AISSMS
INSTITUTE OF INFORMATION TECHNOLOGY
(IOIT)
ADDING VALUE TO ENGINEERING
An Autonomous Institute Affiliated to Savitribai Phule Pune University
Approved by AICTE, New Delhi and Recognised by Govt. of Maharashtra
Accredited by NAAC with "A+" Grade | NBA - 5 UG Programmes

Program - Electrical Engineering

Structure and Detailed Curriculum (UG Program)

Second Year B.TECH

(Effective from A. Y.: 2023-24)

AISSMS INSTITUTE OF INFORMATIONTECHNOLOGY
Kennedy Road, Near RTO,
Pune – 411 001, Maharashtra State, India Email:
principal@aissmsioit.org ,
Website: https://aissmsioit.org/

Institute Vision & Mission

Vision

To be recognized amongst top 10 private engineering colleges in Maharashtra by the year 2026 by rendering value added education through academic excellence, research, entrepreneurial attitude, and global exposure.

Mission

To enable placement of 150 plus students in the 7 lacs plus category & ensure 100% placement of all final year students
To connect with 10 plus international universities, professional bodies and organizations to provide global exposure to students
To create conducive environment for career growth, prosperity, and happiness of 100% staff.
To be amongst top 5 private colleges in Pune in terms of admission cut off.

Quality Policy

We commit ourselves to provide quality education & enhance our students quality through continuous improvement in our teaching and learning processes.

Department Vision & Mission

VISION

To be known for imparting quality education in the field of electrical engineering and preparing competent professionals with high human values to serve the society.

MISSION

- To train the graduates with the latest technologies through industry institute interactions and experiential teaching learning practices to meet the emerging global challenges.
- To enhance engineering skills, employability skills, and research through professional activities.
- To develop globally competent electrical engineers with professional ethics and commitment to society.

PROGRAM EDUCATION OBJECTIVES

Graduates will

- Investigate problems in electrical engineering and provide effective solutions.
- Excel in the professional career, research, higher studies, and entrepreneurship.
- Engage in lifelong learning by adapting a professional, social, and ethical attitude for contributing to societal needs.

Program Outcomes (POs)

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. [Engineering knowledge]
2. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. [Problem analysis]
3. 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. [Design/development of solutions]
4. 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. [Conduct investigations of complex problems]
5. 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. [Modern tool usage]
6. 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. [The engineer and society]
7. Understandtheimpactoftheprofessionalengineeringsolutionsinsocietalandenvironmental contexts, and demonstrate the knowledge of, and need for sustainable development. [Environment and sustainability]

8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. [Ethics]
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. [Individual and teamwork]
10. Communicateeffectivelyoncomplexengineeringactivitieswiththeengineeringcommunity 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. [Communication]
11. Demonstrateknowledgeandunderstandingoftheengineeringandmanagementprinciples and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. [Project management and finance]
12. 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. [Life-long learning]

Program Specific Outcomes (PSOs)

PSO 1: The graduates will be able to proficiently employ the software tools used in the design and analysis of electrical systems.

PSO2: The graduates will be able to acquire skills in electric mobility, power quality, and renewable energy.

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical (Lab)/week	0.5 credits 1 credit

B. Range of credits –

A range of credits from 160 to 176 for a student to be eligible to get Undergraduate degree in Engineering. A student will be eligible to get Undergraduate degree with Honors and additional Minor Engineering, if he/she completes an additional 20 credits.

C. Credit for Undergraduate Degree in Electrical Engineering

Sr. No.	Year	Semester	Credits
1	First Year	I	21
2		II	19
3	Second Year	III	22
4		IV	24
5	Third Year	V	23
6		VI	25
7	Final Year	VII	12
8		VIII	14
Total Credits			**160**

D. Structure of Undergraduate Engineering program

Sr. No.	Domains	Code	Total Credits	As per NEP Credits
1	Basic Science Courses	BSC	**16**	14-18
2	Engineering Science Courses	ESC	**16**	12-16
3	Programme Core Courses	PCC	**56**	44-56
4	Programme Elective courses	PEC	**18**	20
5	Open Elective other than particular Programme	OEC	**06**	08
6	Vocational and Skill Enhancement Courses	VSE	**08**	08
7	Humanities Social Science and Management	HSM	**12**	14
8	Experiential Learning Courses	ELC	**24**	22
9	Liberal Learning Courses	LLC	**04**	04
Total Credits			**160**	**160-176**

E. Domain wise Credits Distribution:

Sr. No.	Domain Code	UG Program Credits									
		Semesters								Total Credits	Credits As Per NEP
		I	II	III	IV	V	VI	VII	VIII		
1	BSC	8	8	-	-	-	-	-	-	**16**	14-18
2	ESC	9	7	-	-	-	-	-	-	**16**	12-16
3	PCC	-	-	16	16	13	8	3	-	**56**	44-56
4	PEC	-	-	-	-	4	7	7	-	**18**	20
5	OEC	-	-	3	-	3	-	-	-	**06**	08
6	VSE	1	1	-	3	-	3	-	-	**08**	08
7	HSM	-	-	3	3	3	3	-	-	**12**	14
8	ELC	3	3	-	-	-	2	2	14	**24**	22
9	LLC	-	-	-	2	-	2	-	-	**04**	04
Total Credits		**21**	**19**	**22**	**24**	**23**	**25**	**12**	**14**	**160**	160 - 176
Total Marks		**650**	**650**	**725**	**775**	**725**	**775**	**600**	**600**	**5500**	**-**
Total Working Hours per Week		**30**	**28**	**25**	**28**	**27**	**31**	**16**	**26**	**-**	**-**

F. Honor Degree–Advanced Electrical Engineering

Sr. No.	Course Code	Course Name	Offered in Semester	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	ELHDT511	Advanced Power Electronics	V	3	1	2	**05**	40	60	25	--	--	**125**
2	ELHDT613	Advanced Power System	VI	3	--	2	**04**	40	60	--	--	--	**100**
3	ELHDT707	Advanced Control System	VII	3	1	2	**05**	40	60	25	--	--	**125**
4	ELHDT803	Non-Conventional Energy Systems	VIII	3	--	2	**04**	40	60	--	--	--	**100**
Total				**12**	**02**	**08**	**18**	**160**	**240**	**50**	--	--	**450**

G. Honor Degree –with Research

Sr. No.	Course Code	Course Name	Offered in Semester	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	ELHDR708	Research Methodology	VII	3	--	--	**03**	40	60	--	--	--	**100**
2	ELHDR709	Mathematical Modeling		3	--	--	**03**	40	60	--	--	--	**100**
3	ELHDR710	Dissertation Phase I		--	--	4	**02**	--	--	25	--	25	**50**
5	ELHDR804	Paper Publication	VIII	--	--	4	**02**	--	--	50	--	--	**50**
6	ELHDR805	Research Publication Ethics		2	--	--	**02**	--	50	--	--	--	**50**
7	ELHDR806	Dissertation Phase II		--	--	12	**06**	--	--	100	-	50	**150**
Total				**08**	**--**	**20**	**18**	**80**	**170**	**175**	**--**	**75**	**500**

H. Major Courses:

Sr. No.	Course Code	Course Name	Semester	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	ELPCC302	Electrical Circuit Analysis	III	3	1	--	**04**	40#	60*	--	--	--	**100**
2	ELPCC303	Electrical Measurements	III	3	--	--	**03**	40#	60**	--	--	--	**100**
3	ELPCC304	Analog and Digital Circuits	III	3	--	--	**03**	40#	60*	--	--	--	**100**
4	ELPCC305	Power System Engineering	III	3	--	--	**03**	40#	60*	--	--	--	**100**
5	ELPCC307	Electrical Circuit Analysis Lab	III	--	--	2	**01**	--	--	25	50	--	**75**
6	ELPCC308	Electrical Measurements Lab	III	--	--	2	**01**	--	--	25	--	--	**25**
7	ELPCC309	Analog and Digital Circuits Lab	III	--	--	2	**01**	--	--	25	25	--	**50**
8	ELPCC402	Computational Techniques	IV	3	--	--	**03**	40#	60*	--	--	--	**100**
9	ELPCC403	DC and Induction Machines	IV	3	--	--	**03**	40#	60*	--	--	--	**100**
10	ELPCC404	Microcontroller & Integrated Circuit based Application	IV	3	--	2	**04**	40#	60**	--	--	--	**100**
11	ELPCC405	Power Electronics	IV	3	--	--	**03**	40#	60*	--	--	--	**100**
12	ELPCC407	Computational Techniques Lab	IV	--	--	2	**01**	--	--	25	25	--	**50**
13	ELPCC408	DC and Induction Machines Lab	IV	--	--	2	**01**	--	--	25	25	--	**50**
14	ELPCC409	Power Electronics Lab	IV	--	--	2	**01**	--	--	25	25	--	**50**
15	ELPCC502	Power System Analysis	V	3	--	--	**03**	40#	60*	--	--	--	**100**
16	ELPCC503	Control System Engineering	V	3	1	--	**04**	40#	60*	--	--	--	**100**
17	ELPCC504	Principles of Electrical Machine Design	V	3	--	2	**04**	40#	60**	--	--	--	**100**
18	ELPEC505	Elective-I	V	3	--	--	**03**	40#	60*	--	--	--	**100**
19	ELPCC507	Power System Analysis Lab	V	--	--	2	**01**	--	--	25	25	--	**50**
20	ELPCC508	Control System Engineering Lab	V	--	--	2	**01**	--	--	25	--	50	**75**
21	ELPEC509	Elective-I Lab	V	--	--	2	**01**	--	--	25	--	--	**25**
22	ELPCC602	Switch Gear and Protection	VI	3	--	--	**03**	40#	60*	--	--	--	**100**
23	ELPCC603	Power System Operation & Control	VI	3	--	--	**03**	40#	60*	--	--	--	**100**

24	ELPEC604	A. Electrical Estimation Costing &Design/ B. Electric Dives	VI	3	--	2	**04**	40#	60**	--	--	--	**100**
25	ELPEC605	Elective-II	VI	3	--	--	**03**	40#	60*	--	--	--	**100**
26	ELPCC607	Switch Gear and Protection Lab	VI	--	--	2	**01**	--	--	25	--	25	**50**
27	ELPCC608	Power System Operation & Control Lab	VI	--	--	2	**01**	--	--	25	--	25	**50**
28	ELPCC701	Power Quality: Issues and Mitigation	VII	2	--	--	**02**	40#	60*	--	--	--	**100**
29	ELPEC702	Elective-III	VII	3	--	--	**03**	40#	60*	--	--	--	**100**
30	ELPEC703	Elective-IV	VII	3	--	--	**03**	40#	60*	--	--	--	**100**
31	ELPCC705	Power Quality: Issues and Mitigation lab	VII	--	--	2	**01**	--	--	--	--	50	**50**
32	ELPEC706	Elective-III Lab	VII	--	--	2	**01**	--	--	50	50	--	**100**
33	ELELC609	Mini Project	VI	--	--	4	**02**	--	--	--	--	50	**50**
34	ELELC704	Project Stage-I	VII	--	--	4	**02**	--	--	100	--	50	**150**
35	ELELC801	Internship/ 2 MOOCs/ Entrepreneurship/ Research Project	VIII	2	--	20	**12**	--	--	200 @	--	100	**300**
36	ELELC802	Project Stage-II	VIII	--	--	4	**02**	--	--	200	--	100	**300**
Total				**58**	**2**	**64**	**92**	**760**	**1140**	**625**	**225**	**450**	**3400**

I. Minor Courses:

Sr. No.	SEM	Course Code	Course Name	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	3rd	ELMNR301	Electrical Measurements	3	--	--	**03**	--	75	--	--	--	**75**
2	3rd	ELMNR302	Electrical Measurements Lab	--	--	2	**01**	--	--	25	--	--	**25**
3	4th	ELMNR401	DC and Induction Machines	3	--	--	**03**	--	75	--	--	--	**75**
4	4th	ELMNR402	DC and Induction Machines Lab	--	--	2	**01**	--	--	25	--	--	**25**
5	5th	ELMNR501	Principles of Electrical Machine Design	3	--	--	**03**	--	75	--	--	--	**75**
6	5th	ELMNR502	Principles of Electrical Machine Design Lab	--	--	2	**01**	--	--	25	--	--	**25**
7	6th	ELMNR601	Switch Gear and Protection	3	--	--	**03**	--	75	--	--	--	**75**
8	6th	ELMNR602	Switch Gear and Protection Lab	--	--	2	**01**	--	--	25	--	--	**25**
Total				**12**	**--**	**08**	**16**	**--**	**300**	**100**	**--**	**--**	**400**

J. Open Elective Courses:

Sr. No.	Course Code	Course Name	Semester	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	ELOEC306	Solar and Wind Energy Systems/ MOOCs	III	3	--	--	**03**	40$^{\$}$	60$$	--	--	--	**100**
2	ELOEC506	Energy Audit and Management/ MOOCs	V	3	--	--	**03**	40$^{\$}$	60$$	--	--	--	**100**
Total				**06**	**--**	**--**	**06**	**80**	**120**	**--**	**--**	**--**	**200**

K. Vocational and Skill Enhancement Courses:

Sr. No.	Course Code	Course Name	Semester	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	ELVSE406	Electrical Safety	IV	1	--	4	**03**	--	--	50	50	--	**100**
2	ELVSE606	Electric Vehicle	VI	1	--	4	**03**	--	--	50	50	--	**100**
Total				**02**	**--**	**08**	**06**	**--**	**--**	**100**	**100**	**--**	**200**

L. Humanities Social Science and Management Courses:

Sr. No.	Course Code	Course Name	Semester	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	ELHSM301	Democracy, Election and Governance	III	2	--	--	**02**	--	--	25	--	25	**50**
2	ELHSM310	Audit Course 3 – Vedic Mathematics	III	1	--	--	**01**	--	--	25	--	--	**25**
3	ELHSM401	Industrial Management	IV	1	1	--	**02**	--	--	25	--	25	**50**
4	ELHSM410	Audit Course 4 – Sustainable Development Goals (SDG)	IV	1	--	--	**01**	--	--	25	--	--	**25**
5	ELHSM501	Intellectual Property Rights	V	2	--	--	**02**	--	--	25	--	25	**50**
6	ELHSM510	Audit Course 5 – Foreign Language Level-I (German/ Japanese)	V	1	--	--	**01**	--	--	25	--	--	**25**
7	ELHSM601	Seminar and Technical Paper writing	VI	1	--	2	**02**	--	--	50	--	--	**50**
8	ELHSM610	Audit Course 6 – Foreign Language Level-II (German/ Japanese)	VI	1	--	--	**01**	--	--	25	--	--	**25**
Total				**10**	**01**	**02**	**12**	**--**	**--**	**225**	**0**	**75**	**300**

M. Experiential Learning Courses:

Sr. No.	Course Code	Course Name	Semester	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	ELELC609	Mini Project	VI	--	--	4	**02**	--	--	--	--	50	**50**
2	ELELC704	Project Stage-I	VII	--	--	4	**02**	--	--	100	--	50	**150**
3	ELELC801	Internship/ 2 MOOCs/ Entrepreneurship/ Research Project	VIII	2	--	20	**12**	--	--	200@	--	100	**300**
4	ELELC802	Project Stage-II	VIII	--	--	4	**02**	--	--	200	--	100	**300**
Total				**02**	**--**	**32**	**18**	**--**	**--**	**500**	**--**	**300**	**800**

N. Liberal Learning Courses:

Sr. No.	Course Code	Course Name	Semester	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	ELLLC411	Lifelong Learning Skills - I	IV	--	--	--	**01**	--	--	25	--	--	--
2	ELLLC412	Lifelong Learning Skills - II	IV	--	--	--	**01**	--	--	25	--	--	--
3	ELLLC611	Lifelong Learning Skills - III	VI	--	--	--	**01**	--	--	25	--	--	--
4	ELLLC612	Lifelong Learning Skills - IV	VI	--	--	--	**01**	--	--	25	--	--	--
Total				**--**	**--**	**--**	**04**	**--**	**--**	**100**	**--**	**--**	**--**

Lifelong Learning Skills courses I, II, III, IV courses introduced in 4th and 6th sem. where all the students are required to acquire 2 credits in each semester, one each from **Extracurricular Activities and Co-curricular Activities** respectively which will have grades as below. The Activity Certificate obtained during S.Y.& TY B. Tech will be considered in 4th and 6th semester.

i) Extra-curricular Activities:

Sr. No.	Activity	Level	Achievement	Grade	Achievement	Grade
1.	Sports	Inter collegiate	Participation	P	Prize winner	C
		University	Participation	C	Prize winner	B
		Zonal	Participation	B	Prize winner	B+
		State	Participation	B+	Prize winner	A
		National	Participation	A	Prize winner	A+
		International	Participation	A+	Prize winner	O
2.	NSS/NCC	Camp	Attended	B		
		Camp + 5 Activities	Attended	B+		
		Camp + 10 Activities	Attended	A		
		Camp + 15 Activities	Attended	A+		
		Camp + 20 Activities	Attended	O		
3.	Cultural	Inter collegiate	Participation	B	Prize winner	B+
		State	Participation	B+	Prize winner	A
		National	Participation	A	Prize winner	A+
		International	Participation	A+	Prize winner	O

4.	Community Engagement	Certified by NGO/Authorities with report and geo-tagged photograph	1 Activity	B		
			2 Activities	B+		
			3 Activities	A		
			4 Activities	A+		
			5 Activities	O		

ii) Co-curricular Activities:

Sr. No	Activity	Level	Achievement	Grade	Achievement	Grade
1.	Conference	National	Participation	B	Prize winner	A
		International	Participation	B+	Prize winner	A+
		International (Scopus indexing)	Participation	A+	Prize winner	O
2.	Journal Publication	Non-refereed but recognized and reputed journal/ periodical, having ISSN number.		B		
		Refereed Journal - As listed by UGC		A		
		Refereed Journals- As listed by Scopus		A+		
		Refereed Journals - As listed by SCI/ SCIE		O		
3.	Hackathon		Participation	A+	Prize winner	O
4.	Professional Body	National	Membership	P	3rd Prize	A
			Activities/participation	B	2nd Prize	A+
			5 participations	B+	1st Prize	O
5.	Internship	1 week	Completed	C		
		2 week	Completed	B		
		3 week	Completed	B+	Sponsored Project	A+
		4 week	Completed	A	Job through internship	O
6.	Entrepreneurship	Awareness camp	Attended	A	Product Developed	A+
					Own Startup	O
7.	Project/Technical events	Inter collegiate	Participation	P	Prize winner	C
		University	Participation	C	Prize winner	B
		Zonal	Participation	B	Prize winner	B+
		State	Participation	B+	Prize winner	A
		National	Participation	A	Prize winner	A+
		International	Participation	A+	Prize winner	O

Any activity other than listed above but having equal weight age should be considered for getting additional credit.

O. Exit Courses:

i) Certification Course in Electrical Operation and Maintenance:

Sr. No.	Exit Point	Course Code	Course Name	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	After First Year	ELEXC101	Electrical Wiring and Maintenance	--	--	4	**02**	--	--	50	--	--	**50**
2		ELEXC102	Electrical Safety	--	--	4	**02**	--	--	50	--	--	**50**
3		ELEXC103	Internship	--	--	8	**04**	--	--	100	--	--	**100**
Total				--	--	**16**	**08**	--	--	**200**	--	--	**200**

ii) Diploma in Electrical Audits:

Sr. No.	Exit Point	Course Code	Course Name	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	After Second Year	ELEXC201	Electrical Installation and Maintenance	--	--	4	**02**	--	--	50	--	--	**50**
2		ELEXC202	Energy Audit	--	--	4	**02**	--	--	50	--	--	**50**
3		ELEXC203	Internship	--	--	8	**04**	--	--	100	--	--	**100**
Total				--	--	**16**	**08**	--	--	**200**	--	--	**200**

iii) B. Vocational in Sub-station Operations:

Sr. No.	Exit Point	Course Code	Course Name	Hours per week			Credits	Examination scheme					
				L	T	P		ISE	ESE	TW	PR	OR	Total
1	After Third Year	ELEXC301	Sub-station Operation	--	--	4	**02**	--	--	50	--	--	**50**
2		ELEXC302	Commissioning of Installation	--	--	4	**02**	--	--	50	--	--	**50**
3		ELEXC303	Internship	--	--	8	**08**	--	--	100	--	--	**100**
Total				--	--	**16**	**08**	--	--	**200**	--	--	**200**

Electrical Engineering- Second Year B. Tech (Semester –III)												
Sr. No.	**Code**	**Course Title**	**Hours per week**			**Credits**	**Examination scheme**					
			L	**T**	**P**		**ISE**	**ESE**	**TW**	**PR**	**OR**	**Total**
1	ELHSM301	Democracy, Election and Governance @@	2	--	--	2	--	--	25	--	25	**50**
2	ELPCC302	Electrical Circuit Analysis	3	1	--	4	40#	60*	--	--	--	**100**
3	ELPCC303	Electrical Measurements	3	--	--	3	40#	60**	--	--	--	**100**
4	ELPCC304	Analog and Digital Circuits	3	--	--	3	40#	60*	--	--	--	**100**
5	ELPCC305	Power System Engineering	3	--	--	3	40#	60*	--	--	--	**100**
6	ELOEC306	Solar and Wind Energy/ MOOCs	3	--	--	3	40$	60$$	--	--	--	**100**
7	ELPCC307	Electrical Circuit Analysis Lab @@	--	--	2	1	--	--	25	50	--	**75**
8	ELPCC308	Electrical Measurements Lab	--	--	2	1	--	--	25	--	--	**25**
9	ELPCC309	Analog and Digital Circuits Lab @@	--	--	2	1	--	--	25	25	--	**50**
10	ELHSM310	Audit Course 3 - Vedic Mathematics	1	--	--	1	--	--	25	--	--	**25**
	Total		**18**	**01**	**06**	**22**	**200**	**300**	**125**	**75**	**25**	**725**
11	ELMNR301	Minor (Electrical Measurements)	3	--	--	**3**	--	75	--	--	--	**75**
12	ELMNR302	Minor Lab (Electrical Measurements Lab)	--	--	2	**1**	--	--	25	--	--	**25**
	Minor Total		**03**	**--**	**02**	**04**	**--**	**75**	**25**	**--**	**--**	**100**
Grand Total			**21**	**01**	**08**	**26**	**200**	**375**	**150**	**75**	**25**	**825**

L- Lecture, T-Tutorial, P-Practical

* **End Semester Examination (ESE)** based on subjective questions.

** **Practical or Activity based Evaluation.**

\# **In Semester Evaluation**
In Semester I : Subjective Examination/ Multiple-Choice Question (MCQ) examination.
In Semester II: based on Presentation/ Group Discussion/ Laboratory Work/ Course Project/ Home Assignment/ Comprehensive Viva Voce/ Blog Writing/ Case Study/ Survey.

$ **For MOOCs:** Assignments marks will be converted on the scale of 40 marks.

$$ **For MOOCs:** Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

MOOC: Solar and Wind Energy:
https://onlinecourses.nptel.ac.in/noc23_ge41/preview

Note: @@ Passing is mandatory in both the examination heads to gain total Course Credits

Electrical Engineering - Second Year B. Tech (Semester –IV)												
Sr. No.	**Code**	**Course Title**	**Hours per week**			**Credits**	**Examination scheme**					
			L	**T**	**P**		**ISE**	**ESE**	**TW**	**PR**	**OR**	**Total**
1	ELHSM401	Industrial Management @@	1	1	--	**2**	--	--	25	--	25	**50**
2	ELPCC402	Computational Techniques	3	--	--	**3**	40#	60*	--	--	--	**100**
3	ELPCC403	DC and Induction Machines	3	--	--	**3**	40#	60*	--	--	--	**100**
4	ELPCC404	Microcontroller & Integrated Circuit based Application	3	--	2	**4**	40#	60**	--	--	--	**100**
5	ELPCC405	Power Electronics	3	--	--	**3**	40#	60*	--	--	--	**100**
6	ELVSE406	Electrical Safety @@	1	--	4	**3**	--	--	50	50	--	**100**
7	ELPCC407	Computational Techniques Lab @@	--	--	2	**1**	--	--	25	25	--	**50**
8	ELPCC408	DC and Induction Machines Lab @@	--	--	2	**1**	--	--	25	25	--	**50**
9	ELPCC409	Power Electronics Lab @@	--	--	2	**1**	--	--	25	25	--	**50**
10	ELHSM410	Audit Course 4 - Sustainable Development Goals (SDG)	1	--	--	**1**	--	--	25	--	--	**25**
11	ELLLC411	Lifelong Learning Skills - I	--	--	--	**1**	--	--	25	--	--	**25**
12	ELLLC412	Lifelong Learning Skills - II	--	--	--	**1**	--	--	25	--	--	**25**
	Total		**15**	**01**	**12**	**24**	**160**	**240**	**225**	**125**	**25**	**775**
13	ELMNR401	Minor (DC and Induction Machines)	3	--	--	**3**	--	75	--	--	--	**75**
14	ELMNR402	Minor Lab (DC and Induction Machines Lab)	--	--	2	**1**	--	--	25	--	--	**25**
	Minor Total		**03**	**--**	**02**	**04**	**--**	**75**	**25**	**--**	**--**	**100**
Grand Total			**18**	**01**	**14**	**28**	**160**	**315**	**250**	**125**	**25**	**875**

L- Lecture, T-Tutorial, P-Practical

* **End Semester Examination (ESE)** based on subjective questions.

** **Practical or Activity based Evaluation.**

\# **In Semester Evaluation**

In Semester I : Subjective Examination/ Multiple-Choice Question (MCQ) examination.

In Semester II: based on Presentation/ Group Discussion/ Laboratory Work/ Course Project/ Home Assignment/ Comprehensive Viva Voce/ Blog Writing/ Case Study/ Survey.

Note: @@ Passing is mandatory in both the examination heads to gain total Course Credits.

Second Year B.TECH			
Democracy, Election and Governance (ELHSM301)			
Course Code:	**ELHSM301**	**Credit**	**2**
Contact Hours:	2 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	Term-work 25 marks	Oral 25 marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term-work	Internal	25
2.	Oral	Internal	25

Course Objectives:	
1	To introduce the students meaning of democracy and the role of the governance.
2	To help them understand the various approaches to the study of democracy and governance.

Course Outcomes: Students will be able to	
301.1	Know the meaning of democracy and the role of the governance in life.
301.2	Understand the various approaches to the democracy and governance.

Topics covered:

UNIT I: Democracy (5 hrs.)

a. Constitution of India
b. Evolution of Democracy- Different Models
c. Dimensions of Democracy- Social, Economic, and Political

UNIT II: Election (5 hrs.)

a. Indian tradition of decentralization
b. History of panchayat Raj institution in the lost independence period
c. 73rd and 74th amendments
d. Challenges of caste, gender, class, democracy and ethnicity

UNIT III: Governance (5 hrs.)

a. Meaning and concepts
b. Government and governance
c. Inclusion and exclusion

Textbooks:

1. Banerjee-Dube, I. (2014). *A history of modern India*. Cambridge UniversityPress.
2. Basu, D. D. (1982). *Introduction to the Constitution of India*. Prentice Hall ofIndia.
3. Bhargava, R. (2008). *Political theory: An introduction*. Pearson EducationIndia.

4. Bhargava, R., Vanaik, A. (2010) *Understanding Contemporary India: Critical Perspective.* New Delhi: Orient Blackswan.

5. Chandhoke. N., Proyadardhi.P, (ed) (2009), '*Contemporary India: Economy, Society, Politics*', Pearson India Education Services Pvt. Ltd, ISBN 978-81- 317-1929-9.

6. Chandra, B. (1999). *Essays on contemporary India*. Har-Anand Publications.

7. Chaterjee, P. (1997). State and Politics in India.

8. Dasgupta. S., (ed) (2011), *'Political Sociology'*, Dorling Kindersley (India)Pvt. Ltd., Licensees of Pearson Education in south Asia. ISBN: 978-317-6027- 7.

9. Deshpande, S. (2003). Contemporary India: A Sociological View, New Delhi:Viking Publication.

10. Guha, R. (2007). India After Gandhi: The History of the World's Largest. *Democracy, HarperCollins Publishers, New York.*

11. Guha, R. (2013). *Gandhi before India*. Penguin UK.

12. Jayal. N.G. (2001). *Democracy in India.*New Delhi: Oxford University Press.

13. Kohli, A. (1990). *Democracy and discontent: India's growing crisis ofgovernability*. Cambridge University Press.

14. Kohli, A., Breman, J., & Hawthorn, G. P. (Eds.). (2001). *The success of India'sdemocracy* (Vol. 6). Cambridge University Press.

15. Kothari, R. (1989). *State against democracy: In search of humane governance*.Apex Pr.

16. Kothari, R. (1970). *Politics in India*. New Delhi: Orient Blackswan.

17. Kothari, R. (1995). *Caste in Indian politics*. Orient Blackswan.

18. Sarkar, S. (2001). *Indian democracy: the historical inheritance. the Success ofIndia's Democracy*, 23-46.

Reference Books:

मराठी संदर्भ ग्रंथ:

१. राही श्रुती गणेश., आवटे श्रीरंजन, (२०१९), *'आपलं आयकार्ड'*, सुहास पळशीकर द युनिक अकॅडमी पब्लिकेशनप्रा.लि.,.

२. व्होरा राजेंद्र., पळशीकर, सुहास.(२०१४). *भारतीय लोकशाही अर्थ आणि व्यवहार.* पुणे : डायमंड प्रकाशन.

३. सुमंत, यशवंत.(२०१८). *प्रा. यशवंत सुमंत यांची तीन भाषणे.* पुणे : युनिक अँकॅडमी पब्लिकेशन्स प्रा.लि

४. भोळे. भा.ल. (२०१५). *भारतीय गणराज्याचे शासन आणि राजकारण.* नागपूर: पिंपळापुरे बुक प्रकाशन

५. कसबे. रावसाहेब. (२०१०)डॉ. आंबेडकर आणि भारतीय राज्यघटना. पुणे: सुगावा प्रकाशन

Note: The assessment for the subject shall be based on presentation and report submission.

Second Year B.TECH			
Electric Circuits Analysis (ELPCC302)			
Course Code:	**ELPCC302**	**Credit**	**4**
Contact Hours:	3 Hrs./week (L) 1 Hrs./week (Tut.)	**Type of Course:**	Lecture/Tutorial
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Prerequisite: -
Terminology of electrical networks, series and parallel combinations of resistance, Laplace transform, linear differential equations.

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	External	**60**

Course Objectives:	
1	To develop the strong foundation for Electrical Networks.
2	To develop analytical qualities in Electrical circuits by application of various theorems.
3	To understand the behaviour of circuits by analysing the transient response using classical methods and Laplace Transform approach.
4	To apply knowledge of laws and Network theory for analysis of 2-port networks and design of other circuits like filters.

Course Outcomes: Students will be able to: able to	
302.1	Calculate current/voltage in electrical circuits using simplification techniques, Mesh, Nodal analysis and network theorems.
302.2	Analyse the response of circuits with electrical supply in transient and stead state.
302.3	Apply Laplace transform to analyse behaviour of an electrical circuit.
302.4	Derive formula and solve numerical of two port network and Design of filters.

Topics covered:		
UNIT I:	**Circuit Concepts and Network Theorems**	**(6 hrs.)**
Energy Sources, Independent and dependent sources, Source transformation, Nodal and Mesh analysis in DC circuits, Concept of Super mesh and super node. D.C. Network Theorems: Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum Power Transfer theorem, Millman’s theorem, Reciprocity theorem.		
UNIT II:	**Introduction to Graph Theory**	**(6 hrs.)**
Concept of the network graph, the terminology used in the network graph, the relation between twigs and links, the formation of incidence matrix, tie-set matrix, cut-set matrix, Kirchhoff’s laws into topological form, the relationship between branch voltage matrix, twig voltage matrix, and node voltage matrix, the relation between branch current matrix and loop current matrix.		

UNIT III:	Applications of Differential Equations	(6 hrs.)
Introduction to first order and second order differential equations. Behaviors of network elements under switching condition and their representation, Solution of initial and final condition in series RL, RC and RLC networks using DC sources.		
UNIT IV:	**Applications of Laplace Transform**	**(6 hrs.)**
Introduction to Laplace transform, Laplace transform and its application to network analysis, transient and steady state response to Standard signals. Analysis of RC, RL and RLC network with and without initial conditions with Laplace transforms.		
UNIT V:	**Two port Network**	**(6 hrs.)**
Two port parameters: Open circuit, short circuit, transmission and hybrid Parameters, relationships between parameter sets, parallel connection of two port networks.		
UNIT VI:	**Network Functions and Filters**	**(6 hrs.)**
Network functions: Network functions for one port and two-port networks, driving point and transfer functions, poles and zeros of network functions, restrictions on Pole and zero locations for driving point functions and Transfer functions, time domain behavior from pole - zero plot. **Filters:** Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T-section, π-section of low pass filter.		

List of Tutorials (any Ten)
1. Determine the current using mesh and nodal analysis for AC networks with independent sources with dependent and for DC networks with dependent sources.
2. Determine Thevenin's equivalent circuit and Norton equivalent circuit of AC networks.
3. Determine the current in AC networks independent sources and DC networks with dependent using Superposition Theorem.
4. Find the load impedance of network delivering Maximum Power to the load. Also, determine amount of Maximum Power.
5. Determine the current in load impedance by Millman's Theorem.
6. Identify tree and co-tree of DC and AC networks.
7. Determine the current in series RL, RC and RLC circuit by using Transient Response.
8. Find the current flowing through and voltage across circuit element using Laplace Transform approach. Also, find their initial and final value.
9. Determine the Impedance, Admittance, ABCD and Hybrid parameters of the network.
10. Determine and plotting pole zero from transfer function.
11. Design T-section and π-section of Low Pass Filter (LPF).

	Textbooks:
1	W H Hayt, S M Durbin, J E Kemmerly, "Engineering Circuit Analysis", 7th Edition Tata McGraw-Hill Education.
2	M. E. Van Valkenburg, "Network Analysis", 3rd Edition, PHI Learning.
3	D. Roy Choudhury, "Networks and Systems", 2nd Edition, New Age International.
4	Ravish R. Singh "Network Analysis and Synthesis"

	Reference Books:
1	F. F. Kuo,“ Network Analysis and synthesis“, John Wiley and sons.
2	N Balabanian and T.A. Bickart, „Linear Network Theory: Analysis, Properties, Design and Synthesis“, Matrix Publishers, Inc.
3	C. L. Wadhwa, Network Analysis and synthesis“, New Age international.
4	B. Somanathan Nair, “Network Analysis and Synthesis”, Elsevier Publications

Second Year B.TECH			
Electrical Measurements (ELPCC303)			
Course Code:	**ELPCC303**	**Credit**	**3**
Contact Hours:	3 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Prerequisite: -
Fundamental concepts, various laws-principles and theorems related to electrical systems, Introduction to resistance, inductance, capacitance. Basic knowledge of current, voltage, power, energy, and frequency.

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	**40**
2.	Practical or Activity based Evaluation	External	**60**

Course Objectives:	
1	To explain fundamental concepts of the measurement.
2	To explain the concepts of instrument transformers and meters and procedure to map the relevant standards.
3	To demonstrate the configuration and setup of digital meters to measure the electrical parameters.
4	To discuss different communication technologies and explain the process of collecting data from the digital/smart meters.
5	To introduce advanced instruments and demonstrate different software tools.

Course Outcomes: Students will be able to:	
303.1	Explain the fundamental concepts of the measurement.
303.2	Use instrument transformers, multimeter/panel meters/clamp meters and map relevant standards.
303.3	Configure/set up digital meters and measure electrical parameters.
303.4	Select appropriate communication technology to log data from the digital/smart meters.
303.5	Use relevant software tools to prepare the basic report from the data received from digital/smart meters.

Topics covered:		
UNIT I:	**Fundamentals of Measurement**	**(6 hrs.)**
SI System of measurement, Concept of Static Dynamic Characteristics of Measuring Instruments, Types of Error in Measuring Instruments, Review of electromechanical measurements (Generic principle of conventional electro dynamometer theory). Measurement of other parameters: temperature, pressure, solar radiation, wind etc.		

UNIT II:	Use of Instrument Transformers and Study of Standards	(6 hrs.)
Applications of Instrument transformers [BIS ETD 34], Types and use of i. Multimeter ii. Panel meters [Basic/Multifunction] iii. Clamp meters, Calibration of meters. Study of BIS / IEEE / IEC standards [BIS ETD 12 & 13 Standards, IEEE 1459-2010, IEEE P120]		
UNIT III:	**Measurement of Basic Electrical Parameters**	**(6 hrs.)**
Digital meters – Basics, Block diagram, ADC, sampling, Connections, Setup and Configuration. Measurement of [using digital meters] - R, L and C. - voltage, current [True RMS], PF, and Frequency. - Insulation, Earth resistance – Megger, Earth clamp meter. - Earth Loop Impedance measurement		
UNIT IV:	**Measurement of Power & Energy**	**(6 hrs.)**
Measurement of Power – Single phase, multi-phase, balanced and unbalanced, active, reactive, and apparent power. Measurement of Energy – Single phase, multi-phase, four quadrant theory, active, reactive, and apparent energy. 1-phase utility energy meter, 3-phase utility meter (LT and HT).		
UNIT V:	**Modern Communication Technologies and Systems**	**(6 hrs.)**
Data Acquisition & Virtual Instrumentation Communication – RS 485, Ethernet, Wi-Fi. Datalogger, Energy monitoring system. Digital Transient measurements and analysis with an introduction to the measurement of pre-during-post event cycles and the concept of the trigger.		
UNIT VI:	**Introduction to Advanced Instruments and Software**	**(6 hrs.)**
Advanced meters – Power Quality Analyzer, Portable Appliance Testing (PAT), Electrical Installation tester, Thermal Imaging, Maximum Demand Controller Introduction to software – LabVIEW, Smart Meter software (Fluke Energy Analyze Plus, Janitza GridVis), Microsoft Excel, Microsoft Power BI.		

Textbooks:

1. Sawhney, A. K., and Puneet Sawhney. A course in Electrical and Electronic Measurements and Instrumentation, 19th Edition, 2016, Dhanpat Rai & Company
2. J. B. Gupta, “A Course in Electronics and Electrical Measurements and Instrumentation” S. K. Kataria & Sons
3. Electronic Instrumentation and Measurements 4th Edition By H S. Kalsi 2019 McGraw Hill
4. M. M. S. Anand “Electronics Instruments and Instrumentation Technology” by, PHI Publication
5. B. C. Nakra& K. K. Chaudhari, “Instrumentation Measurement and Analysis”, Tata McGraw Hill.

Reference Books:

1. Golding's Electrical Measurements and Measuring Instruments, 6/e (Revised & Enlarged) : With Solved Examples & MCQ's (In M.K.S. Units)
2. David A. Bell, Electronic Instrumentation and Measurements, 2013, 3rd Edition, Oxford University Press
3. Albert D. Helfrick, William David Cooper, Modern electronic instrumentation and measurement techniques, 2016, Pearson India Education
4. NPTEL Course: Electrical Measurement And Electronic Instruments By Prof. Avishek Chatterjee, Dept. of Electrical Engineering, IIT Kharagpur:- Web link https: // nptel.ac.in /courses /108 /105 / 108105153/
5. 1459-2010 - IEEE Standard Definitions for the Measurement of Electric Power Quantities Under Sinusoidal, Non-sinusoidal, Balanced, or Unbalanced Conditions – Redline [https://ieeexplore.ieee.org/document/5953405]
6. 120-1989 - IEEE Master Test Guide for Electrical Measurements in Power Circuits [https://ieeexplore.ieee.org/document/89666]
7. P120/D3, May 2023 - IEEE Draft Master Test Guide for Electrical Measurements in Power Circuits
8. BIS - ET12, 13 & 34 Standards

Second Year B.TECH			
Analog and Digital Circuits (ELPCC304)			
Course Code:	**ELPCC304**	**Credit**	3
Contact Hours:	3 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Prerequisite: -
Basic Electrical and Electronics engineering

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	External	**60**

Course Objectives:	
1	To use K map for Boolean algebra reduction and design digital circuit
2	To construct sequential and combinational circuits using flip flops and K map
3	To develop the concept of basics of operational Amplifier and its applications
4	To understand the concept of transistor as amplifier and its operations

Course Outcomes: Students will be able to:	
304.1	Use numbering system and Boolean algebra for simplification of complex logic expression
304.2	Design logical, sequential and combinational digital circuit using K-Map
304.3	Apply and analyse applications of OPAMP in open and closed loop condition
304.4	To identify various transistor configuration and compare the same

Topics covered:

UNIT I:	**Digital Fundamentals**	**(6 hrs.)**

Numbering systems-binary, octal, decimal and hexadecimal and their conversion, Binary and Decimal Codes, Binary arithmetic: - addition and subtraction by 1's and 2's compliment. Booleans algebra, De-Morgan's theory-map: - structure for two, three and four Variables, Sum Of Product (SOP) and Product of Sum (POS) form reduction of Boolean expressions by K-map.

UNIT II:	**Combinational Circuits**	**(6 hrs.)**

Adder, Subtractor, Binary parallel adder, 4-Bit parallel subtractor, Serial adder, BCD adder, Code converters, Comparators, Encoders, Priority Encoder, Decoder.

UNIT III:	**Sequential Circuits**	**(6 hrs.)**

Types of Flip flop, Edge Triggered flip flop, applications of flip-flops, Registers, shift registers and its applications, serial to parallel converter, parallel to serial converter, Counters, Counter design Using flip-flops, Asynchronous sequential circuits.

UNIT IV:	Bipolar Junction Transistor (BJT) & Applications	(6 hrs.)
BJT amplifier: Introduction, Class A amplifier, AC-DC load line analysis, Single stage and Multistage BJT amplifier, direct coupled, RC coupled, and transformer coupled, Darlington pair, Push-Pull amplifier and differential amplifier.		
UNIT V:	**Operational Amplifier**	**(6 hrs.)**
Op-Amp: Block diagrams of 741, ideal and practical parameters, open loop and close loop configuration of Op-Amp. Applications of Op- Amp- Comparator, Schmitt trigger, zero crossing detectors, V-I and I-V converters, Instrumentation amplifier, peak detector.		
UNIT VI:	**Waveform generation and DC Voltage regulators**	**(6 hrs.)**
Waveform generation using Op-amp - sine, square, saw tooth and triangular generator, Active filters-Its configuration with frequency response, Analysis of first order low pass and high pass filters, IC 555 – construction, working and modes of operation- Astable and mono stable multi vibrators, Sequence generator voltage regulators using ICs 78xx, 79xx,LM 317 .		

Textbooks:

1. Floyd and Jain, “Digital Fundamentals”, Pearson Education
2. R. P. Jain, “Digital Electronics”, Tata McGraw Hill, New Delhi.
3. Malvino, “Digital Computer Electronics- An Introduction to Microcomputers,” Tata McGraw Hill
4. Gaikwad R., “Operational Amplifier”, PHI New Delhi
5. Floyd, “Electronics Devices”, Pearson Education
6. Mottershed, “Electronics Devices & Circuits”, PHI New Delhi

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. Forth 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. Bimbhra, “Power Electronics”, Khanna Publications.

Second Year B.TECH			
Power System Engineering (ELPCC305)			
Course Code:	**ELPCC305**	**Credit**	**3**
Contact Hours:	3 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Prerequisite: -
1. Knowledge of fundamentals of electrical circuit components and engineering mathematics. 2. Power and energy calculation

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	External	**60**

Course Objectives:	
1	To introduce the different conventional and nonconventional power generation plants.
2	To explain the basic structure of electrical power systems and different electrical terms related to them.
3	To discuss the components of overhead lines and the procedure to calculate line sag, and string efficiency.
4	To discuss concepts of resistance, inductance, and capacitance of transmission lines and their impact on the performance of lines.
5	To discuss the classification of transmission lines and explain the procedure to estimate the performance of transmission lines.

Course Outcomes: Students will be able to:	
305.1	Identify components and explain the working principle of conventional and nonconventional power generation plants.
305.2	Calculate factors associated with generating station and draw the load curve.
305.3	Explain components of overhead lines and calculated line sag, and string efficiency.
305.4	Calculate the resistance and inductance of different transmission line configurations.
305.5	Calculate the inductance and capacitance of different transmission line configurations.
305.6	Analyze the performance of short and medium transmission lines.

Topics covered:		
UNIT I:	**Introduction to Electrical Power Generation**	**(8 hrs.)**
Thermal, Hydro, nuclear, diesel & gas power generation (Limited to block diagrams). Introduction to renewable energy sources, Concept of cogeneration and captive generation. Introduction to Indian National Power Grid, Load Dispatch Center (LDC).		

UNIT II:	Introduction to Electrical Power Systems	(8 hrs.)

Structure of Electrical Power System**,** different factors associated with generating stations (Such as connected load, maximum demand, demand factor, average load, load factor, diversity factor, plant capacity factor, reserve capacity, plant use factor).
Load curve, load duration curve, concept of base load and peak load stations, Interconnected grid system. Various systems of transmission of electric power, choice of working voltage for transmission.

UNIT III:	Overhead Lines and Insulators	(8 hrs.)

Main components of overhead lines, Line supports, conductor spacing, length of span, calculation of sag for equal and unequal supports and effect of ice and wind loadings. Statutory rules & Indian electricity rules, High Temperature and Low Sag (HTLS) conductor.
Types of insulators, voltage distribution along string of suspension insulators, string efficiency, equalization of potential across each unit, method of improving string efficiency, insulator failure, testing of Insulators. Relevant Standards.

UNIT IV:	Resistance, Inductance of Transmission Line	(8 hrs.)

Resistance of transmission line, skin effect and its effects, proximity effect.
Internal & external flux linkages of single conductor, inductance of single phase two wire line, inductance of three phase line with symmetrical and unsymmetrical spacing, concept of G.M.R. and G.M.D, necessity of transposition

UNIT V:	Capacitance of Transmission Line	(8 hrs.)

Electric potential at single charged conductor, potential at conductor in a group of charged conductors, capacitance of single-phase line, Capacitance of single phase line with effect of earth's surface on electric field, Concept of G.M.R. and G.M.D for capacitance calculations, capacitance of three phase line with symmetrical and unsymmetrical spacing.

UNIT VI:	Performance of Transmission Lines	(8 hrs.)

Classification of lines based on length and voltage levels. Performance of short transmission line with voltage current relationship and phasor diagram, Representation of medium lines as 'Nominal Pi' and 'Nominal Tee' circuits using R, L and C parameters. Ferranti effect,
Representation of 'Tee' and 'Pi' models of lines as two port networks, evaluation and estimation of generalized circuit constants (ABCD) for short and medium lines, Estimation of Efficiency & regulation of short & medium lines.

Industrial Visit: Visit to HV/EHV substation.

Textbooks:

1 J. B. Gupta, "Transmission and Distribution", S. K. Kataria & Sons, New Delhi.
2 V. K. Mehta, Rohit Mehta, "Principles of Power System", S. Chand Publication
3 J. B. Gupta, "Generation and Economic Considerations", S. K. Kataria & Sons, New Delhi.
4 Dr. B. R. Gupta, "Generation of Electrical Energy", S. Chand Publication
5 A Chakraborty, M. L. Soni, P. V. Gupta, U.S. Bhatnagar, "A textbook on Power System Engineering", Dhanpatrai & Co., Delhi.

	Reference Books:
1.	Nagrath & Kothari, “Power System Engineering”, Tata McGraw Hill Publications.
2.	D. Das, “Electrical Power System”, New Age Publication.
3.	W.D. Stevenson, “Power System Analysis”, Tata McGraw Hill Publications.
4.	MAHADISCOM Website https://www.mahadiscom.in/en/daily-power-position/
5.	Ministry of Power Website https://powermin.gov.in/
6.	Grid Controller of India Limited (Formerly POSOCO -Power System Operation Corporation Limited) website (Reports Section) https://posoco.in/ Western Region Load Dispatch Center website (Data Dashboard Section) https://wrldc.in/
7.	NPTEL Power System Analysis, Prof. Debapriya Das IIT Kharagpur https://youtube.com/playlist?list=PLRWKj4sFG7-6gWwDMLI0Wy5DDRqyKP1uQ
8.	Nagrath & Kothari, “Power System Engineering”, Tata McGraw Hill Publications.

Second Year B.TECH			
Solar and Wind Energy (ELOEC306)			
Course Code:	**ELOEC306**	**Credit**	**3**
Contact Hours:	3 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Prerequisite: -
1. Renewable energy system, Energy conversion system

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	External	**60**

Course Objectives:	
1	To explain basics and types of solar thermal systems.
2	To discuss various types of concentrators
3	To make students aware of different solar PV systems
4	To explain development and operation of wind energy system

Course Outcomes: Students will be able to:	
306.1	Differentiate between types of solar Concentrators
306.2	Explain solar cells and solar PV systems
306.3	Explain the basics of wind energy systems and turbines used in wind generation
306.4	Compare different types of wind energy systems

Topics covered:		
UNIT I:	**Solar Energy: Basics and Concepts**	**(6 hrs.)**
Solar Radiation Need for solar concentration, various types of solar concentrators, movement of Sun and tracking		
UNIT II:	**Solar cell concepts**	**(6 hrs.)**
Types of solar cell and comparison, Introduction to various types of solar module manufacturing, Basic system design and economics		
UNIT III:	**Solar PV Systems**	**(6 hrs.)**
Introduction to solar PV (SPV) systems, SPV appliances, small capacity SPV power plants, Grid tied SPV power plants and Large scale SPV power plants.		
UNIT IV:	**Wind Energy Basics**	**(6 hrs.)**
Power Contained in Wind, Thermodynamics of Wind Energy, Efficiency Limit for Wind Energy Conversion, the maximum energy obtained for a Thrust-operated converter (Efficiency limit), Design of Wind Turbine Rotor, Power-Speed Characteristics, Torque-Speed Characteristics.		
UNIT V:	**Basics: Turbine terms, types and theories**	**(6 hrs.)**
Wind Turbine Control Systems: a) Pitch Angle Control, b) Stall Control, c) Power Electronics Control, d) Yaw Control, Control Strategy, Wind Speed Statistics, Statistical Wind Speed Distributions, Site and Turbine Selection.		

UNIT VI:	Power Generation from Wind Energy	(6 hrs.)
Extraction of wind energy and wind turbine power. Introduction to Offshore Wind Energy System and its comparison with Wind Energy System.		
Textbooks:		
1. S.P. Sukhatme, “Solar Energy”, Tata McGraw Hill **2.** Chetan Singh Solanki, “Solar Photovoltaics-Fundamentals, Technologies and Applications”, PHI Second Edition **3.** Godfrey Boyle, “Renewable Energy”, Third edition, Oxford University Press **4.** H. P. Garg, J. Prakash, “Solar Energy-Fundamentals and Applications”, Tata McGraw hill Publishing Co. ltd., First Revised Edition. **5.** Mukund R. Patel, “Wind and Power Solar System”, CRC Press		
Reference Books:		
1. P.Kothari, K.C.Singal, Rakesh Rajan,“Renewable Energy Sources and Emerging Technologies”, PHI Second Edition **2.** Tapan Bhattacharya, “Terrestrial Solar Photovoltaics”, Narosa Publishing House **3.** Paul Gipe, “Wind Energy Comes of Age”, John Wiley & Sons Inc **4.** Thomas Ackermann, “Wind Power in Power Systems”, Wiley Publications **5.** Tony Burton, Nick Jenkins, David Sharpe, “Wind Energy HandBook-Second Edition”, John Wiley & Sons, Ltd., Publication		

Second Year B.TECH			
Electric Circuits Analysis Lab (ELPCC307)			
Course Code:	**ELPCC307**	**Credit**	**1**
Contact Hours:	2 Hrs./week (Pr.)	**Type of Course:**	Practical
Examination Scheme	Term Work 25 Marks	Practical. Examination 50 Marks	

Prerequisite: -
Terminology of electrical networks, series and parallel combinations of resistance, Laplace transform, linear differential equations.

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work. Evaluation	Internal	**25**
2.	Practical. Examination	External	**50**

Course Objectives:	
1	To learn the verification of different network theorems using AC and DC sources.
2	To analyse the Transient response of the circuits in time domain.
3	To analyse the behaviour of the circuit's response using a software
4	To understand the significance of network functions.

Course Outcomes: Students will be able to:	
307.1	Illustrate electrical network theorems.
307.2	To verify and use the various network theorems in practical applications.
307.3	Develop differential equation for steady state and transient analysis
307.4	Design different filters using software's.

List of Experiments:

1. Verification of Kirchhoff's current law and voltage law for ac as well as dc source.
2. Verification of super position theorem for ac as well as dc source.
3. Verification of maximum power transfer theorem for ac circuit.
4. Verification of Thevenin's and Norton's theorem.
5. Determination of parameter of Two Port Network.
6. Verification of series resonance using hardware and digital simulation
7. Study of resonance using MATLAB/ pspice.
8. Study of High pass and low pass filter using MATLAB/ Pspice.
9. Study of transient response of RL and RC circuit using MATLAB/ Pspice.
10. Study of transient response of series RLC circuit using MATLAB/ Pspice.

Experiments on Virtual laboratory

1. Verification of Norton Theorem
2. Verification of Thevenin Theorem
3. Verification of Superposition Theorem
4. Verification of Millman's Theorem
5. R-L-C Circuit Analysis
6. Verification of Reciprocity Theorem
7. Verification of Maximum Power Transfer Theorem

Second Year B.TECH			
Electrical Measurements Lab (ELPCC308)			
Course Code:	**ELPCC308**	**Credit**	**1**
Contact Hours:	2 Hrs./week (Pr.)	**Type of Course:**	Practical
Examination Scheme	Term Work 25 Marks		

Prerequisite: -
Fundamental concepts, various laws-principles and theorems related to electrical systems, Introduction to resistance, inductance, capacitance. Basic knowledge of current, voltage, power, energy, and frequency.

Sr. No.	**Course assessment methods/tools**	**External/ Internal**	**Marks**
1.	Term Work. Evaluation	Internal	**25**

Course Objectives:	
1	To demonstrate parts of electromechanical meters.
2	To explain the concepts and connections of instrument transformers and meters and procedure to map the relevant standards.
3	To demonstrate the configuration and setup of digital meters to measure the electrical parameters.
4	To demonstrate different communication technologies and the process of collecting data from the digital/smart meters.
5	To demonstrate advanced instruments and different software tools.

Course Outcomes: Students will be able to:	
308.1	Select and use instrument transformers.
308.2	Configure/set up and use instruments / digital meters to measure electrical parameters.
308.3	Select appropriate communication technology to log data from the digital/smart meters.
308.4	Use relevant software tools to prepare the basic report from the data received from digital/smart meters.

List of Experiments:

Basic Experiments [Compulsory]

1. Demonstration of parts (by dismantling the meter) of various electromechanical meters. Explanation of symbols & notations used on instruments.
2. Selection and use of CT & PT for digital meters.
3. Measurement of basic electrical parameters using multimeters, panel meters, and clamp meters.
4. Calibration of digital meters available in the laboratory.
5. Measurement of insulation resistance, earth resistance & earth loop impedance.
6. Measurement of Power - Single phase, multi-phase, balanced and unbalanced, active, reactive, and apparent power.
7. Measurement of Energy – Single phase, multi-phase, four quadrant theory, active, reactive, and apparent energy. 1-phase utility energy meter, 3-phase utility meter.
8. Collection of digital meter data using RS485/Ethernet/WiFi (datalogger/PC) and analyzing it using software.

Advanced Experiments [Optional]

1. Measurement of parameters using Power Quality Analyzers.
2. Testing of home appliances using Portable Appliance Testers (PAT).
3. Use of Electrical Installation tester.
4. Thermography of Electrical installation. Configuration and using Maximum Demand Controller.
5. Analysis of electrical measurement data using software.

Second Year B.TECH			
Analog and Digital Circuits Lab (ELPCC309)			
Course Code:	**ELPCC309**	**Credit**	**1**
Contact Hours:	2 Hrs./week (Pr.)	**Type of Course:**	Practical
Examination Scheme	Term Work 25 Marks	Practical. Examination 25 Marks	

Prerequisite: -
Basic Electrical and Electronics engineering

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work. Evaluation	Internal	**25**
2.	Practical. Examination	External	**25**

Course Objectives:	
1	To familiarise students with digital electronics laboratory, ICs and concept of VCC and ground.
2	To prepare students to perform the design of various digital electronic circuit and circuits using OPAMPS.
3	To teach students to implement the designed digital as well as analog circuits.

Course Outcomes: Students will be able to:	
309.1	Read the datasheets of various ICs.
309.2	Design simple digital electronics circuits and circuits using OPAMP
309.3	Implement the circuits and verify the results

List of Experiments:

Experiment 1 is compulsory and perform any 7 experiments from 2 to 13

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.
2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.
3. Implementation of Adder and Subtractor circuits.
4. Design logical circuit to convert binary to EXCESS 3/Gray number system
5. Counters: Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Design 2:4 / 3:8 decoder for binary to octal decoding.
7. Find phase angle difference between the same frequency signal using ZCD and AND gate.
8. Design of comparator and Schmitt trigger.
9. Design sine and square wave generator.
10. Design first order high pass and low pass filter using OP AMP IC741
11. Design of monostable muti vibrator using IC555 and digital circuit to count number of pulses.
12. Design astable multivibrator using IC-555.
13. Design a small signal voltage amplifier, plot its frequency response and obtain bandwidth.

Second Year B.TECH			
Audit Course 3 - Vedic Mathematics (ELHSM310)			
Course Code:	**ELHSM310**	**Credit**	**1**
Contact Hours:	1 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	Term Work 25 Marks		

Prerequisite: -
1. Vedic Sutras, Vedic Sub Sutras.

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	**25**

Course Objectives:	
1	To develop the understanding of Techniques/Sutras to solve mathematical arithmetic's in easy and faster way and use these techniques to varies Competitive Examinations.
2	To Improve speed and efficiency to solve even the most complex Mathematical problems.
3	To remove the phobia about mathematics in the minds of Students.
4	To help students to have better command over mathematical concepts and boost up their self-confidence level towards the subject.

Course Outcomes: Students will be able to:	
310.1	Apply Vedic Mathematics techniques to Perform quickly and accurately mathematical calculations like multiplication, division, squares, cubes, LCM, HCF.
310.2	Apply Vedic Mathematics techniques to solve Linear Equations, Quadratic Equations, Factorization of a Cubic Polynomial.
310.3	Apply Vedic Mathematics techniques to Perform calculations in Coordinate Geometry, Differentiation, Integration and Trigonometry without relying heavily on calculators or written methods.

Topics covered:		
UNIT I:	**Basic Level**	**(4 hrs.)**
Introduction of Vedic Mathematics, Multiplication, Square, Cube, Divisibility Test, Highest Common Factor of Polynomials, Multiplication of Polynomials, Division of Polynomials,		
UNIT II:	**Intermediate Level**	**(4 hrs.)**
Linear Equations, Quadratic Equations, Factorization of a Cubic Polynomial, Magic squares, Dates and Calendar.		
UNIT III:	**Advance Level**	**(4 hrs.)**
Determinant, Coordinate Geometry, Differentiation, Integration, Trigonometry.		

	Textbooks:
1	Advanced Vedic Mathematics, Rajesh Kumar Thakur.
2	Vedic Mathematics Made Easy, DhavalBathia
3	VEDIC MATHEMATICS for Students: LEVEL – 1 OF 5 SERIES, by Nava Vision
	Reference Books:
1	Sri Bharatikrishna Tirthaji," Vedic Mathematics",Published by MotilalBanarsidass, 1965.ISBN 81-208-0163-6.
2	Williams K.R. "Discover Vedic Mathematics" Vedic Mathematics Research Group, 1984.ISBN 1-869932-01-3.
3	Wiliams K.R. and M.Gaskell "The Cosmic Calculator". MotilalBanarsidass ,2002.ISBN 81-208-1871-7.
4	Nicholas A.P., Williams,J. Pickles."Vertically and Crosswise". Inspiration books, 1984.ISBN 1-902517-03-2

Second Year B.TECH			
Industrial Management (ELHSM401)			
Course Code:	**ELHSM401**	**Credit**	2
Contact Hours:	1 Hrs./week (L) 1 Hrs./week (Tut.)	**Type of Course:**	Lecture/ Tutorial
Examination Scheme	Term Work 25 Marks	Oral Examination 25 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work Evaluation	Internal	**25**
2.	Oral Examination	External	**25**

Course Objectives:	
1	To explain the principles of management and the fundamentals of economics and Management.
2	To make students aware about the basic concepts of human and industrial relationships, professional ethics and the importance of leadership skill and motivation.
3	To explain the fundamentals of Human Resource management and Entrepreneurship.
4	To enhance problem solving skills by collaborative / team learning
5	To imbibe employability and entrepreneur skills.

Course Outcomes: Students will be able to:	
401.1	Explain fundamentals of economics and management and compare different types of business organization.
401.2	Explain the importance of technology management and quality management.
401.3	Discuss the qualities of a good leader and entrepreneur.
401.4	Explain the fundamentals of human resources management.

Topics covered:

UNIT I:	Principles of Management	(2 hrs.)

Management: Meaning, scope and its importance. Difference between administration and management. Types of business ownership: Sole proprietorship, Partnership (Act 1934), LLP (Limited Liability Partnership), (Act2008). Joint Stock Company: Public Limited and Private Limited, Public-Sector Undertaking (PSU)

Managerial Economics: Definition of economics, Demand and Supply concept and the law, Elasticity of demand and supply,

Sustainable development Goals (SDG): Introduction and Implementation. Structure of goals, targets and indicators.

UNIT II:	Human Resource Management	(2 hrs.)

a. Human and Industrial Relations: Human relations and performance in organization. Understand self and others for effective behavior. Industrial relations and disputes. Relations with subordinates' peers and superiors. Characteristics of group behavior, handling of grievances.

b. **Professional Ethics:**

Concept of ethics and professionalism. Need and Code of professional ethics. Typical problems of professional engineers.

UNIT III:	Quality Management and Safety	(2 hrs.)
a. Quality Management Definition of Quality Management: Assistance Tools: Ishikawa diagram – Pareto Analysis. Pokka Yoke (Mistake Proofing) quality circles, Kaizen. TQM, 5S (Case study of Toyota). Six-Sigma, The ISO 9001:2015 Quality Management System Standard- The ISO 14001:2015. Environmental Management System Standard (SDG 13) **b. Accidents and Safety**: Classification and causes of accidents; according to nature of injuries i.e. fatal, temporary; according to event and according to place. Effects of accidents. Action to be taken in case of accidents. Safety procedures. Safety measures-Do's and don'ts		
UNIT IV:	**Marketing and Financial Management**	**(2 hrs.)**
Marketing and selling, marketing planning. Market survey and market research, online Marketing. Perfect Competition, Monopoly, Monopolistic competition and Oligopoly. Definition of financial management, cost. Types of costs, and methods of costing, price, capital. Debit, credit.		
UNIT V:	**Leadership and Human Resource**	**(2 hrs.)**
Introduction to Motivation, theories of work motivation: Maslow Hierarchy of need's theory (SDG 1,2 ,3,6,8), Theory X, Theory Y. Herzberg's two factor theory. (SDG 8) **Group dynamics:** stages of group dynamics: Norming, Storming, Forming, Performing and Adjourning. **Leadership-** Laissez-faire, importance, qualities of good leadership. Human Resource Management- Introduction, importance, scope. HR planning. Recruitment, selection, training and development.		
UNIT VI:	**Entrepreneurship**	**(2 hrs.)**
Entrepreneurship- Definition, concept, traits, qualities of entrepreneur. Incentives for small business development, Government policies and incentives.		

Textbooks:

1. Industrial Engineering and Management by TR Banga.
2. Industrial Engineering and Management by OP Khanna, Dhanpat Rai Publications, Delhi
3. Industrial Management by VK Sharma, OP Harkut.
4. Environmental and Pollution Awareness: Satya Prakashan, New Delhi.
5. Thakur Kailash, Environment Protection Law & Policy in India: Deep & Deep publication, New Delhi.
6. Handbook of Small-Scale Industry by P.M. Bhandari.
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Principles of Management by Philip Kotler, TEE Publication.
9. Industrial Organization and Management by Tara Chand, Nem Chand and Brothers, Roorkee

	Reference Books:
1.	C. B. Mamoria and V.S.P.Rao- Personnel Management, Himalaya Publishing House, 30th Edition 2014
2.	Harold Koonlz and O D'onnel – Management.McGrawHill Publication 1980
3.	Philip Kotler- Marketing Management. Pearson Edition 2008 [R4] Robert Heller, Managing Teams, Dorling Kindersley, London
4.	Kelly John M, Total Quality Management, InfoTech Standard, Delhi
5.	Joseph M. Juran Juran's Quality Handbook TATA McGraw-Hill.

List of problem statements: Guidelines:	
1	Groups of 5 to 6 students should be formed.
2	Students should select one problem from the below given list.
3	Data collection to be done for the problem statement followed by analysis.
4	Findings and solutions should be presented either in the form of Poster / Model.
5	Students can also present the solution using software, simulations.

Problem statements:	
1	Make cities and human settlements inclusive, safe, resilient and sustainable- i) Sustainable Transport, ii) Disaster Risk Reduction and iii) Sustainable cities and human settlements.
2	Development and implementation tools to monitor sustainable development
3	Reduction of product failure rate in an Industry which is manufacturing drives for Electric vehicles.
4	In every house the energy meter shows only the watt usage per hour, whereas there is no information about daily or monthly usage of energy readily available. Beside this many consumers do not know how to read the energy meter and the electricity bill to be paid at the end of the month.
5	Energy conservation measures for residential consumers.
6	Energy conservation measures for industrial consumers.
7	Collect information and prepare report/presentation related to Government policies and incentives beneficial for Entrepreneurship.
8	Just over a third of reported electric vehicle traction battery fires occurred while connected to energized AC or DC charging, or within one hour of being disconnected from energized charging.
9	In the last three quarterly employee engagement surveys, less than 30% of employees at the XYZ company stated that they feel valued by the company. This represents a 20% decline compared to the same period in the year prior.
10	Insurance claim forms originating at the Fremont North Memorial emergency department are causing a loss of revenue, excessive rework costs, and delayed payment to the hospital. Forty-five percent of the claim forms have errors, with an average of 2.3 defects per form.

Second Year B. TECH			
Computational Techniques (ELPCC402)			
Course Code:	**ELPCC402**	**Credit**	**3**
Contact Hours:	3 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Prerequisite: -
1. Differentiation and integration of a single real variable, ordinary differential equations. 2. Programming and Problem solving. 3. Linear Algebra. 4. Programming language basics

Sr. No.	**Course assessment methods/tools**	**External/ Internal**	**Marks**
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	External	**60**

Course Objectives:	
1	To emphasize the need of computational techniques and analyse errors involved in the computation.
2	To provide sound knowledge of various numerical methods.
3	To apply various numerical methods to obtain solution of different types of equations such as transcendental, simultaneous, ODE etc. and for interpolation, integration, and differentiation.
4	To impart skills to develop algorithms and programs for various numerical methods.

Course Outcomes: Students will be able to:	
402.1	Demonstrate types of errors in computation and their causes of occurrence.
402.2	Calculate root of algebraic and transcendental equations using various methods.
402.3	Apply numerical methods for various mathematical problems such as interpolation, numerical differentiation.
402.4	Solve linear simultaneous equation using direct and indirect method.
402.5	Apply numerical methods for various mathematical problems such as integration and ordinary differential equation.
402.6	Develop algorithms and write computer programs for various numerical methods

Topics covered:		
UNIT I:	**Introduction to Python**	**(6 hrs.)**
Variables, Strings, Tuples and Lists, Operators, Conditionals, Loops, Type conversion, Reading Input, Printing output, Functions, and modules.		
UNIT II:	**Errors and Concept of Root of equation**	**(6 hrs.)**
Errors: Different types of errors, causes of occurrence and remedies to minimize them. Generalized error formula. C**oncept of roots** of an equation. Descartes' rule of signs, Intermediate value theorem.		

UNIT III:	**Roots of equations:**	**(6 hrs.)**
Intermediate value theorem. Algebraic Equation: Bisection method, Regular-Falsi method, Newton-Raphson method. Newton Raphson method for 2 variables. Application: Analysis of electrical circuits using above methods.		
UNIT IV:	**Interpolation and Numerical Differentiation**	**(6 hrs.)**
Interpolation: Difference operators, Introduction to interpolation - Newton's forward, backward interpolation formulae, Stirling's, and Bessel's central difference formulae (Only Numerical), Newton's divided difference formula, Lagrange's interpolation. Numerical Differentiation using Newton's forward and backward interpolation formulae (Only Numerical)		
UNIT V:	**Linear Simultaneous algebraic equations**	**(6 hrs.)**
Numerical Solution of a system of linear equation: Gauss elimination method, Matrix Inversion, LU Factorization method, Gauss Jacobi method, Gauss Seidel method Application: solving resistive networks		
UNIT VI:	**Numerical Integration and solution of differential equations**	**(6 hrs.)**
Numerical solution of ordinary differential equation: Taylor's series method, Euler's method, Runge-kutta method – 4^{th} order, Numerical Integration: Trapezoidal, Rule, Simpson's 1/3 Rule, Application: Calculation of RMS values		

Textbooks:

1. Steven Chapra, Raymond P. Canale," Numerical Methods for Engineers", McGrawHill International Student Edn.
2. Santosh K. Gupta," Numerical Methods for Engineers", Wiley Eastern.
3. Numerical Methods in Engineering with Python by Jaan Kiusalaas
4. E. Balagurusamy, "Numerical Methods", Tata McGraw Hill Publication
5. Dr. B. S. Grewal, "Numerical Methods in Engineering & Sciences", Khanna Publishers
6. Reema Thareja," PYTHON PROGRAMMING using problem solving approach ", Oxford University press

Reference Books:

1. M. K. Jain, S.R.K. Iyangar, R. K. Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Publications.
2. T. Veerarajan and T. Ramchandran, "Numerical Methods with Programs in C and C++", Tata McGraw Hill Publication
3. P.P. Gupta & G.S Malik, "Calculus of Finite Difference and Numerical Analysis", Krishna Prakashan Media Ltd, Meerut
4. S.S. Sastry, "Introductory methods of Numerical Analysis", PHI Learning PrivateLtd.
5. P. Thangaraj, "Computer oriented Numerical Methods", PHI Learning Private Ltd.

Second Year B.TECH			
DC and Induction Machines (ELPCC403)			
Course Code:	**ELPCC403**	**Credit**	**03**
Contact Hours:	3 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Prerequisite: -
Engineering Physics, Fundamental concepts and Laws related to electromagnetic induction

Sr. No.	**Course assessment methods/tools**	**External/ Internal**	**Marks**
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	External	**60**

Course Objectives:	
1	To impart knowledge about DC machine, power flow in DC machine and to introduce the concept of armature reaction.
2	To introduce fundamental concepts related to Electrical Machines and impart knowledge related to Transformer types, equivalent circuit formation and analysis, testing of transformer for determining performance parameters.
3	To explain parallel operation of transformers and various three phase transformer configurations, special transformers.
4	To introduce concept of rotation magnetic field in three phase induction motor and to study and analyse power flow, performance parameters of three phase induction motor.
5	To impart knowledge about various characteristics, starting methods, testing of three phase induction motor, computation of various parameters from circle diagram.
6	To explain fundamental concepts related to BLDC Motor.

Course Outcomes: Students will be able to:	
403.1	Classify DC motors, explain various performance characteristics of DC motors and evaluate the performance parameters of DC motor.
403.2	State classification of transformers, develop equivalent circuit and evaluate parameters of equivalent circuit, performance parameters of transformer using experimentation data.
403.3	Explain parallel operation and various configurations of three phase transformer.
403.4	Explain rotating magnetic field concept, constructional details of three phase induction motor and evaluate parameters of equivalent circuit, power flow stages.
403.5	Relate transformer –induction motor and analyse the performance of three phase induction motor by plotting circle diagram.
403.6	Explain fundamental concepts of BLDC Motor.

Topics covered:		
UNIT I:	**D.C. Machines**	**(6 hrs.)**
Motoring action, significance of back E.M.F torque equation, working at no-load and on-load. Losses, power flow diagram and efficiency. Descriptive treatment to armature reaction. Compensation methods for armature reaction. Characteristics and applications of D.C. Shunt and Series Motors, speed control of various types of DC motors, Descriptive treatment to different conducting, magnetic, insulating materials used in DC machines		
UNIT II:	**Single Phase Transformer**	**(6 hrs.)**
Single phase Transformer: Concept of ideal transformer. Practical transformer - Useful and leakage flux, its effects. Resistance, leakage reactance and leakage impedance of transformer windings & their effects on voltage regulation and efficiency. Exact and approximate equivalent circuits referred to L.V. and H. V. side of the transformer. Phasor diagrams for no-load and on load conditions. Open circuit and short circuit tests, determination of equivalent circuit parameters from the test data and determination of voltage regulation and efficiency. Transformer ratings. Losses in a transformer, their variation with load, voltage & Frequency on no load losses Efficiency and condition for maximum efficiency. Polarity test, Parallel operation of single-phase transformers, conditions to be satisfied, load sharing under various conditions. Power transformer and distribution transformer. All day Efficiency. Autotransformers, their ratings, and applications. Comparison with two winding transformers with respect to saving of copper and size. & Welding Transformer.		
UNIT III:	**Three Phase Transformers**	**(6 hrs.)**
Standard connections of three phase transformers and their suitability for various applications, voltage Phasor diagrams and vector groups. Descriptive treatment of Parallel operation of three phase transformers Scott connection and V connections. Three winding (tertiary windings) transformers. Testing of transformer as per relevant standards. Descriptive treatment to different conducting, magnetic, insulating materials used in transformer.		
UNIT IV:	**Three Phase Induction Motor**	**(6 hrs.)**
Production of rotating mmf by 3-phase balanced voltage fed to a symmetrical 3-phase winding. Construction: Stator, Squirrel cage & wound rotors. Principle of working, simplified theory with constant air gap flux; slip, frequency of rotor emf and rotor currents, mmf produced by rotor currents, its speed w.r.t. rotor and stator mmf. Production of torque, torque slip relation, condition for maximum torque, torque-slip Characteristics, effect of rotor resistance on torque-slip characteristics. Relation between starting torque, full load torque and maximum torque. Losses in three phase induction motor, power-flow diagram. Relation between rotor input power, rotor copper loss & gross mechanical power developed, efficiency. Descriptive treatment to different conducting, magnetic, insulating materials used in induction motor. Energy efficient induction motor		
UNIT V:	**Performance Analysis of Three Phase Induction Motor**	**(6 hrs.)**
Induction motor as a generalized transformer; phasor diagram. Exact & approximate equivalent circuit. No load and blocked rotor tests to determine the equivalent circuit parameters and plotting the circle diagram. Computation of performance characteristics from the equivalent circuit and circle diagram. Performance curves. Necessity of starter for 3-phase induction motors. Starters for slip-ring and cage rotor induction motors; stator resistance starter, auto transformer starter, star delta starter and rotor resistance starter. D.O.L. starter and soft starting, with their relevant torque and current relations. Comparison of various starters, testing of three phase induction motor as per relevant standards.		

UNIT VI:	Brushless D.C. Motors	(6 hrs.)
Construction, principle of working, types, characteristics, ratings, applications, brushless dc motor control, comparison between BLDC motor and brushed DC motor, Comparison between BLDC Motor and AC Induction Motor		

Textbooks:

1. Edward Hughes "Electrical Technology", ELBS, Pearson Education
2. S. K. Bhattacharya, "Electrical Machine", Tata McGraw Hill publishing Co. Ltd, 2nd Edition.
3. Nagrath& Kothari, "Electrical Machines", Tata McGraw Hill.
4. Bhag S Guru, Husein R. Hiziroglu, "Electrical Machines", Oxford University Press.
5. K Krishna Reddy, "Electrical Machines- I and II", SCITECH Publications (India) Pvt. Ltd. Chennai.
6. Energy efficient induction motor- Dr.B.E.Kushare
7. Ashfaq Husain, "Electrical Machines", DhanpatRai& Sons.

Reference Books:

1. A.E. Clayton and N. N. Hancock, "Performance and Design of Direct Current Machines", CBS Publishers, Third Edition.
2. A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electrical Machines", Tata McGraw Hill Publication Ltd., Fifth Edition.
3. A.S. Leinsdorf, "Theory and performance of DC machines", Tata McGraw Hill.
4. M.G. Say, "Performance and Design of AC. Machines", CBS Publishers and Distributors.
5. Smarajit Ghosh, "Electrical Machines", Pearson Education, New Delhi.
6. Charles I Hubert, "Electrical Machines Theory, Application, & Control", Pearson Education, New Delhi, Second Edition.

Second Year B.TECH			
Microcontroller & Integrated Circuit based Application (ELPCC404)			
Course Code:	**ELPCC404**	**Credit**	**4**
Contact Hours:	3 Hrs./week (L) 2 Hrs./week (Pr.)	**Type of Course:**	Lecture/ Practical
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Prerequisite: -
Fundamentals of Digital Electronics Basic Knowledge of combinational and sequential logic circuits.

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	**40**
2.	Practical or Activity based Evaluation	External	**60**

Course Objectives:	
1	Describe architecture of 8051 microcontroller.
2	To use the 8051-instruction set and apply this knowledge to develop simple programs in assembly language and C language.
3	Explain the organization of Arduino and interface various I/O devices with Arduino
4	Describe communication protocols

Course Outcomes: Students will be able to:	
404.1	Explain the architecture and memory organization of 8051 microcontroller.
404.2	Write simple programs in assembly and C language for 8051microcontroller
404.3	Explain the serial port and interrupt structure of 8051 microcontroller**.**
404.4	To Program Arduino and interface simple I/O Devices
404.5	To interface various sensors with Arduino
404.6	To interface devices with Arduino using various communication protocols.

Topics covered:		
UNIT I:	**Architecture of 8051 Microcontroller**	**(6 hrs.)**
Introduction to concept of microcontroller, Memory organization of 8051, Program Status Word (PSW), Stack and Stack pointer. Ports of 8051. Overview of Instruction set of 8051.		
UNIT II:	**Programming of 8051 Microcontroller**	**(6 hrs.)**
Embedded C concepts, Variables and constants, Operators, Control Loops and Functions Loops Header and source files. 8051 Programming in C. Port programming of 8051 in C (Byte Level and Bit-level). Time delay programming in C.		
UNIT III:	**Serial port and interrupts of 8051.**	**(6 hrs.)**
Introduction to Serial port structure and Interrupt structure in 8051 and its programming.		
UNIT IV:	**Introduction and programming of Arduino**	**(6 hrs.)**
Introduction to ARDUINO. Programming in Embedded-C, Concepts of C language. Interfacing and programming of LED and Switches to Arduino.		

UNIT V:	Interfacing of I/O devices with Arduino	(6 hrs.)
Reading an Analog signal through Arduino with use of Analog to Digital Converter. Introduction of Sensors and actuators. Interfacing of sensors such as temperature, pressure, humidity, light sensor with Arduino. Pulse width modulation technique and its use for controlling DC Motor.		
UNIT VI:	**Communication protocols**	**(6 hrs.)**
Interfacing of Arduino with PC, Sending data to PC through Serial Monitor. Introduction to communication protocols such as Blue tooth communication. and ZIGBEE Wireless communication, Serial Peripheral Interface (SPI) and Inter-integrated circuit(I2C).		

List of Experiments:

Compulsory experiments:

1. Assembly Language Program for the arithmetic operation of 8-bit numbers.
2. 8051 Port programming using IDE
3. Interfacing of LED, Relay with Arduino
4. Interfacing of Seven segment Display with Arduino
5. Interfacing of LCD display with Arduino
6. Control of DC motor using PWM technique
7. Interfacing of IC555 with Arduino for mono stable operation
8. Temperature measurement and display using Arduino
9. Controlling of a led through Zig bee wireless communication
10. Interfacing of SPI enabled device with Arduino
11. Interfacing of Inter-integrated circuit(I2C) enabled device with Arduino

Textbooks:

1. Muhammad Ali Mazidi, J.G. Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearsons Publishers
2. Han-Way Huang," Embedded System Design with C8051", Cengage Learning
3. "Getting Started with Arduino "Mazimo Banzi
4. "C programming for Arduino" Julien Bayle
5. "Learn to Program in Arduino™ C" William Osborne

Reference Books:

1. Scott Mackenzie, "8051 Microcontroller", Pearson Education.
2. Intel Microcontroller data book.
3. "Arduino Cookbook "O-Reilly Michael Margolis

Second Year B.TECH			
Power Electronics (ELPCC405)			
Course Code:	**ELPCC405**	**Credit**	**3**
Contact Hours:	3 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Prerequisite: -
1. Basic electronics engineering. 2. Basic electrical engineering.

Sr. No.	**Course assessment methods/tools**	**External/ Internal**	**Marks**
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	External	**60**

Course Objectives:	
1	Describe basic theory of power semiconductor devices and their practical applications in power electronics.
2	Explain concepts and operating principles of power electronics converters.
3	Analyse performance of different converters.
4	Calculate performance parameters of different converters for R, R-L & R-L-E loads
5	Evaluate effect of change in the firing angle on the output parameters of converters.
6	Compare different converter topologies.

Course Outcomes: Students will be able to:	
405.1	Describe basic theory of power semiconductor devices.
405.2	Develop characteristics of different power electronic switching devices.
405.3	Reproduce working principle of power electronic converters for different types of loads.
405.4	Analyse the performance and characteristics of power electronic converters.
405.5	Solve numerical to calculate performance parameters of different converters for R, R-L & R-L-E loads.
405.6	Compare different converter topologies.

Topics covered:		
UNIT I:	**Power Semiconductor Switches**	**(6 hrs.)**
Thyristor and Power Transistor family Devices (SCR, TRIAC, IGBT, MOSFET) - Construction, working, Static and dynamic Characteristics for SCR, Triggering Circuits (R, R-C, UJT), Commutation Circuits (class C & D) of SCR, Construction, working and Static Characteristics of TRIAC, IGBT and MOSFET.		

UNIT II:	DC to DC converters	(6 hrs.)
Working principle, classification on the basis of operating quadrants (A, B, C, D, E), Control techniques: CLC, TRC, PWM and FM Techniques, analysis of boost (step up) converter with RLE load, buck-boost converter (Descriptive Treatment), Numerical.		
UNIT III:	**Single Phase Controlled AC-DC Converters**	**(6 hrs.)**
Classification of converters, Single phase half (semi) and fully controlled thyristor converters: Quadrants of operation, circuit configurations, working, performance parameters and input-output waveforms for R, R-L & R-L-E loads, Numerical based on output voltage and current calculations.		
UNIT IV:	**Three Phase Controlled AC-DC Converters & AC-AC Converters (AC voltage controllers)**	**(6 hrs.)**
A. **Three Phase Controlled AC-DC Converters -** Three phase fully controlled thyristor converters: circuit configurations, working, performance parameters and input-output waveforms for R & R-L-E loads, Numerical based on output voltage and current calculations. B. **Single phase AC Voltage Controller-** operation with R and RL Load, derivation of Average and RMS output voltage. Single phase cyclo-converter. (Descriptive treatment only).		
UNIT V:	**DC – AC Converters (Inverters)**	**(6 hrs.)**
Classification of inverters, single phase voltage source inverters, single phase current source inverter, single phase full bridge inverter (RLE Load), sinusoidal PWM, harmonics elimination methods of PWM (descriptive treatment only), three phase PWM Inverter, 120^0 and 180^0 mode of conduction.		
UNIT VI:	**Multilevel Inverters**	**(6 hrs.)**
Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped and cascade H bridge multilevel inverters (5 level)		

Textbooks:

1. "Power Electronics: Circuits Devices and Applications", M. H. Rashid, 3rd edition, Pearson/Prentice Hall Publications
2. "Power Electronics Converters, Applications and Design", Ned Mohan, 3rd edition, Jonh Wiley, and Sons.
3. "Power Electronics", Dr. P. S. Bhimra, 2 nd edition, Khanna Publishers.
4. "Thyristorised Power Controller", G. K. Dubey, Wiley Eastern Ltd.
5. "Power Electronics", K. Hari Babu, Scitech Publication.

Reference Books:

1. "Modern Power Electronics and Drives", B. K. Bose, Prentice Hall PTR.
2. "Power Electronics, Devices, circuits, and industrial applications",V.R. Moorthi, Oxford press.
3. "Power Electronics", Vedam Subramanyam, New Age International, New Delhi
4. "Power Electronics", M. D. Singh and K. B. Khandchandani, Tata McGraw Hill
5. "Power Electronics", M.S. Jamil Asghar, PHI.
6. "Power Electronics systems theory and design LPE", Jai P. Agrawal, Pearson Education, Asia.
7. "Power Electronics",B.W. Williams, 2nd edition, John Wiley and sons.

Second Year B. TECH			
Electrical Safety (ELVSE406)			
Course Code:	**ELVSE406**	**Credit**	3
Contact Hours:	1 Hrs./week (L) 4 Hrs./week (P)	**Type of Course:**	Lecture/ Practical
Examination Scheme	TW. Evaluation 50 Marks	PR Examination 50 Marks	

Prerequisite: -

1. Knowledge of basic concept of Electrical engineering.
2. Knowledge of main features of IE rules, 1956.
3. Knowledge of working of firefighting equipment's.

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	**50**
2.	Practical Examination	External	**50**

Course Objectives:	
1	To make students aware about various aspects of electricity safety
2	To explain students the general procedures of operation and maintenance of safety equipment.
3	To explain students' current rules and regulations as per Electricity Act 2003, related to electrical safety.

Course Outcomes: Students will be able to:	
406.1	To identify various protection schemes and circuit breakers
406.2	Develop skills in identifying the presence of electrical hazards
406.3	To understand the significance earthing schemes.
406.4	To recognize different conductor clearances at various system voltages
406.5	To explain the operation and maintenance of firefighting equipment's.
406.6	To explain the working of Nitrogen Injection systems, fire alarm systems and high velocity water mist systems.

Topics covered:

UNIT I:	Overview of basic concepts	(02 hrs.)

AC and DC supply, Fundamentals of electric power, Energy and Power factor, Circuit Breakers and Protective Relays, Basic Protection Schemes of Power Equipment's, interlocking of breaker and isolator, Lightning Arrestors, Earth wire. Introduction of Disaster Management Systems.

UNIT II:	General principles of electric safety	(02 hrs.)

Electricity & Human body, Introduction to different electrical faults/hazards, AC and DC shock, Shock due to induction, Safety Requirements as per Electricity Act 2003, minimum horizontal, vertical, and sectional clearances, Design of safety oriented Electrical installations, General principles of electrical safety, Safety against over voltage, extra-low and residual voltages.

UNIT III:	Earthing / Grounding	(02 hrs.)
Importance of earthing from safety point of view, earthing layout, touch potential and step potential, types of earthing, earthing of equipment, structure, foundation, and cable. Earth mesh, measurement of earthing values, construction of earth pits.		
UNIT IV:	**Electrical Inspection**	**(02 hrs.)**
Inspection procedures for statutory measures, inspection by Electrical inspectors, Check Point of Electrical inspection, Accident Statistics, Risk assessment & management, Central Electricity Authority (Measures relating to Safety and Electric Supply) (Amendment) Regulations, 2019		
UNIT V:	**Safety and Fire Fighting equipment**	**(02 hrs.)**
Safety equipment's- discharge rods, isolator earth blades, safety belts, shoes, helmets, hand gloves, rubber mat etc. Fire Fighting equipment's- Sand buckets, CO_2 gas cylinder, Soda-Acid type and foam type fire extinguishers, Nitrogen injection system, High Velocity water mist trolley		
UNIT VI:	**Miscellaneous topics**	**(02 hrs.)**
Hazardous areas, Electrical insulation Electrical fires, Arc flash Safety issues with emerging energy sources First aid and Fire Fighting Practices in Industrial Installations/Substations, Fire alarm system		

Textbooks:

1. Massimo A.G. Mitolo, "Electrical Safety of Low-Voltage Systems", Mc Graw Hill, 2009.
2. John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel, "Electrical Safety Handbook", 3rd edition, McGraw-Hill, 2006.
3. J. Maxwell Adams, "ELECTRICAL SAFETY - a guide to the causes and prevention of electrical hazards", The Institution of Electrical Engineers, 1994.

Reference Books:

1. W. Fordham Cooper, "Electrical Safety Engineering", second edition, Butterworth & Co., 1986.
2. D.C. Winburn, "Practical Electrical Safety", Marcel Dekker Inc., 1988.
3. Handbook of International Electrical Safety Practices, Princeton energy Resources International, 2010, Scrivener Publishing, USA.

List of Practical's: It is expected to take minimum 8 experiments from the following list:

(Maintain Record in file or separate notebook)

1. Study of provisions made on electrical and fire safety under IE Rules 1956
2. Report on the working of Fire Alarm systems at Substations.
3. Report on the working of Nitrogen Injection Systems for Power Transformers at EHV substations.
4. Report on the working of smoke detectors installed at substations.
5. Study of provisions made on Electrical and fire safety in Disaster Management Systems.
6. Measurement of Earth Resistance at Electrical Installations/substations.
7. Measurement of touch potential & step potential.
8. Use of discharge rods, safety belts, safety shoes, chain pulley blocks, rubber matting etc.
9. Measurement of internal resistance of equipment by using Megger.
10. Measurement of surge counter of Lightning Arrester.
11. Report on action to be taken to reduce accidents.

12. Demo/Substation Visit

The demo on the following topics should be arranged at college. Alternatively, the visit at EHV substation should be organized covering these topics-

a) Demo on safety equipment's –
   i. Discharge rods.
   ii. Hand Gloves
   iii. Helmets
   iv. Chain pulley blocks.
   v. Safety belts
   vi. Safety shoes
   vii. Rubber matting
b) Presentation/ video on operation of firefighting equipment's such as Sand buckets, CO_2 gas
c) cylinder, Soda-Acid type and foam type fire extinguishers.
d) Measurement of earthing values at electrical installations.
e) Demo on use of First Aid kits.
f) Presentation/ video on working of Nitrogen Injection Systems for transformers.

Second Year B.TECH			
Computational Techniques Lab (ELPCC407)			
Course Code:	**ELPCC407**	**Credit**	**1**
Contact Hours:	2 Hrs./week (Pr.)	**Type of Course:**	Practical
Examination Scheme	Term Work 25 Marks	Practical. Examination 25 Marks	

Prerequisite: -
1. Differentiation and integration of a single real variable, ordinary differential equations. 2. Programming and Problem solving. 3. Linear Algebra. 4. Programming language basics

Sr. No.	**Course assessment methods/tools**	**External/ Internal**	**Marks**
1.	Term Work Evaluation	Internal	**25**
2.	Practical Examination	External	**25**

Course Objectives:	
1	To explain how to draw flowchart
2	To explain how to write algorithm
3	To explain the fundamentals of programming and fundamentals of python

Course Outcomes: Students will be able to:	
407.1	Draw flowchart and write algorithm
407.2	Write programs for numerical methods using the concepts of python

List of Experiments:
Experiments are to be performed (Use Python Programming) 1.Programs for intermediate value theorem and Descartes Rule of Sign 2.Solution of a transcendental equation using Bisection or Regula-Falsi method. 3.Program for interpolation using Newton's forward or backward interpolation 4.Program for interpolation using Lagrange's or Newton's Divided difference Interpolation 5.Solution of simultaneous equation using Gauss Seidel or Jacobi method. 6. Solution of a transcendental equation using Newton Rapson 1or 2 variables. 7.Solution of Numerical Integration using Simpson's (1/3) rd. or (3/8) th rule 8.Solution of first order ODE using 4th order RK method or Modified Euler method.

Second Year B.TECH			
DC and Induction Machines Lab (ELPCC408)			
Course Code:	**ELPCC408**	**Credit**	**1**
Contact Hours:	2 Hrs./week (Pr.)	**Type of Course:**	Practical
Examination Scheme	Term Work 25 Marks	Practical Examination 25 Marks	

Prerequisite: -
Standard symbols and notations in circuit diagram, Theory related to transformer, DC machines,3 Phase Induction motor

Sr. No.	**Course assessment methods/tools**	**External/ Internal**	**Marks**
1.	Term Work Evaluation	Internal	**25**
2.	Practical Examination	External	**25**

Course Objectives:	
1	To impart knowledge about DC machine, power flow in DC machine and to introduce the concept of armature reaction.
2	To introduce fundamental concepts related to Electrical Machines and impart knowledge related to Transformer types, equivalent circuit formation and analysis, testing of transformer for determining performance parameters.
3	To explain parallel operation of transformers and various three phase transformer configurations, special transformers.
4	To introduce concept of rotation magnetic field in three phase induction motor and to study and analyse power flow, performance parameters of three phase induction motor.
5	To impart knowledge about various characteristics, starting methods, testing of three phase induction motor, computation of various parameters from circle diagram.
6	To explain fundamental concepts related to BLDC Motor.

Course Outcomes: Students will be able to:	
408.1	Classify DC motors, explain various performance characteristics of DC motors and evaluate the performance parameters of DC motor.
408.2	State classification of transformers, develop equivalent circuit and evaluate parameters of equivalent circuit, performance parameters of transformer using experimentation data.
408.3	Explain parallel operation and various configurations of three phase transformer.
408.4	Explain rotating magnetic field concept, constructional details of three phase induction motor and evaluate parameters of equivalent circuit, power flow stages.
408.5	Relate transformer –induction motor and analyse the performance of three phase induction motor by plotting circle diagram.
408.6	Explain fundamental concepts of BLDC Motor.

List of Experiments: Perform at least any 8 Experiments given below

1. Speed control of D.C. Shunt Motor.
2. Brake test on D.C. Shunt Motor.
3. Hopkinson's test on D.C. Shunts Machines.
4. Polarity test on Single Phase and Three Phase Transformers.
5. O.C. and S.C. test on Single Phase Transformer.
6. Parallel operation of two Single Phase Transformers and study of their load sharing under various conditions of voltage ratios and leakage impedances.
7. To Perform Sumpner's test on Single Phase Transformers.
8. Study of relevant standards for Transformer.
9. Load test on 3-phase Induction Motor.
10. No load & blocked-rotor test on 3-phase induction motor:
    a) Determination of parameters of equivalent circuit.
    b) Plotting of circle diagram
11. Study of constructional details and materials used for –Transformer,3 phase induction motor, DC machine.
12. Comparative study of BLDC Motor, Brushed DC Motor and Induction Motor.

Second Year B. TECH			
Power Electronics Lab (ELPCC409)			
Course Code:	**ELPCC409**	**Credit**	**1**
Contact Hours:	2 Hrs./week (Pr.)	**Type of Course:**	Practical
Examination Scheme	Term Work 25 Marks	Practical Examination 25 Marks	

Prerequisite: -
1. Basic electronics engineering. 2. Basic electrical engineering.

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work Evaluation	Internal	**25**
2.	Practical Examination	External	**25**

Course Objectives:	
1	Introduce power electronics components and static V-I characteristics of SCR, TRIAC, IGBT and MOSFET.
2	Apply the concepts of power electronic converters for efficient conversion/control of power.
3	Demonstrate the working principle of various power electronic converters using simulation.
4	To develop the skills of analysis and simulation of power electronics converters.

Course Outcomes: Students will be able to:	
409.1	Describe the operation and characteristics of SCR, TRIAC, MOSFET and IGBT
409.2	Describe the operation of Single phase-controlled rectifiers
409.3	Describe the operation of Three phase-controlled rectifiers
409.4	Discuss the operation of different types of Choppers.
409.5	Discuss the operation of different types of Inverters.
409.6	Design the different power electronic circuits using MATLAB/Simulation.

List of Experiments:

Compulsory experiments:

1. Static VI characteristic of SCR and TRIAC
2. Output and transfer characteristic of IGBT and MOSFET
3. Analysis of Single phase fully controlled converter with R & RL load.
4. Study of Single phase A.C. voltage regulator.
5. Study of Three phase voltage source PWM inverter using 120^0 and 180^0 mode with R load.

Any three experiments are to be performed out of following (either hardware or simulation)

1. Three phase AC-DC fully controlled bridge converter R and RL load
2. Study of DC step down chopper.
3. Performance of Single phase A.C. voltage regulator with R and RL load in simulation.
4. Simulation of three phase AC-DC fully controlled bridge converter for R and RL load.
5. Simulations of three phase PWM Bridge Inverter for R Load for 120^0 and 180^0 conduction mode.
6. Performance analysis of three phase cascaded H-Bridge Multilevel inverter in simulation.

Second Year B.TECH			
Audit Course - 4 Sustainable Development Goals (ELHSM410)			
Course Code:	**ELHSM410**	**Credit**	**1**
Contact Hours:	1 Hrs./week (L)	**Type of Course:**	Lecture
Examination Scheme	Term Work 25 Marks		

Prerequisite: -
1. Basic Concepts of Environmental Studies

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	**25**

Course Objectives:	
1	To discuss the sustainable development goals.
2	To explain framework of Seventeen Sustainable Development Goals.
3	To discuss structure and order of Sustainable Development Goals.
4	To study cases of Sustainable Development Goals.

Course Outcomes: Students will be able to:	
410.1	Explain sustainable development goals.
410.2	Describe framework of Seventeen Sustainable Development Goals.
410.3	Discuss structure and order of Sustainable Development Goals.
410.4	Report case studies of Sustainable Development Goals.

Topics covered:		
UNIT I:	**Introduction to SDGs**	**(3 hrs.)**
Sustainability, Sustainable development, Role of UN and the Need for SDGs, Scope and Inclusion and Agenda 2030, Our Common Future and Philosophy behind SDGs, Distinction between Development and Sustainable Development		

UNIT II:	Sustainable Development Goals	(5 hrs.)

Framework and Structuring of Seventeen SDGs
SDG 1: No Poverty
SDG 2: Zero Hunger
SDG 3: Good Health and Well-being
SDG 4: Quality Education
SDG 5: Gender Equality
SDG 6: Clean Water and Sanitation
SDG 7: Affordable and Clean Energy
SDG 8: Decent Work and Economic Growth
SDG 9: Industry, Innovation and Infrastructure
SDG 10: Reduced Inequality
SDG 11: Sustainable Cities and Communities
SDG 12: Responsible Consumption and Production
SDG 13: Climate Action
SDG 14: Life Below Water
SDG 15: Life on Land
SDG 16: Peace and Justice Strong Institutions
SDG 17: Partnerships to achieve the Goal.

UNIT III:	SDG Structure and Order	(3 hrs.)

Interrelationships and Connections between Seventeen SDGs, SDG Structure and Order at Levels of People, Ecological and Spiritual, SDGs and Socio Ecological Systems: Economy; Society; Biosphere

UNIT IV:	Sustainable Development Goals- Case Studies	(2 hrs.)

Case Studies from around the World, Case studies from India

Books:

1. Hazra, Somnath., Bhukta, Anindya (2020) Sustainable Development Goals An Indian Perspective, Springer International Publishing, Switzerland
2. Ziai, Aram (2016) Development Discourse and Global History from colonialism to the sustainable development goals. Routledge, London & New York
3. OECD (2019), Sustainable Results in Development: Using the SDGs for Shared Results and Impact, OECD Publishing, Paris, https://doi.org/10.1787/368cf8b4-en.
4. Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., Woelm, F. 2020. The Sustainable Development Goals and COVID-19. Sustainable Development Report 2020. Cambridge: Cambridge University Press.
5. **Relevant websites, movies, and documentaries**
   https://www.un.org/sustainabledevelopment/