York: John Wiley & Sons, 2015
4. Apostol, *Calculus* Vol 1, 1st ed. New Delhi: Wiley, 2014.

CE1011E ENGINEERING GRAPHICS

Pre-requisites: NIL

L	T	P/D	O	C
2	0	2	5	3

Total sessions: 26L + 26D

Course Outcomes:

CO1: Make use of the Indian Standard Code of Practice in Engineering Drawing
CO2: Represent any engineering object by its orthographic views
CO3: Convert orthographic views of an engineering object into its isometric view.
CO4: Use software for drawing and visualization of engineering objects

Introduction: Drawing instruments and their uses; lines, lettering and dimensioning; Introduction Auto CAD software, geometrical construction; constructions of plain and diagonal scales.
Orthographic projection—first and third angle projections (using CAD); orthographic projection of points on principal, profile, and auxiliary planes.
Orthographic projection of straight line in simple and oblique positions; application of orthographic projection of line

Orthographic projection of planes in simple and oblique position on principal and profile planes; orthographic projection of lines and planes on auxiliary planes. Orthographic projection of solids in simple and oblique positions on principal and profile planes; orthographic projections of solids in oblique position

Orthographic projection of solids in section; development of surfaces of solids; method of isometric projection (Using CAD). Introduction to perspective projection (no drawing)

References:

1. Agrawal B. and Agrawal C. M., *Engineering Drawing*, 3rd ed. McGraw Hill Education, 2019.
2. Bhatt, N. D., *Engineering Drawing*, 54th ed. Charotar Publishing House, 2023.
3. Venugopal K. and Raja V P, *Engineering Drawing + Auto CAD*, 6th Edition, New Age Intl. Pvt Ltd., 2022.

EE1001E INTRODUCTION TO ELECTRICAL ENGINEERING

Pre-requisites: NIL

L	T	P	O	C
3	1	0	5	3

Total Lecture Sessions: 39

Course Outcomes:

CO1: Explain the characteristics of voltage sources, current sources and various passive circuit elements.
CO2: Solve simple magnetic and capacitive circuits for signal and power processing.
CO3: Analyse electrical circuits using various circuit analysis methods and circuit theorems.
CO4: Analyse single phase ac circuits.
CO5: Analyse balanced and unbalanced three-phase ac circuits.

Study of Resistive Circuits
v-i relationship for Independent Voltage and Current Sources, Passive sign convention, Kirchhoff's Laws, Solution of resistive circuits with independent sources- Node Voltage and Mesh Current Analysis, NodalConductance Matrix and Mesh Resistance Matrix and symmetry properties of these matrices

Circuits with Linear Dependent Sources: VCVS, VCCS, CCVS and CCCS - node analysis and mesh analysis of circuits containing resistors, independent sources and linear dependent sources - effect of dependent sources on the symmetry of nodal admittance matrix and mesh impedance matrix

Source Transformation and Star-Delta / Delta-Star Conversions to reduce resistive networks

Circuit Theorems and Energy Storage Elements
Circuit Theorems - Superposition Theorem, Thevenin's Theorem, Norton's Theorem, MaximumPower Transfer Theorem and Reciprocity Theorem. Determination of Thevenin's and Norton's equivalent for circuits containing dependent sources.

MMF, Magnetic Flux, Reluctance, Energy stored in a Magnetic Field, Solution of Magnetic Circuits.
Inductance - Faraday's Law of Electromagnetic Induction, Lenz's Law, Self and Mutual Inductance, Inductances in Series and Parallel, Mutual Flux and Leakage Flux, Coefficient of Coupling, Dot Convention, Cumulative and Differential Connection of Coupled Coils. Capacitance – Electrostatics, Capacitance, Parallel Plate Capacitor, Capacitors in series and parallel, Energy stored in Electrostatic Field
v-i relationship for Inductance and Capacitance

Analysis of Single-phase AC Circuits
Alternating Quantities - Average Value, Effective Value, Form and Peak factors for square, triangle,trapezoidal and sinusoidal waveforms. Power Superposition principle, Phasor representation of sinusoidal quantities - phase difference, Addition and subtraction of sinusoids,Symbolic Representation: Cartesian, Polar and Exponential forms.

Analysis of a.c circuits - R, RL, RC, RLC circuits using phasor concept, Concept of impedance,admittance, immittance, conductance and susceptance – Resonance in RLC circuits

Power in single phase circuits - instantaneous power, average power, active power, reactive power,apparent power, power factor, complex power, solution of series, parallel and series parallel a.c circuits. Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem for a.c circuits.

Analysis of Three-phase AC Circuits
Polyphase circuit working - 3 phase a.c systems - balanced system - phase sequence - Star Delta Transformation Theorem - Balanced 3 phase a.c source supplying balanced 3 phase star connected and delta connected loads - 3 wire and 4 wire systems - Power in three phase balanced circuits: active power, reactive power, complex power, apparent power and power factor in balanced circuits.

Steady-state analysis of three-phase balanced loads excited by three-phase unbalanced sources, power factor in unbalanced three phase systems, neutral shift, neutral current, neutral tie, circulating currents- symmetrical transformation – sequence components – sequence decoupling – power in sequence components.

References:

1. K.S. Suresh Kumar, *Electric Circuits & Networks*, Pearson Education, 2009
2. J.W. NILsson and S.A. Riedel, *Electric Circuits*, 8th ed., Pearson, 2002
3. C. A. Desoer and E. S. Kuh, *Basic Circuit Theory*, McGraw Hill, 2009
4. J. A. Edminister, *Electric Circuit Theory*, Schaum's Outline series: 6th ed., McGraw Hill, 2014.

EE1002E ELECTRICAL MEASUREMENTS

Pre-requisites: NIL

L	T	P	O	C
3	0	0	6	3

Total lecture sessions: 39

Course Outcomes:

CO1: Familiarization with different type of electrical measurement systems.
CO2: Analyze the working principles of resistance, inductance, capacitance and magnetic quantities with necessary skill development in instrument design.
CO3: Analyze the working principles of waveform measurements.
CO4: Perform measurement of power & energy in poly phase systems.

Voltage and current measurements
Concepts of measurement, static and dynamic characteristics of instruments, definitions relating to measuring instruments, errors in measurement principle, construction and working of moving coil instruments, principle, construction and working of moving iron instruments ,ammeter shunts, voltmeter multipliers, instrument transformers, current transformers-potential transformers, thermocouple instruments, electrostatic volt meter, rectifier voltmeters, Advantages and disadvantages of digital instruments, resolution, accuracy and error in digital measurements, digital multimeter.

Magnetic Measurements
Magnetic measurements, Ballistic galvanometer, calibration-flux meter, determination of BH curve and Hysterisis loop

Waveform Measurements
Cathode ray Oscilloscope, Electrostatic Deflection, Time Base Generator and Synchronization– Observation of Waveforms, Phase and Frequency (Lissajous Patterns) , Digital Storage Oscilloscope – sampling of waveforms for understanding the functioning of DSO (Basic understanding is expected).

Measurement of Resistance, Inductance and capacitances
Measurements of resistances, Ammeter–voltmeter method, Wheatstone bridge, Kelvin double bridge, measurement of high resistances, use of guard circuits, loss of charge method, Megger and insulation test, location of cable fault, Murray loop test, Varley loop test, Megger and insulation test, AC bridges, Maxwells Inductance bridge, Maxwells Inductance, Capacitance bridge, Hay's Bridge, Schering Bridge, Wein Bridge

Power and Energy measurements
Measurement of power in DC and AC circuits, Dynamometer type watt meters–Construction, Theory and operation, errors and calibration, power in poly phase systems, Blondel's theorem, measurement of power in three phase balanced and un balanced systems, measurement of reactive volt amperes, induction type single phase energy meters, Construction theory and operation-errors, compensation and adjustments-testing of energy meters, phantom loading, measurement of kVA.

References:

1. Golding E.W *Electrical Measurements & Measuring Instruments*, 6th ed. Reem Publications,2019.
2. Cooper W.D, *Modern Electronics Instrumentation*, PHI, 1996.
3. Stout M.B, *Basic Electrical Measurements*, Prentice Hall, 1986.
4. Oliver & Cage, *Electronic Measurements & Instrumentation*, McGraw Hill, 1979.
5. Sawhney A. K., *Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai &Co.,2015

EE1003E ELECTRONIC CIRCUITS - I

Pre-requisites: NIL

L	T	P	O	C
3	1	0	5	3

Total Lecture Sessions: 39

Course Outcomes:

CO1: Design Rectifiers with filters, Clipping Circuits, DC Restoration Circuits and simple voltage regulator circuits using diodes and zener diodes

CO2: Design biasing circuits as per specification for BJTs, JFETs and MOSFETs

CO3: Design single-stage and multi-stage amplification systems with specified mid-band performance using BJTs, JFETs and MOSFETs.

CO4: Design simple Class A, Class B and Class AB power stages using BJTs.

CO5: Conduct performance evaluation of prototype amplifier designs by small signal analysis procedure.

CO6: Choose digital components from various standard logic families in simple digital circuits with power supply current, propagation delay, rise and fall times etc., as basis of comparison.

Semiconductors Devices and Small Signal Models

Revision of principles of operation of diodes and bipolar junction transistors - transition capacitance of a diode - minority carrier storage-diffusion capacitance-breakdown diodes -schottky diode – forward and reverse recovery processes in a diode – Switching diode versus Rectifier diodes

Bipolar Junction Transistor capacitances- Emitter diffusion capacitance and its dependence on bias current, miller capacitance and its voltage dependence – Transistor ratings – Biasing a BJT – Various biasing schemes - Thermal stability of bias.

Concept of small signal operation of semiconductor devices – small signal equivalent circuit for diodes including capacitances – h-parameter equivalent circuit for a BJT – high-frequency hybrid-π equivalent for a BJT – determination of small signal parameters from static characteristics.

Construction and characteristics of JFETs – capacitances of a JFET – biasing a JFET - small signal model for a JFET

Construction and characteristics of depletion type and enhancement type MOSFETs – MOSFET capacitances – biasing a MOSFET – small signal model of a MOSFET including capacitances

Diode Circuits

Rectifier Circuits – Single-phase half-wave rectifier without filter capacitor, Single-phase half-wave rectifier with filter capacitor, Single-phase Full-wave rectifier with C-Filter, Single-phase Full-bridge rectifier with C- Filter, Full-wave and full-bridge rectifiers with LC Filter – Design of LC Filter – Rectifier ripple factor, transformer utilization factor etc., rectifier output voltage variation with loading.

Diode/Zener Diode Clipping Circuits and applications.

DC Restoration by Diode Clamping Circuits.

Voltage regulator design using Zener diodes.

BJT, JFET and MOSFET Amplifier Circuits – Midband Analysis

A Transistor as an amplifying element – Biasing for amplification – RC Coupling versus Direct Coupling - Signal coupling and signal bypassing - Graphical analysis and explanation for amplification in a CE amplifier - Midband gain, input resistance and output resistance of CE Amplifier , CB Amplifier and Emitter Follower - Analysis and Comparison using h parameters as well as hybrid-π parameters – Qualitative explanation for low-frequency and high-frequency response of amplifiers - considerations in cascading transistor amplifiers – Common Source and Common Drain Amplifiers using JFETs and MOSFETs – comparison of BJT, FET and MOSFET amplifiers – Class A, Class B and Class AB Power Amplifiers using BJT.

Digital Logic Families

Transistor as an inverter (i.e., resistive switching) – switching delays – various components of switch-off and switch-on delays – calculation of switching time components – comparison between high frequency transistor and switching transistor.

Charging and discharging a capacitive load by a BJT and MOSFET – rise time and fall time calculations for capacitive load switching in both cases
Analysis of basic DTL gate, propagation delay, rise and fall times, fan-in and fan out – power supply current versus frequency of operation
Analysis of basic TTL gate, propagation delay, rise and fall times, fan-in and fan out, ratings, power supply current versus frequency of operation
Different variants of TTL gates including Schottky TTL
Analysis of basic ECL gate, propagation delay, rise and fall times, fan-in and fan out.
Analysis of basic CMOS gate, propagation delay, rise and fall times, fan-in and fan out – power dissipation in the gate and effect of (i) supply voltage (ii) frequency of operation and (iii) load capacitance on gate dissipation – Different variants of CMOS Logic Families
Comparison of various digital logic families – speed-power product as a figure of merit.

References:

1. A.S Sedra and K.C Smith, *Microelectronic Circuits*, 5th ed. Oxford University Press, 2009
2. Taub & Scilling, *Digital Integrated Electronics*, McGraw-Hill, Singapore, 1997
3. Millman J, *Microelectronic*, 2nd ed. McGraw-Hill, New Delhi, 2005.
4. Schilling & Belove, '*Electronic Circuits – Discrete and Integrated*, 3rd ed. McGraw-Hill, New Delhi, 2006
5. Boylested & Nashesky, *Electronic Devices and Circuit Theory*, 10th ed. Pearson Education, New Delhi, 2009

EE1004E PROFESSIONAL ETHICS

Pre-requisites: NIL

L	T	P	O	C
1	0	0	2	1

Total Lecture Sessions: 13

Course Outcomes:

CO1: Develop a clear understanding of human values and use it as basis for all the activities.
CO2: Understand and follow the ethical aspects of engineering profession.
CO3: Align with the Code of Ethics prescribed by IEEE in all professional activities.
CO4: Assimilate the elements of academic integrity and Honour Codes, and adopt them in all relevant activities.

Human Values
Morals, values and ethics – integrity – work ethic – service learning – civic virtue – sharing – honesty – courage – valuing time – cooperation – commitment – empathy – self-confidence – character.

Ethics in Professional Practice
Ethics in professional context – ethical basis of engineering activities – ethical responsibilities to consumers and customers – safety and risk – ethics in management of intellectual property – environmental matters and sustainability.

Code of Ethics and Academic Integrity
An overview about IEEE code of ethics - Integrity, responsible behavior, ethical conduct- treating others fairly and respectfully, avoid harassment, discrimination and injuries to others – helping others to keep ethics in their life

Elements of Academic Integrity: honesty, trust, fairness, respect, responsibility – plagiarism as a violation of academic integrity – Honour Codes: specifying the expected ethical standards from the stakeholders of an organization.

References:

1. R.S. Naagarazan, A Textbook on Professional Ethics and Human Values, 3rd edn., 2022, New Age International Pvt. Ltd.
2. A.F. Bainbridge, Ethics for Engineers: A Brief Introduction, 2021, CRC Press
3. E.G. Seebauer and R.L. Barry, Fundamentals of Ethics for Scientists and Engineers
4. IEEE Code of Ethics – available at ‘https://www.ieee.org/about/corporate/governance/p7-8.html’ (accessed on 2nd June 2023)
5. International Center for Academic Integrity – available at ‘https://academicintegrity.org/’ (accessed on 2nd June 2023)

EE1091E BASIC ELECTRICAL ENGINEERING LAB

Pre-requisites: NIL

L	T	P	O	C
0	0	2	1	1

Total Practical Sessions: 26

Course Outcomes:

CO1: Perform basic electrical wiring, select fuse for a given electrical circuit and perform electrical measurements using different meters and instruments
CO2: Estimate and measure power, power factor and current of linear and non-linear types of loads.
CO3: Apply basic circuit theorems to electrical circuits and design potential divider circuits for given specifications.
CO4: Measure winding inductance and analyse the resonance phenomena in RLC circuits
CO5: Measure earth resistance and insulation resistance
CO5: Prepare laboratory reports that clearly communicate experimental information in a logical and scientific manner.

Syllabus / List of Experiments:

1. a) Familiarization of wiring tools, lighting and wiring accessories, various types of wiring systems.
   b) Wiring of one lamp controlled by one switch.
2. a) Study of Electric shock phenomenon, precautions, preventions, Earthing.
   b) Wiring of one lamp controlled by two SPDT Switches and one 3 pin plug socket independently.
3. a) Study of Fuse, MCB, ELCB – Selection of Fuse rating for circuits.
   b) Wiring of fluorescent lamp controlled by one switch with ELCB & MCB.
4. a) Study of Analog/Digital meters/Multimeters/DSOs.
   b) Characteristics of Linear and Non- linear loads – Determination of voltage – current characteristics of linear resistor and linear inductor, incandescent and CFL/LED lamps, iron cored solenoid
5. Verification of Kirchhoff's laws in D.C circuits.
6. a) Potential divider connection and study of the dependence of output voltage upon the value of theloading resistance.
   b) Methods of measurement for low- medium-high resistance using voltmeter and ammeter.
7. Verification of Superposition Theorem and Maximum Power Transfer theorem.
8. Verification of Thevenin's Theorem and Generalized Reciprocity theorem.
9. a) Single phase power measurement (fan load) – study of variation of speed, input power and powerfactor with supply voltage.
   b) Determination of thermal efficiency of an electric kettle.
10. Experiments and Analysis of Resonance in the RLC circuits.
11. Measurement of Self-inductance, Mutual inductance and Coupling coefficient of windings.
12. Measurement of Earth Resistance and Insulation Resistance.

Note: Normally the practical classes are administered in two cycles. Depending on the availability of equipment and time, class coordinators may choose the experiments for each cycle.

References:

1. H Cotton, *Advanced Electrical Technology*, Reem Publications, 2011.
2. Suresh Kumar K.S, *Electrical Circuit and Networks*, Pearson Education, New Delhi, 2009.
3. EW. Golding, *Electrical Measurements and Measuring Instruments*, 5^{th} ed. Reem Publications, 2011.

Semester-II

MA1011E MATHEMATICS II

Pre-requisites: NIL

L	T	P	O	C
3	1	0	5	3

Total Lecture Sessions: 39

Course Outcomes

CO1: Find the parametric representation of curves and surfaces in space and evaluate integrals over curves and surfaces
CO2: Use Laplace transform and its properties to solve differential equations and integral equations.
CO3: Test the consistency of the system of linear equations and solve it.
CO4 Diagonalise symmetric matrices and use it to find the nature of quadratic forms.

Vector field, divergence, curl, identities involving divergence and curl, scalar potential, line integral, independence of path, conservative field, evaluation of double integral, change of variables, Jacobian, polar coordinates, Green's theorem for plane, finding areas using Green's theorem, triple integral, cylindrical and spherical coordinates, mass of a lamina, centre of gravity, moments of inertia, parameterized surface, surface area and surface integral, flux, Gauss' divergence theorem, Stokes' theorem.

Laplace transform, sufficient condition for existence, linearity, inverse Laplace transform, Dirac delta function, transforms of derivatives and integrals, shifting theorems, convolution, differentiation and integration of transform, solution of differential equations and integral equations using Laplace transform.

System of linear equations, augmented matrix, existence and uniqueness of solution, Gauss elimination method, elementary row operations, LU decomposition, row-equivalent systems, row echelon form, rank of a matrix, linear dependence, consistency of linear system, linear combination of solutions, general solution. types of matrices and their properties, eigenvalues, eigenvectors, eigenvalue problems, Cayley- Hamilton theorem, similarity of matrices, diagonalisation, quadratic form, reduction to canonical form.

Vector field, divergence, curl, identities involving divergence and curl, scalar potential, line integral, independence of path, conservative field, evaluation of double integral, change of variables, Jacobian, polar coordinates, Green's theorem for plane, finding areas using Green's theorem, triple integral, cylindrical and spherical coordinates, mass of a lamina, centre of gravity, moments of inertia, parameterized surface, surface area and surface integral, flux, Gauss' divergence theorem, Stokes' theorem.

References:

1. E. Kreyszig, *Advanced Engineering Mathematics*, 10th edition, New Delhi, India: Wiley, 2015.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, 10th edition, New York: John Wiley & Sons, 2015.
3. V. I. Arnold, *Ordinary Differential Equations,* New York: Springer, 2006.
4. P. Dyke, *An Introduction to Laplace Transforms and Fourier Series*, New York: Springer,2014.

PH1003E ELECTRICITY AND MAGNETISM

Pre-requisites: NIL

L	T	P	O	C
3	0	0	6	3

Course Outcomes:

CO1: Apply knowledge of vector calculus to describe Electric and Magnetic fields.
CO2: Identify simplifying principles like symmetry to compute Electric and Magnetic fields.
CO3: Formulate and solve problems involving time dependent electromagnetic fields using Maxwell's equations.
CO4: Analyse propagation of electromagnetic waves in vacuum and dielectric media.

Electrostatics
Electric field – charge density: line, surface and volume – Coulomb's law – Coordinate systems and vector fields: rectangular, cylindrical and spherical coordinates, divergence and curl of Electric field – Gauss law – potential – gradient of the potential – Poisson and Laplace equation – electrostatic work and energy – conductors and electric fields – field and potential of dipoles – electric polarization vector – Gauss law for a dielectric medium – electrostatic boundary conditions.

Magnetostatics
Electric current – current density – surface and volume currents – continuity equation – magnetic field – Biot-Savart law – divergence and curl of magnetic field – Ampere's law – field due to a magnetic dipole – magnetic dipole in external magnetic field – magnetostatic energy – magnetized materials – magnetostatic boundary conditions

Time varying Fields
Electromotive force – Faraday's law – Lenz law – electromagnetic induction – mutual and self- inductance – Maxwell's equations – Maxwell's correction to Ampere's law – displacement current – electromagnetic field – energy density – Poynting's theorem

Electromagnetic Waves
Maxwell's equations in free space – wave equation – plane wave solution – structure of the electromagnetic wave – spherical waves – propagation in dielectric medium and refractive index

References:

1. D. J. Griffiths, *Introduction to Electrodynamics (4th Edition)*, PHI Learning, New Delhi, 2015.
2. E. Purcell and D. Morin, *Electricity and Magnetism (3rd Edition)*, Cambridge University Press, 2013.
3. M. O. Sadiku and S. V. Kulkarni, *Principles of Electromagnetics (6th Edition)*, Oxford University Press, 2015.
4. D. J. Cheng, *Field and Wave Electromagnetics (2nd Edition)*, Pearson, 2014.
5. R. P. Feynman, R. Leighton and M. Sands, *Feynman Lectures on Physics Vol.-II (Millennium Edition)*, Pearson, 2012.
6. J. Edminister, *Schaum's Outline: Theory and Problems in Electromagnetics (revised 2nd Edition)*, Tata McGraw-Hill, 2010.

MS1001E PROFESSIONAL COMMUNICATION

Pre-requisites: NIL

L	T	P	O	C
3	1	0	5	3

Total Lecture Sessions : 39

Course Outcomes:

CO1: Distinguish the role and purpose of communication at the workplace and for academic purposes.
CO2: Decide strategies and modes for effective communication in a dynamic workplace.
CO3: Combine multiple approaches for successful and ethical information exchange.
CO4: Estimate best communication practices to assist productivity and congeniality at the workplace.

Listening and Reading Comprehension
Conversation starters: introductions and small talk - Seek and provide information, clarification, polite enquiries, requests, congratulate people, apologise, give and respond to feedback - Describe graphs, tables, and charts - Words often confused: Lexicon and Meaning - Sense Groups - Listening for specific purposes: Listening to lectures, Summarise academic lectures for note-taking - Appropriate Language to Request and Respond - Public Speaking

Vocabulary and Speaking
Developing professional vocabulary - Basic Sentence Structures from Reading Texts - Concord - Functions of Auxiliary Verbs and Modals - Strategies for Effective Reading - Skimming and Scanning, Determine themes and main ideas, Predicting content using photos, images and titles - Critical Reading: Discussing and Summarising text points - Understanding Text Structures: sequencing, comparing and contrasting, relating cause and effect, problems and problem-solving - Discussing Rhetorical and Cultural Aspects in Texts - Text Appreciation: Drawing inferences, Framing Opinions and Judgments on Reading Text

Effective Writing
Note Making and Summarising: Prepare notes from reading texts, Paraphrasing - Use of Multimedia for Assistive Purposes - Paragraph Writing: cohesive devices to connect sentences in a paragraph - transitional devices - Use Text Structures in Paragraphs: sequencing, comparing and contrasting, relating cause and effect, problems and problem-solving - Avoiding Ambiguity and Cleft Sentences - Applications- Writing Instructions, Descriptions and Explanations - Official Letters of Request and Denial - Official E-mails - Abstract Writing - Digital Resources for Effective Communication

Communication at Workplace
Communication Theory - Process of Communication - Modes of Communication - Verbal and Non-Verbal Communication - Tone in Communication - Formal and Informal Communication at Workplace - Passive, Assertive and Aggressive Styles of Communication - Positive Body Language - Group Discussions - Presentation - Workplace Communication - Active Listening - Giving Feedback - Communication Etiquette - Persuasion - Negotiation - Tone and Voice - Telephone etiquette - Establishing Credibility in Conversations - Digital Communication and Netiquette: Conducting Oneself in Virtual Interactions, Constructive use of Social media - Ethical and Culturally Sensitive Communication: Ethical considerations in professional communication, Addressing diversity, Inclusive Communication Practices

References:

1. Bhatnagar N and Bhatnagar, M, *Communicative English for engineers and professionals*. Dorling Kindersley, 2010.
2. Foley, M and Hall, D, *Longman advanced learners ’grammar: A self-study reference & practice book with answers*. Pearson Education, 2018.
3. Garner, B. A., *HBR Guide to better business writing: Engage readers, tighten and Brighten, make your case*. Harvard Business Review Press, 2012.
4. Hewings, M, *Advanced grammar in use: A reference and practice book for Advanced learners of English*. Cambridge University Press, 2013.

5. Ibbotson, M, *Cambridge English for engineering*. Cambridge University Press, 2015.
6. Kumar, S., and Lata, P, *Communication skills*. Oxford University Press, 2015.
7. Sudarshana, N., and Savitha, C, *English for Technical Communication*. Cambridge English, 2016.

EE1011E CIRCUITS AND NETWORKS

Pre-requisites: NIL

L	T	P	O	C
3	1	0	5	3

Total Lecture Sessions: 39

Course Outcomes:

CO1: Analyse dynamic and steady state response of electrical circuits in time domain

CO2: Analyse dynamic and steady state response of electrical circuits in frequency domain

CO3: Examine simple first-order and second-order electrical circuits to perform basic signal processing tasks employing frequency response approach

CO4: Solve two-port systems by applying two-port network modelling.

Circuit Analysis in Time-domain

Time Domain Analysis of Circuits**:** Time domain analysis of simple series and parallel RL, RC, RLC circuits by differential equation method - Determination of initial conditions and its interpretation – Interpretation of various response components- Time constant and its interpretation-Steady-state response versus forced response and various kinds of steady-state response. Zero-input response, zero-state response and their interpretation- Obtaining step response and ramp response of circuits from impulse response

Solution of multi-mesh and multi-node circuits (containing RLCM and linear dependent sources) by differential equation method - Determination of initial conditions- the important properties exhibited by nth order linear time-invariant circuits

Circuit Analysis in Frequency-domain

Review of Laplace Transforms: Transform Pairs-Gate Functions-Shifting Theorem - Solution of Differential Equations by Laplace Transforms - Initial and Final Value Theorems – Laplace Transforms of periodic signals-Inversion of transforms by partial fractions

s-domain Analysis of Circuits - Transformed equivalent of inductance, capacitance and mutual inductance -Impedance and admittance in the transform domain – concept of the transformed circuit in *s*-domain –

Node Analysis and Mesh Analysis of the transformed circuit - Nodal Admittance Matrix and Mesh Impedance-Matrix in the s-domain-Solution of transformed circuits with mutual inductance – step response of an ideal transformer – step response of a non-ideal transformer– instantaneous change in current in coupled coil systems.

Generalization of Circuit theorems – Input and transfer immittance functions - Transfer functions - Impulseresponse and Transfer function - Poles and Zeros - Pole Zero plots – Stability and poles

Sinusoidal Steady - State Frequency Response and Fourier Analysis

Sinusoidal steady - state and frequency response function – frequency response function as a complex function of ω as evaluated from phasor equivalent circuit - frequency response function from s-domain transfer and immittance functions- explanation for substituting s=jω in transfer function to obtain frequency response function – Properties of frequency response function of LTI circuits.

Frequency response of first order circuits – concept of cut-off frequencies and bandwidth – Series and parallel RC circuits as an averaging filter (for current signal and voltage signal), low-pass filter, high-pass filter, integrator, differentiator, signal coupling circuit, signal bypassing circuit etc.

Series and Parallel RLC circuit frequency response - Graphical evaluation of frequency response function from pole-zero plots: introduction to filtering and illustration of graphical evaluation of frequency response function from pole-zero plots in the case of standard second order filter functions using Series RLC and Parallel RLC Circuits – frequency response specifications for second order functions – correlation between time-domain specs and freq-domain specsin the case of first order and second order circuits.

Review of Fourier Series representation of non-sinusoidal periodic waveforms: Fourier Coefficients-Determination of Coefficients-Waveform Symmetry-Exponential Fourier Series - Discrete Amplitude and Phase Spectra

Steady State Solution of Circuits with non-sinusoidal periodic inputs: by Fourier Series and frequency response function, power and rms value of non-sinusoidal waveforms, Discrete Power Spectrum, THD measure for waveforms.

Two Port Networks

Two Port Networks**:** Two port networks-characterization in terms of impedance, admittance, hybrid and transmission parameters - inter relationships among parameter sets - Interconnectionof Two port networks: Series, Parallel and Cascade - Input impedance, output impedance and gain of terminated two-ports in terms of two-port parameters and termination impedance – Applications of two-port parameters in negative feedback systems, power transmission

Dependent source equivalent circuits for coupled coils – ac steady-state analysis of circuits containing coupled coils – the perfectly coupled two-winding transformer and the ideal two-winding transformer.

References:

1. K. S. Suresh Kumar, *Electric Circuits and Networks*, Pearson Education, New Delhi, 2009.
2. M. E. Van Valkenburg, *Network Analysis*, Revised 3rd ed. Pearson Education, 2019.
3. W. H. Hayt, J. E. Kemmerly, *Engineering Circuit Analysis*, 9th ed. McGraw- Hill, 2020.
4. John D. Ryder, *Networks, Lines and Field*s, 2nd ed. Pearson, 2015.

ME1401E ENGINEERING MECHANICS

Pre-requisites: NIL

L	T	P	O	C
3	0	0	6	3

Total Lecture Sessions: 39

Course Outcomes:

CO1: Determine the resultants of a force system.
CO2: Solve rigid body statics problems using equations of equilibrium.
CO3: Determine the first and second moments of area for planar surfaces.
CO4: Perform kinematic analysis of particles.
CO5: Solve particle dynamics problems using Newton's laws, energy methods and momentum methods

Equivalent force systems
Introduction: idealizations of mechanics, vector and scalar quantities, equality and equivalence of vectors, laws of mechanics, elements of vector algebra – Important vector quantities: position vector, moment of a force about a point, moment of a force about an axis – couple and couple moment: definition, couple moment as a free vector, moment of a couple about a line – Equivalent force systems: translation of a force to a parallel position, resultant of a force system, simplest resultant of special force systems – distributed force systems.

Rigid body statics
Equations of equilibrium: free-body diagram, free bodies involving interior sections, general equations of equilibrium – problems of equilibrium – static indeterminacy – Friction forces: laws of Coulomb friction, simple contact friction problems.

Properties of surfaces
First moment and centroid of plane area – second moments and product of area for a plane area: transfer theorems, rotation of axes, polar moment of area, principal axes.

Particle kinematics
Introduction – differentiation of a vector with respect to time – velocity and acceleration calculations in rectangular coordinates – velocity and acceleration in terms of path variables and cylindrical coordinates – simple kinematical relations and applications.

Particle dynamics
Newton’s law for rectangular coordinates – rectilinear translation – Newton’s law for cylindrical coordinates – Newton’s law for path variables – general motion of a system of particles – energy methods: introduction, conservative force field, conservation of mechanical energy, alternative form of work-energy equation – energy methods for a system of particles – methods of momentum for particles – Linear impulse and momentum relations for a single particle and system of particles – moment-of-momentum equation for a single particle and system of particles.

References:
1. I. H. Shames and G. K. M. Rao, *Engineering Mechanics – Statics and Dynamics*, 4th ed. Pearson Education India, 2005.
2. F. P. Beer, E. R. Johnston Jr., P. J. Cornwell, B. P. Self, D. F. Mazurek, and S. Sanghi, *Vector Mechanics for Engineers – Statics and Dynamics.* 12th ed. McGraw Hill, 2019.
3. J. L. Meriam, L. G. Kraige, and J. N. Bolton, *Engineering Mechanics – Statics and Dynamics*, 9th ed. Wiley, 2021.
4. R. C. Hibbeler, *Engineering Mechanics – Statics and Dynamics*, 14th ed. Pearson, 2017.

EE1012E DIGITAL CIRCUITS AND SYSTEMS

Pre-requisites: NIL

L	T	P	O	C
3	1	0	5	3

Total Lecture Sessions: 39

Course Outcomes:

CO1: Formulate Combinational Logic Problems and perform Logic Optimization

CO2: Design combinational logic applications using standard SSI and MSI gates and state of the art MUX, ROM, PLA and PAL units

CO3: Perform design verification/validation of synchronous and asynchronous sequential circuit designs.

CO4: Design synchronous and asynchronous sequential circuits for simple applications

Combinational Logic Design

Boolean functions: - canonical and standard forms - simplification of Boolean functions by Karnaugh map up to five variable map - NAND, NOR, EX-OR & EX-NOR implementation - multi level NAND circuits – multilevel NOR circuits

Binary Number Operations: Binary representations, Binary Arithmetic, Binary codes, Octal and Hexadecimal codes

MSI and LSI Combinational circuits and their applications: Arithmetic Circuits, Comparators and parity generators, multiplexers and demultiplexers, decoders and encoders, 7-segment display drivers - AND-OR-INVERT gates, Wired-OR logic, Tri-State Bus systems

Combinational circuit design using Multiplexer

Practical aspects: Fan-in and Fan-out, propagation delay, timing diagrams, glitches, power supply decoupling, power supply current requirements.

Introduction to Sequential circuits

Need for sequential circuits, basic architectural difference between combinational and sequential logic, concept of memory, the binary cell, switch debouncing using binary cell,

Asynchronous versus synchronous sequential machines, basics of sequential machine operation, classification of sequential machines

Latches and flip-flops (RS, JK, D, T and Master Slave) - Design of a clocked flip-flop – Flip-flop conversion – clocks and oscillators.

Practical clocking aspects concerning flip-flops – timing and triggering considerations – clock skew - Shift registers – parallel & serial, serial transfer – universal shift register- study of IC-74LS95 and IC74LS195

Counters: - Binary Ripple Counter, Binary Synchronous UP/DOWN Counter, Binary Counter with Parallel Load, BCD Counters, Modulo-n counters, Ring Counter, Johnson Counter – cascading of counters – study of ICs 74LS90, 74LS93, 74192, 74193 - Sequence detector/Recogniser.

Analysis and Design of Sequential Circuits

General model of sequential networks - State diagrams – Analysis and design of Synchronous sequential

Finite State Machine – Exact State reduction – State reduction with don't cares -Minimization and design of the next state decoder.

Design of counters with arbitrary count sequence and unused states, design of sequence detectors.

Asynchronous sequential logic: Analysis and Design – Race conditions and Cycles – Hazards in combinational circuits – Hazard-free realization.

Practical design aspects: Timing and triggering considerations in the design of synchronous circuits – Setup time - Hold time – Clock skew - Static timing analysis - Dynamic analysis - Debugging and testing of Sequential circuit design.

Memory and Programmable Logic

Random Access Memory, Memory decoding, Error detection and correction, Read-Only Memory, ROMs

PROMs and applications, PLA, PAL -Combinational circuit implementation using ROM, PAL and PLA –

FPGAs - Introduction to Sequential Programmable Devices - Introduction to circuit simulators (SPICE) and hardware description languages (HDL) such as VHDL.

Practical design aspects: Sequential circuit implementation using ROMs.

References:

1. M. M. Mano and M. D. Ciletti, *Digital Design*, 6th ed. Pearson, 2018.
2. C. E. Strangio, *Digital Electronics: Fundamental Concepts and Applications*, PHI, 1987.
3. C. H. Roth, *Fundamentals of Logic Design*, 7th ed. Jaico Publishers, 2013.
4. W. I. Fletcher, *An Engineering Approach to Digital Design*, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1980.
5. R. J. Tocci, and N. S. Widmer, *Digital Systems - Principles and Applications*, 11th ed. Prentice Hall, 2010.
6. J. F. Wakerly, *Digital Design: Principles and Practices*, 4thed. Prentice-Hall, 2008.
7. D.D. Givone, *Digital Principles and Design*, Tata McGraw-Hill, 2003
8. R. Katz, *Contemporary Logic Design*, 2nd ed. Addison Wesley, 2004.
9. D. Lewin and D. Protheroe, *Design of Logic Systems*, 2nd ed. Chapman & Hall, University and Professional Division, 1992.
10. T. L. Floyd, *Digital Fundamentals*, 11th ed. Prentice Hall, 2017.

EE1092E ELECTRICAL MEASUREMENTS LAB

Pre-requisites: NIL

L	T	P	O	C
0	0	2	1	1

Total Practical Sessions: 26

Course Outcomes:

CO1: Use different electrical calibration and measurement devices.
CO2: Determine loss characteristics of a magnetic material.
CO3: Design measuring devices employing range extension principles.
CO4: Measure characteristics of electrical elements employing DC and AC Bridge technique.
CO5: Prepare laboratory reports that clearly communicate experimental information in a logical and scientific manner.

Syllabus / List of Experiments:

1. Extension of range of ammeter/voltmeter using shunt/series resistance and calibration of the meter using standard ammeter/voltmeter.
2. Measurement of low/medium resistance using Kelvin's double bridge and Wheatstone's bridge.
3. Measurement of inductance and capacitances using AC Bridges and LCR meter
4. Extension of range of a dynamometer type wattmeter using CT/PT and calibration of the extended meter using a standard wattmeter.
5. Calibration of single – phase energy meter by direct loading and phantom loading at various powerfactors.
6. Measurement of three phase power using two wattmeter method.
7. Measurement of reactive power and power factor with different loads.
8. Calibration of 3-phase energy meter using standard wattmeter.
9. Determination of Iron losses using Lloyd Fischer square
10. Determination of hysteresis loop of an iron ring specimen using DSO/CRO.
11. Determination of ratio error and phase error of CT.

Note: Normally the practical classes are administered in two cycles. Depending on the availability of equipment and time, class coordinators may choose the experiments for each cycle.

References:

1. Golding E.W, *Electrical Measurements & Measuring Instruments*, 5th ed. Reem publications, 2009.
2. Cotton.H, *Advanced Electrical Technology*, Wheeler Publications, 2011.
3. Suresh Kumar K.S *Electric Circuit and Networks,* Pearson education, 2009.
4. Cooper W.D, *Modern Electronics Instrumentation*, Prentice Hall of India, 1986.