ARUNAI ENGINEERING COLLEGE

(AUTONOMOUS)

TIRUVANNAMALAI

REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM AND SYLLABI FOR I TO VIII SEMESTERS

SEMESTER I

SL. NO	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	IP24101	Induction programme	-	-	-	-	-	0
THEORY								
2	HS24101	Professional English-I	HSMC	3	0	0	3	3
3	MA24101	Matrices and Calculus	BSC	3	1	0	4	4
4	PH24101	Engineering Physics	BSC	3	0	0	3	3
5	CY24101	Engineering Chemistry	BSC	3	0	0	3	3
6	GE24101	Problem Solving and Python Programming	ESC	3	0	0	3	3
7	GE24102	தமிழர் மரபு / Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
8	GE24111	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
9	BS24111	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
10	GE24112	English Laboratory $	EEC	0	0	2	2	1
TOTAL				**16**	**1**	**10**	**27**	**22**

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SEMESTER II

SL. NO	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	HS24201	Professional English–II	HSMC	2	0	0	2	2
2	MA24201	Statistics and Numerical Methods	BSC	3	1	0	4	4
3	PH24202	Physics for Electrical Engineering	BSC	3	0	0	3	3
4	BE24202	Basic Civil and Mechanical Engineering	ESC	3	0	0	3	3
5	GE24201	Engineering Graphics	ESC	2	0	4	6	4
6	EE24201	Electric Circuit Analysis	PCC	3	1	0	4	4
7	GE24202	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HSMC	1	0	0	1	1
8		NCC Credit Course Level 1#		2	0	0	2	2
PRACTICALS								
9	GE24211	Engineering Practices Laboratory	ESC	0	0	4	4	2
10	EE24213	Electric Circuits Laboratory	PCC	0	0	4	4	2
11	GE24212	Communication Laboratory/ Foreign Language$	EEC	0	0	4	4	2
TOTAL				**17**	**2**	**16**	**35**	**27**

NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in Mark Sheet, however the same shall not be considered for the computation of CGPA.

$ Skill Based Course

SEMESTER III

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA24302	Differential Equation and Transforms	BSC	3	1	0	4	4
2.	EE24301	Electromagnetic Theory	PCC	3	0	0	3	3

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3.	EE24302	DC Machines and Transformers	PCC	3	0	0	3	3
4.	EE24303	Analog Electronics	PCC	3	0	0	3	3
5.	EE24304	Digital Electronics	PCC	3	0	0	3	3
6.	CS24331	C Programming and Data Structures	PCC	3	0	0	3	3
PRACTICALS								
7.	EE24311	DC Machines and Transformers Laboratory	PCC	0	0	3	3	1.5
8.	EE24312	Analog and Digital Electronics Laboratory	PCC	0	0	3	3	1.5
9.	CS24332	C Programming and Data Structures Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**18**	**1**	**9**	**28**	**23.5**

SEMESTER IV

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA24403	Probability and Complex Functions	BSC	3	1	0	4	4
2.	EE24401	Synchronous and Induction Machines	PCC	3	0	0	3	3
3.	EE24402	Transmission and Distribution	PCC	3	0	0	3	3
4.	EE24403	Linear Integrated Circuits	PCC	3	0	0	3	3
5.	EE24404	Analog and Digital Instrumentation	PCC	3	0	0	3	3
6.	GE24901	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
PRACTICALS								
7.	EE24411	Synchronous and Induction Machines Laboratory	PCC	0	0	3	3	1.5
8.	EE24412	Linear Integrated Circuits Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**17**	**1**	**6**	**24**	**21**

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SEMESTER V

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	EE24501	Power System Analysis	PCC	3	0	0	3	3
2.	EE24502	Power Electronics	PCC	3	0	0	3	3
3.	EE24503	Control Systems	PCC	3	1	0	4	4
4.		Professional Elective - I	PEC	3	0	0	3	3
5.		Professional Elective - II	PEC	3	0	0	3	3
6.		Open Elective – I	OEC	3	0	0	3	3
PRACTICALS								
7.	EE24511	Power Electronics Laboratory	PCC	0	0	3	3	1.5
8.	EE24512	Control Systems Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**18**	**1**	**6**	**25**	**22**

SEMESTER VI

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	EE24601	Protection and Switchgear	PCC	3	0	0	3	3
2.	EE24602	Power System Operation and Control	PCC	3	0	0	3	3
3.		Professional Elective – III	PEC	3	0	0	3	3
4.		Professional Elective - IV**	PEC	2	0	2	4	3
5.		Management Elective	HSMC	3	0	0	3	3
6.		Open Elective – II	OEC	3	0	0	3	3
7.		Mandatory Course - I	MC	3	0	0	3	0
PRACTICALS								
8.	EE24611	Power System Simulation Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**20**	**0**	**5**	**25**	**19.5**

**** - Elective should be a Theory cum Lab Course**

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SEMESTER VII

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	EE24701	Renewable Energy Systems	PCC	3	0	0	3	3
2.	GE24701	Human Values and Ethics	HSMC	2	0	0	2	2
3.		Professional Elective – V	PEC	3	0	0	3	3
4.		Professional Elective –VI**	PEC	2	0	2	4	3
5.		Open Elective – III	OEC	3	0	0	3	3
6.		Mandatory Course - II	MC	3	0	0	3	0
PRACTICALS								
7.	EE24711	Renewable Energy Systems Laboratory	PCC	0	0	4	4	2
8.	EE24712	Industrial Training/Internship	EEC	-	-	-	-	1
			TOTAL	**16**	**0**	**6**	**22**	**17**

**** - Elective should be a Theory cum Lab Course**

SEMESTER VIII

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EE24811	Project Work	EEC	0	0	20	20	10
			TOTAL	**0**	**0**	**20**	**20**	**10**

TOTAL CREDITS: 162

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1 **POWER ENGINEERING**	VERTICAL 2 **CONVERTERS AND DRIVES**	VERTICAL 3 **EMBEDDED SYSTEMS**	VERTICAL 4 **ELECTRIC VEHICLE**	VERTICAL 5 **ADVANCED CONTROL**	VERTICAL 6 **DIVERSIFIED COURSES**
Utilization and Conservation of Electrical Energy	Special Electrical Machines	Embedded System Design	Electric Vehicle Technology	Process Modelling and Simulation	Energy Storage Systems
Smart Grids	Electrical Drives and Control	Embedded Control for Electric Drives	Design of Motor and Power Converters for Electric Vehicles	Computer Control of Processes	Grid integrating Techniques and Challenges
Energy Management and Auditing	Multilevel Power Converters	VLSI DESIGN	Design of Electric Vehicle Charging System	System Identification	Power System Transients
Power Quality	Power Electronics for Renewable Energy Systems	MEMS & NEMS	Grid Integration of Electric Vehicles	Non Linear Control	Sustainable and Environmental Friendly HV
High Voltage Engineering	Control of Power Electronics Circuits	Soft Computing Techniques	Intelligent control of Electric Vehicles	Optimal Control	PLC Programming
HVDC and FACTS	SMPS & UPS	Smart System Automation	Electric Vehicle Design, Mechanics and Control	Machine Monitoring System	Power Plant Engineering

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I : POWER ENGINEERING

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EE24001	Utilization and Conservation of Electrical Energy	PEC	3	0	0	3	3
2.	EE24002	Smart Grid	PEC	3	0	0	3	3
3.	EE24003	Energy Management and Auditing	PEC	3	0	0	3	3
4.	EE24004	Power Quality	PEC	3	0	0	3	3
5.	EE24005	High Voltage Engineering	PEC	3	0	0	3	3
6.	EE24006	HVDC and FACTS	PEC	3	0	0	3	3

VERTICAL II : CONVERTERS AND DRIVES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EE24007	Special Electrical Machines	PEC	2	0	2	4	3
2.	EE24008	Electrical Drives and Control	PEC	2	0	2	4	3
3.	EE24009	Multilevel Power Converters	PEC	2	0	2	4	3
4.	EE24010	Power Electronics for Renewable Energy Systems	PEC	2	0	2	4	3
5.	EE24011	Control of Power Electronics Circuits	PEC	2	0	2	4	3
6.	EE24012	SMPS & UPS	PEC	2	0	2	4	3

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VERTICAL III : EMBEDDED SYSTEMS

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EE24013	Embedded System Design	PEC	2	0	2	4	3
2.	EE24014	Embedded Control for Electric Drives	PEC	2	0	2	4	3
3.	EE24015	VLSI Design	PEC	3	0	0	3	3
4.	EE24016	MEMS & NEMS	PEC	2	0	2	4	3
5.	EE24017	Soft Computing Techniques	PEC	3	0	0	3	3
6.	EE24018	Smart System Automation	PEC	2	0	2	4	3

VERTICAL IV : ELECTRIC VEHICLE TECHNOLOGIES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EE24019	Electric Vehicle Technology	PEC	3	0	0	3	3
2.	EE24020	Design of Motor and Power Converters for Electric Vehicles	PEC	2	0	2	4	3
3.	EE24021	Design of Electric Vehicle Charging System	PEC	2	0	2	4	3
4.	EE24022	Grid Integration of Electric Vehicles	PEC	2	0	2	4	3
5.	EE24023	Intelligent Control of Electric Vehicles	PEC	2	0	2	4	3
6.	EE24024	Electric Vehicle Design, Mechanics and Control	PEC	2	0	2	4	3

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VERTICAL V : ADVANCED CONTROL

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EE24025	Process Modelling and Simulation	PEC	3	0	0	3	3
2.	EE24026	Computer Control of Processes	PEC	3	0	0	3	3
3.	EE24027	System Identification	PEC	3	0	0	3	3
4.	EE24028	Non Linear Control	PEC	3	0	0	3	3
5.	EE24029	Optimal Control	PEC	3	0	0	3	3
6.	EE24030	Machine Monitoring System	PEC	3	0	0	3	3

VERTICAL VI : DIVERSIFIED COURSES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	EE24031	Energy Storage Systems	PEC	3	0	0	3	3
2.	EE24032	Grid Integrating Techniques and Challenges	PEC	2	0	2	4	3
3.	EE24033	Power System Transients	PEC	3	0	0	3	3
4.	EE24034	Sustainable and Environmental Friendly HV Insulation System	PEC	3	0	0	3	3
5.	EE24035	PLC Programming	PEC	3	0	0	3	3
6.	EE24036	Power Plant Engineering	PEC	3	0	0	3	3

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ELECTIVES – MANAGEMENT COURSES

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GE24M01	Principles of Management	HSMC	3	0	0	3	3
2.	GE24M02	Total Quality Management	HSMC	3	0	0	3	3
3.	GE24M03	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	3
4.	GE24M04	Human Resource Management	HSMC	3	0	0	3	3
5.	GE24M05	Knowledge Management	HSMC	3	0	0	3	3
6.	GE24M06	Industrial Management	HSMC	3	0	0	3	3
7.	GE24M07	Foundations of Entrepreneurship	HSMC	3	0	0	3	3

MANDATORY COURSE I

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX24101	Introduction to Women and Gender Studies	MC	3	0	0	3	0
2.	MX24102	Elements of Literature	MC	3	0	0	3	0
3.	MX24103	Disaster Risk Reduction and Management	MC	3	0	0	3	0
4.	MX24104	History of Science and Technology in India	MC	3	0	0	3	0
5.	MX24105	State, Nation building and politics in India	MC	3	0	0	3	0

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6.	MX24106	Political and economic thought for a humane society	MC	3	0	0	3	0
7.	MX24107	Understanding Society & Culture through Literature	MC	3	0	0	3	0
8.	MX24108	Work Ethics & Social Responsibility	MC	3	0	0	3	0
9.	MX24109	Technology & Society	MC	3	0	0	3	0
10.	MX24110	Social Innovation & Entrepreneurship	MC	3	0	0	3	0
11.	MX24111	Education & Social Change	MC	3	0	0	3	0

MANDATORY COURSE II

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX24201	Industrial Safety	MC	3	0	0	3	0
2.	MX24202	Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	MC	3	0	0	3	0
3.	MX24203	Application of Psychology in Everyday Life	MC	3	0	0	3	0
4.	MX24204	Stress Management & Well Being	MC	3	0	0	3	0
5.	MX24205	Health & Well Being in Education	MC	3	0	0	3	0
6.	MX24206	Physical fitness & Mental Resilience	MC	3	0	0	3	0
7.	MX24207	Food, Nutrition and Health	MC	3	0	0	3	0
8.	MX24208	Life style diseases	MC	3	0	0	3	0

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OPEN ELECTIVES I

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCS2401	Artificial Intelligence and Machine Learning fundamentals	OEC	2	0	2	4	3
2.	OCS2402	Data science fundamentals	OEC	2	0	2	4	3
3.	OCS2403	Augmented Reality/ Virtual Reality	OEC	2	0	2	4	3
4.	OCS2404	IOT and its applications	OEC	2	0	2	4	3
5.	OCS2405	Deep Learning Techniques	OEC	2	0	2	4	3
6.	OEC2401	Introduction to ASIC design	OEC	2	0	2	4	3

OPEN ELECTIVES II

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OME2401	Applied design thinking	OEC	3	0	0	3	3
2.	OME2402	Introduction to industrial automation systems	OEC	3	0	0	3	3
3.	OME2403	Industrial Management	OEC	3	0	0	3	3
4.	OME2404	Quality Engineering	OEC	3	0	0	3	3
5.	OME2405	Sustainable Manufacturing	OEC	3	0	0	3	3
6.	OME2406	Industrial design and rapid prototyping techniques	OEC	3	0	0	3	3
7.	OEE2401	Industrial IOT and industry 4.0	OEC	3	0	0	3	3
8.	OEC2402	Robotics and Industrial Automation	OEC	3	0	0	3	3

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OPEN ELECTIVES III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OAG2401	Urban agriculture	OEC	3	0	0	3	3
2.	OAG2402	Agriculture Entrepreneurship Development	OEC	3	0	0	3	3
3.	OBT2401	Basics of Biomolecules	OEC	3	0	0	3	3
4.	OBT2402	Basics of Microbial Technology	OEC	3	0	0	3	3
5.	OBT2403	Biotechnology for Waste Management	OEC	3	0	0	3	3
6.	OBT2404	Food Processing Technology	OEC	3	0	0	3	3
7.	OEC2404	Remote Sensing Concepts	OEC	3	0	0	3	3
8.	OEC2405	Drone technologies	OEC	3	0	0	3	3
9.	OHS2401	Nano technology	OEC	3	0	0	3	3
10.	OHS2402	Operations research	OEC	3	0	0	3	3
11.	OME2407	Additive Manufacturing	OEC	3	0	0	3	3

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SUMMARY OF CREDITS

SL. NO.	SUBJECT CATEGORY	CREDITS PER SEMESTER								TOTAL CREDITS
		I	II	III	IV	V	VI	VII	VIII	
1.	HSMC	4	3	-	-	-	3	2	-	**12**
2.	BSC	12	7	4	6	-	-	-	-	**29**
3.	ESC	5	9	-	-	-	-	-	-	**14**
4.	PCC	-	6	19.5	15	13	7.5	5	-	**66**
5.	PEC	-	-	-	-	6	6	6	-	**18**
6.	OEC	-	-	-	-	3	3	3	-	**9**
7.	EEC	1	2	-	-	-	-	1	10	**14**
	TOTAL	**22**	**27**	**23.5**	**21**	**22**	**19.5**	**17**	**10**	**162**
8.	MANDATORY COURSE (NON CREDIT)						✓	✓		

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Subject Code	Subject Name	Category	L	T	P	C
IP24101	INDUCTION PROGRAMME	-	0	0	0	0

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. "

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i)Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii)Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii)Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue.

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It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv)Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v)Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi)Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii)Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii)Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix)Department Specific Activities

- About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering / Technology / Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Note:

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:

Guide to Induction program from AICTE

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Subject Code	Subject Name	Category	L	T	P	C
HS24101	PROFESSIONAL ENGLISH- I	HSMC	3	0	0	3

Course Objectives:

- To improve the communicative competence of learners.
- To learn to use basic grammatical structures in suitable contexts.
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text.
- To help learners use language effectively in professional contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT – I	INTRODUCTION TO EFFECTIVE COMMUNICATION	1

What is effective communication? (Explain using activities) – Why is communication critical for excellence during study, research and work? –What are the seven C's of effective communication? What are key language skills? – What is effective listening? What does it involve? – What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? – What is effective writing? How does one develop language and communication skills? What does the course focus on? – How are communication and language skills going to be enhanced during this course? – What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION **8**

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT – II	NARRATION AND SUMMATION	9

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT – III	DESCRIPTION OF A PROCESS / PRODUCT	9

Reading - Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT – IV	CLASSIFICATION AND RECOMMENDATIONS	9

Reading - Newspaper articles; Journal reports -and Non Verbal Communication (tables, pie charts etc,.). Writing - Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal (chart , graph etc, to verbal mode) Grammar - Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT – V	EXPRESSION	9

Reading - Reading editorials; and Opinion Blogs; Writing - Essay Writing (Descriptive or narrative). Grammar - Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions - Content vs Function words.

Total Contact Hours : 45

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Course Outcomes	Upon completion of the course students should be able to:
CO1	To use appropriate words in a professional context
CO2	To gain understanding of basic grammatic structures and use them in right context.
CO3	To read and infer the denotative and connotative meanings of technical texts
CO4	To write definitions, descriptions, narrations and essays on various topics

Textbooks:	
1.	English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2.	English for Science & Technology Cambridge University Press, 2021.Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr.KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference books/other materials/web resources:	
1.	Technical Communication - Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2.	A Course Book On Technical English B Lakshminarayanan, Scitech Publications (India) Pvt.Ltd.
3.	English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4.	Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5.	Learning to Communicate - Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	3	3	1	3	-	3	-	-	-
CO2	1	1	1	1	1	3	3	1	3	-	3	-	-	-
CO3	2	3	2	3	2	3	3	2	3	3	3	-	-	-
CO4	2	3	2	3	2	3	3	2	3	3	3	-	-	-
CO5	2	3	3	3	-	3	3	2	3	-	3	-	-	-
Average	1.6	2.2	1.8	2.2	1.5	3	3	1.6	3	3	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
MA24101	MATRICES AND CALCULUS	BSC	3	1	0	4

Course Objectives:

- To develop the use of matrix algebra techniques that are needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT – I	**MATRICES**	**9+3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation–Properties of Eigenvalues/Eigenvectors – Cayley-Hamilton theorem – Diagonalization by orthogonal transformation – Reduction of quadratic form to canonical formby orthogonal transformation – Nature of quadratic forms

Applications: Stretching of an elastic membrane

UNIT – II	**DIFFERENTIAL CALCULUS**	**9+3**

Functions, limits, and continuity– Derivatives and differentiation rules (sum, product, quotient, chain)– Implicit and logarithmic differentiation

Applications: Maxima and Minima of functions of one variable

UNIT – III	**FUNCTIONS OF SEVERAL VARIABLES**	**9+3**

Partial Differentiation & Partial Differentiation of Implicit Functions – Euler's Theorem–Total Derivative– Jacobians–Taylor's series for functions of two variables

Applications: Maxima and Minima of functions of two variables – Lagrange'smethod of undetermined multipliers

UNIT – IV	**INTEGRAL CALCULUS**	**9+3**

Definite and indefinite integrals–Techniques of integration (by parts, trigonometricintegrals, trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions – Improper integrals)

Applications: Hydrostatic force, pressure, moments, and centers of mass

UNIT – V	**MULTIPLE INTEGRALS**	**9+3**

Double and Triple integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals

Applications: Moments, centers of mass, and moment of inertia

Total Contact Hours : 60

Course Outcomes	Upon completion of the course students should be able to:
CO1	Use the matrix algebra methods for solving practical problems.
CO2	Apply differential calculus tools in solving various application problems.
CO3	Able to use differential calculus ideas on several variable functions.
CO4	Apply different methods of integration in solving practical problems.
CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems.

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Textbooks:	
1.	Kreyszig, E., "*Advanced Engineering Mathematics*", John Wiley & Sons, 2016.
2.	Grewal, B.S., "*Higher Engineering Mathematics*", Khanna Publishers, 2018.
3.	Stewart, James, "*Calculus: Early Transcendentals*", Cengage Learning, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

Reference books/other materials/web resources:	
1.	Anton, H., Bivens, I., and Davis, S., "*Calculus*", Wiley, 2016.
2.	Bali, N., Goyal, M., and Watkins, C., "*Advanced Engineering Mathematics*", Firewall Media (An imprint of Lakshmi Publications Pvt. Ltd.), 2009.
3.	Jain, R.K., and Iyengar, S.R.K., "*Advanced Engineering Mathematics*", Narosa Publications, 2016.
4.	Narayanan, S., and ManicavachagomPillai, T.K., "*Calculus, Volumes I & II*", S. Viswanathan Publishers Pvt. Ltd., 2009.
5.	Ramana, B.V., "*Higher Engineering Mathematics*", McGraw Hill Education Pvt. Ltd., 2016.
6.	Pal, Srimantha, and Bhunia, S.C., "*Engineering Mathematics*", Oxford University Press, 2015.
7.	Thomas, G.B., Hass, J., and Weir, M.D., "*Thomas Calculus*", Pearson India, 2018.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	2	-	2	3	-	-	-
CO2	3	3	1	1	-	-	-	2	-	2	3	-	-	-
CO3	3	3	1	1	-	-	-	2	-	2	3	-	-	-
CO4	3	3	1	1	-	-	-	2	-	2	3	-	-	-
CO5	3	3	1	1	-	-	-	2	-	2	3	-	-	-
Average	3	3	1	1	-	-	-	2	-	2	3	-	-	-

Subject Code	Subject Name	Category	L	T	P	C
PH24101	ENGINEERING PHYSICS	BSC	3	0	0	3

Course Objectives:

- To make the students effectively achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT – I	MECHANICS	9

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – Motion of the CM – Kinetic energy of a system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia – theorems of M.I – moment of inertia of continuous bodies – M.I of a diatomic molecule. Torque and rotational dynamics: Rotational dynamics of rigid bodies – conservation of angular

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momentum – rotational energy state of a rigid diatomic molecule. Applications: Gyroscope – torsional pendulum – double pendulum. Introduction to nonlinear oscillations.		
UNIT – II	**ELECTROMAGNETIC WAVES**	**9**
Maxwell's equations: Wave equation– Plane electromagnetic waves in vacuum – Conditions on the wave field Properties of electromagnetic waves: Speed, amplitude, phase, orientation, and waves in matter – polarization. Production of electromagnetic waves: Energy and momentum in EM waves – Intensity – waves from localized sources – momentum – radiation pressure. Applications: Cell-phone reception. Reflection and transmission: Electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.		
UNIT – III	**OSCILLATIONS, OPTICS AND LASERS**	**9**
Oscillations: Simple harmonic motion – resonance – analogy between electrical and mechanical oscillating systems. Wave phenomena: Waves on a string – standing waves – traveling waves – energy transfer of a wave – sound waves – Doppler effect. Optics: Reflection and refraction of light waves – total internal reflection – interference – Michelson interferometer – theory of air wedge and experiment. Lasers: Theory of laser – characteristics – spontaneous and stimulated emission – Einstein's coefficients – population inversion. Laser types and applications: Nd-YAG laser, CO2 laser, semiconductor laser – Basic applications of lasers in industry.		
UNIT – IV	**BASIC QUANTUM MECHANICS**	**9**
Wave-particle duality: Photons and light waves – Electrons and matter waves – Compton effect. Schrodinger equation: Time-dependent and time-independent forms – meaning of wave function – Normalization. Particle in a box: Free particle – Particle in an infinite potential well (1D, 2D, 3D boxes) – Normalization, probabilities, and the correspondence principle.		
UNIT – V	**APPLIED QUANTUM MECHANICS**	**9**
Quantum Mechanics Applications: The Harmonic Oscillator (qualitative) – Barrier Penetration and Quantum Tunneling (qualitative) – Tunneling Microscope – Resonant Diode. Finite Potential Wells: Basics of the Kronig-Penney Model –Origin of Energy Bands.		
	Total Contact Hours : 45	

Course Outcomes	Upon completion of the course students should be able to:
CO1	Understand the importance of mechanics.
CO2	Express their knowledge in electromagnetic waves.
CO3	Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
CO4	Understand the importance of quantum physics.
CO5	Comprehend and apply quantum mechanical principles towards the formation of energy bands.

Textbooks:	
1.	D. Kleppner and R. Kolenkow, "An Introduction to Mechanics", McGraw Hill Education (Indian Edition), 2017.
2.	E. M. Purcell and D. J. Morin, "Electricity and Magnetism", Cambridge University Press, 2013.
3.	Arthur Beiser, ShobhitMahajan, and S. RaiChoudhury, "Concepts of Modern Physics", McGraw Hill (Indian Edition), 2017.

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Reference books/other materials/web resources:	
1.	R. Wolfson, *Essential University Physics*, Volumes 1 & 2, Pearson Education (Indian Edition), 2009.
2.	Paul A. Tipler, *Physics – Volume 1 & 2*, CBS (Indian Edition), 2004.
3.	K. Thyagarajan and A. Ghatak, *Lasers: Fundamentals and Applications*, Laxmi Publications (Indian Edition), 2019.
4.	D. Halliday, R. Resnick, and J. Walker, *Principles of Physics*, Wiley (Indian Edition), 2015.
5.	N. Garcia, A. Damask, and S. Schwarz, *Physics for Computer Science Students*, Springer-Verlag, 2012.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	1	-	-	-	-	-	-	-	-
CO2	3	3	2	1	2	1	-	-	-	-	-	-	-	-
CO3	3	3	2	2	2	1	-	-	-	-	1	-	-	-
CO4	3	3	1	1	2	1	-	-	-	-	-	-	-	-
CO5	3	3	1	1	2	1	-	-	-	-	-	-	-	-
Average	3	3	1.6	1.2	1.8	1	-	-	-	-	1	-	-	-

Subject Code	Subject Name	Category	L	T	P	C
CY24101	ENGINEERING CHEMISTRY	BSC	3	0	0	3

Course Objectives:

- To inculcate sound understanding of water quality parameters and water treatment techniques
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT – I	WATER AND ITS TREATMENT	9

Water Sources and Impurities: Sources of water – Types of impurities in water, Water Quality Parameters: Colour – Odour – Turbidity – pH – Hardness – Alkalinity – TDS – COD – BOD – Fluoride – Arsenic Municipal Water Treatment: Primary treatment – Disinfection methods (UV – Ozonation – Break-point chlorination) Desalination of Brackish Water: Reverse Osmosis, Boiler Troubles: Scale and sludge – Boiler corrosion – Caustic embrittlement – Priming and foaming, Treatment of Boiler Feed Water: Internal treatment (Phosphate – Colloidal – Sodium aluminate – Calgon conditioning) & External treatment (Ion exchange demineralization – Zeolite process)

UNIT – II	NANOCHEMISTRY	9

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Basics of Nano materials: Distinction between molecules–nano materials and bulk materials, Size-dependent Properties: Optical– Electrical – Mechanical –Magnetic, Types of Nano materials: Nanoparticle–Nano cluster–Nano rod– Nanowire – Nanotube (Definition, Properties and uses of each type) Preparation of Nano materials: Sol-gel method –Solvo thermal method –Laser ablation– Chemical vapor deposition– Electrochemical deposition –Electro spinning, Applications of Nano materials: Medicine–Agriculture– Energy– Electronics–Catalysis		
UNIT – III	**PHASE RULE AND COMPOSITES**	**9**
Phase Rule: Introduction–Definition of terms with examples; One-component System: Water system–Reduced phase rule– Construction of a simple eutectic phase diagram–Thermal analysis, Two-Component Systems: Lead-silver system –Pattinson process, Composites: Introduction- Definition and need for composites, Matrix Materials: Polymer matrix– Metal matrix – Ceramic matrix, Reinforcement materials: Fiber– Particulates –Flakes – Whiskers, Properties and Applications of Composites: Metal matrix composites (MMC) – Ceramic matrix composites – Polymer matrix composites – Hybrid composites (Definition and Examples)		
UNIT – IV	**FUELS AND COMBUSTION**	**9**
Fuels: Classification of fuels– Coal and coke: Proximate and ultimate analysis–Carbonization– Manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process) –Knocking: Octane number– Diesel oil: Cetane number–Power alcohol and biodiesel. Combustion of Fuels: Calorific value–Higher and lower calorific values– Theoretical calculation of calorific value– Ignition temperature(Spontaneous ignition temperature, Explosive range) –Flue gas analysis: ORSAT Method– CO_2 emission – carbon footprint		
UNIT – V	**ENERGY SOURCES AND STORAGE DEVICES**	**9**
Stability of Nucleus: Mass defect (problems) – Binding energy, Nuclear Energy: Light water nuclear power plant–Breeder reactor, Solar Energy Conversion: Principle and working of solar cells– Applications of solar cells– Recent developments in solar cell materials, Other Renewable Energy Sources: Wind energy–Geothermal energy, Batteries and Electric Vehicles: Types of batteries (Primary battery–Dry cell and Secondary battery –Lead-acid battery& lithium-ion battery), Electric vehicles: Working principles Fuel Cells (H_2-O_2 fuel cell – Microbial fuel cell), Super capacitors (Storage principle – types and examples)		
		Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO2	To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3	To apply the knowledge of phase rule and composites for material selection requirements.
CO4	To recommend suitable fuels for engineering processes and applications.
CO5	To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

Textbooks:	
1.	P. C. Jain and Monica Jain, Engineering Chemistry, DhanpatRai Publishing Company (P) Ltd, 2018.
2.	Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, 2008.
3.	S. S. Dara, "A Textbook of Engineering Chemistry", S. Chand Publishing, 2018.

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Reference books/other materials/web resources:	
1.	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath, and James Murday, "Textbook of Nanoscience and Nanotechnology", Universities Press – IIM Series in Metallurgy and Materials Science, 2018.
2.	O. G. Palanna, "Engineering Chemistry", 2nd Edition, McGraw Hill Education (India) Private Limited, 2017.
3.	Friedrich Emich, "Engineering Chemistry", Scientific International Pvt. Ltd., New Delhi, 2014.
4.	ShikhaAgarwal, "Engineering Chemistry – Fundamentals and Applications", 2nd Edition, Cambridge University Press, Delhi, 2019.
5.	O. V. Roussak and H. D. Gesser, "Applied Chemistry – A Textbook for Engineers and Technologists", 2nd Edition, Springer Science Business Media, New York, 2013.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	1	-	-	-	-	1	-	-	-
CO2	2	-	-	1	-	2	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	1	-	-	1	-	-	-	-	-	-	-	-
CO5	3	1	2	1	-	2	-	-	-	-	2	-	-	-
Average	2.8	1.3	1.6	1	-	1.5	-	-	-	-	1.5	-	-	-

Subject Code	Subject Name	Category	L	T	P	C
GE24101	PROBLEM SOLVING AND PYTHON PROGRAMMING	ESC	3	0	0	3

Course Objectives:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures -lists, tuples, and dictionaries to represent complex data.
- To do input/output with files in Python

UNIT – I	COMPUTATIONAL THINKING AND PROBLEM SOLVING	9

Introduction to the fundamentals of computing – Identification and formulation of computational problems – Algorithms: building blocks (statements, state, control flow, functions) – Algorithmic representations: pseudo code, flowcharts, programming language – Problem-solving strategies: iteration, recursion. Illustrative Problems: Find the minimum in a list, insert a card in a sorted list, guess an integer in a range, Towers of Hanoi.

UNIT – II	DATA TYPES, EXPRESSIONS, STATEMENTS	9

Using the Python interpreter and interactive mode – Debugging techniques – Data types: int, float, boolean, string, list – Variables, expressions, and statements – Tuple assignment – Operator precedence – Comments and documentation. Illustrative Programs: Exchange values of two variables, circulate values of n variables, compute distance between two points

UNIT – III	CONTROL FLOW, FUNCTIONS, STRINGS	9

Conditionals: Boolean values and operators, *if*, *if-else*, *if-elif-else* – Iteration: *while*, *for*, *break*, *continue*, *pass* – Functions: return values, parameters, local and global scope, function composition, recursion – Strings:

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slicing, immutability, functions and methods, string module – Lists as arrays. Illustrative Programs: Square root calculation, GCD, exponentiation, summing an array, linear and binary search.		
UNIT – IV	**LISTS, TUPLES, DICTIONARIES**	**9**
Lists: operations, slicing, methods, looping, mutability, aliasing, cloning, parameter passing – **Tuples**: assignment, return values – Dictionaries: creation, operations, methods – Advanced list processing using list comprehensions. Illustrative Programs: Simple sorting, histogram generation, student marks statement, retail bill preparation.		
UNIT – V	**FILES, MODULES, PACKAGES**	**9**
Working with text files: reading and writing – Using the format operator – Command line arguments – Errors and exceptions: types and handling – Introduction to modules and packages. Illustrative Programs: Word count, file copy utility, voter's age validation, marks range validation (0–100).		
		Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Develop algorithmic solutions to simple computational problems.
CO2	Develop and execute simple Python programs.
CO3	Write simple Python programs using conditionals and loops for solving problems.
CO4	Decompose a Python program into functions.
CO5	Represent compound data using Python lists, tuples, dictionaries etc.
CO6	Read and write data from/to files in Python programs.

Textbooks:	
1.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference books/other materials/web resources:	
1.	Paul Deitel and Harvey Deitel, "*Python for Programmers*", 1st Edition, Pearson Education, 2021.
2.	G. Venkatesh and MadhavanMukund, "*Computational Thinking: A Primer for Programmers and Data Scientists*", 1st Edition, Notion Press, 2021.
3.	John V. Guttag, "*Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data*", 3rd Edition, MIT Press, 2021.
4.	Eric Matthes, "*Python Crash Course: A Hands-on, Project-Based Introduction to Programming*", 2nd Edition, No Starch Press, 2019.
5.	Official Python Website: https://www.python.org/
6.	Martin C. Brown, "*Python: The Complete Reference*", 4th Edition, McGraw-Hill, 2018.

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PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	3	3	-
CO2	3	3	3	3	2	-	-	-	-	2	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	2	-	3	-	-
CO4	2	2	-	2	2	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	1	-	2	-	-
CO6	2	2	-	-	2	-	-	-	-	1	-	2	-	-
Average	2	3	3	3	2	-	-	-	-	2	2	3	3	-

Subject Code	Subject Name	Category	L	T	P	C
GE24102	HERITAGE OF TAMILS	HSMC	1	0	0	1

UNIT – I	**LANGUAGE AND LITERATURE**	**3**
Overview of language families in India – Dravidian languages – Tamil as a classical language – Classical Tamil literature – Secularism in Sangam literature – Concepts of distributive justice in Sangam texts – Management principles in Thirukkural – Tamil epics and the influence of Buddhism and Jainism – Bhakti literature: Azhwars and Nayanmars – Forms of minor poetry – Evolution of modern Tamil literature – Contributions of Bharathiyar and Bharathidasan.		
UNIT – II	**HERITAGE: ROCK ART PAINTINGS TO MODERN ART & SCULPTURE**	**3**
Development from hero stones to modern sculpture – Bronze icons – Tribal communities and their handicrafts – Art of temple car making – Terracotta sculptures and village deities – Thiruvalluvar Statue at Kanyakumari – Craftsmanship in musical instruments: Mridangam, Parai, Veenai, Yazh, and Nadaswaram – Role of temples in the social and economic fabric of Tamil society.		
UNIT – III	**FOLK AND MARTIAL ARTS**	**3**
Overview of Tamil folk arts: Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyilattam, leather puppetry – Martial arts: Silambattam, Valari, Tiger dance – Traditional sports and games of Tamils.		
UNIT – IV	**THINAI CONCEPT OF TAMILS**	**3**
The Aham and Puram concepts from Tholkappiyam and Sangam literature – Representation of flora and fauna – Ethical life and the concept of Aram – Education and literacy during the Sangam age – Ancient cities and ports – Trade practices and overseas conquests of the Chola dynasty.		
UNIT – V	**CONTRIBUTION OF TAMILS TO THE INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**3**
Role of Tamils in the Indian freedom struggle – Cultural influence of Tamils across India – Self-Respect Movement – Contributions of Siddha medicine to indigenous medical systems – Tamil inscriptions and manuscripts – The history of Tamil book printing.		
		Total Contact Hours : 15

TEXT-CUM-REFERENCE BOOKS	
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித் தமிழ் - முன்னவர் இள. சந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).

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4.	பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு).
5.	Social Life of Tamils (Dr.K.K.Pillay) - A joint publication of TNTB & ESC and RMRL - (in print).
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9.	Keeladi - Sangam City Civilization on the banks of river Vaigai (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

Subject Code	Subject Name	Category	L	T	P	C
GE24102	**தமிழர் மரபு**	HSMC	1	0	0	1

அலகு- 1	**மொழி மற்றும் இலக்கியம்**	3

இந்திய மொழிக்குடும்பங்கள்– திரொவிடமொழிகள்– தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச்சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் –தமிழ்க்காப்பியங்கள், தமிழகத்தில் சமண-பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள்– சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு

அலகு- 2	**மரபு பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை சிற்பக்கலை**	3

நடுகல் முதல் நவீன சிற்பங்கள் வரை– ஐம்பொன்சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர்வு செய்யும்கலை– சுடுமண்சிற்பங்கள்– நாட்டுப்புறத்தெய்வங்கள்– குமரிமுனையில்திருவள்ளுவர்சிலை– இசைகருவிகள்– மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம்– தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு -3	**நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள்**	3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஒயிலாட்டம் , தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்விளையாட்டுகள்.

அலகு -4	**தமிழர்களின் திணைக்கோட்பாடுகள்**	3

தமிழகத்தின் தாவரங்களும் , விலங்குகளும்- தொல்காப்பியம் மற்றும் சங்கஇலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள்- தமிழர்கள் போற்றிய அறக்கோட்பாடு- சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும் கல்வியும்- சங்ககாலநகரங்களும் துறைமுகங்களும்- சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி- கடல் கடந்தநாடுகளில் சோழர்களின் வெற்றி.

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அலகு -5	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு- இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப்பண்பாட்டின் தாக்கம்- சுயமரியாதையை இயக்கம்- இந்திய மருத்துவத்தில் சித்தமருத்துவத்தின் பங்கு- கல்வெட்டுகள் கையழுத்துப்படிகள்- தமிழ் புத்தகங்களின் அச்சுவரலாறு.		
		Total Contact Hours : 15

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

Subject Code	Subject Name	Category	L	T	P	C
GE24111	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	ESC	0	0	4	2

Course Objectives:

- To understand the problem-solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real-world problems.
- To use Python data structures such as lists, tuples, and dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

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LABORATORY / PRACTICAL ACTIVITIES	60
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.	
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).	
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)	
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)	
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries.	
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)	
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)	
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)	
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)	
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)	
11. Exploring Pygame tool.	
12. Developing a game activity using Pygame like bouncing ball, car race etc	
	Total Contact Hours : 60

Course Outcomes	Upon completion of the course students should be able to:
CO1	Develop algorithmic solutions to simple computational problems.
CO2	Develop and execute simple Python programs.
CO3	Implement programs in Python using conditionals and loops for solving problems.
CO4	Deploy functions to decompose a Python program.
CO5	Process compound data using Python data structures.
CO6	Utilize Python packages in developing software applications.

Textbooks:	
1.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference books/other materials/web resources:	
1.	Paul Deitel and Harvey Deitel, "Python for Programmers", 1st Edition, Pearson Education, 2021.
2.	G. Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.

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3.	John V. Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", 3rd Edition, MIT Press, 2021.
4.	Eric Matthes, "Python Crash Course: A Hands-on, Project-Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5.	https://www.python.org/
6.	Martin C. Brown, "Python: The Complete Reference", 4th Edition, McGraw-Hill, 2018.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	3	2	3	3	-
CO2	3	3	3	3	3	-	-	-	-	3	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	2	-	3	-	-
CO4	3	2	-	2	2	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	1	-	2	-	-
CO6	2	-	-	-	2	-	-	-	-	1	-	3	3	-
Average	2	3	3	3	2	-	-	-	-	2	2	3	3	-

Subject Code	Subject Name	Category	L	T	P	C
BS24111	PHYSICS AND CHEMISTRY LABORATORY	BSC	0	0	4	2

PHYSICS LABORATORY: (Any Seven Experiments)

Course Objectives:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student an active participant in each part of all lab exercises

S.NO	LABORATORY / PRACTICAL ACTIVITIES
1.	Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2.	Simple harmonic oscillations of cantilever.
3	Non-uniform bending - Determination of Young's modulus
4	Uniform bending – Determination of Young's modulus
5	Laser- Determination of the wavelength of the laser using grating

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6	Air wedge - Determination of thickness of a thin sheet/wire
7	a) Optical fibre -Determination of Numerical Aperture and acceptance angle b) Compact disc- Determination of width of the groove using laser.
8	Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9	Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10	Post office box -Determination of Band gap of a semiconductor.
11	Photoelectric effect
12	Michelson Interferometer
13	Melde's string experiment
14	Experiment with lattice dynamics kit.
	Total Contact Hours : 30

Course Outcomes	Upon completion of the course students should be able to:
CO1	Understand the functioning of various physics laboratory equipment.
CO2	Use graphical models to analyze laboratory data.
CO3	Use mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4	Access, process and analyze scientific information.
CO5	Solve problems individually and collaboratively.

PO & PSO / CO	**CO-PO Mapping**											**CO-PSO Mapping**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	1	1	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	-	-	-	-	-	-	-
CO3	3	2	3	1	1	-	-	-	-	-	-	-	-	-
CO4	3	3	2	1	1	-	-	-	-	-	-	-	-	-
CO5	3	2	3	1	1	-	-	-	-	-	-	-	-	-
Average	3	2.4	2.6	1	1	-	-	-	-	-	-	-	-	-

CHEMISTRY LABORATORY:

Course Objectives:

- To inculcate experimental skills to test basic understanding of water quality parameters such as acidity, alkalinity, hardness, dissolved oxygen (DO), chloride, and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

LIST OF EXPERIMENTS: (Any seven experiments to be conducted)

1. Preparation of sodium carbonate (Na_2CO_3) as a primary standard and Estimation of acidity of a water sample using the prepared primary standard.

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2. Determination of types and amount of alkalinity in a water sample.
3. Determination of total, temporary, and permanent hardness of water by EDTA method.
4. Determination of dissolved oxygen (DO) content of a water sample by Winkler's method.
5. Determination of chloride content of a water sample by Argentometric method.
6. Estimation of copper content in the given solution by Iodometry.
7. Estimation of total dissolved solids (TDS) of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using a pH meter.
9. Determination of strength of acids in a mixture using a conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration).
11. Estimation of iron content in a given solution using a potentiometer.
12. Estimation of sodium or potassium present in water using a flame photometer.
13. Preparation of nanoparticles (TiO_2 / ZnO / CuO) by Sol-Gel method.
14. Estimation of nickel content in steel.
15. Proximate analysis of coal
Total Contact Hours : 30

Course Outcomes	Upon completion of the course students should be able to:
CO1	To analyze the quality of water samples with respect to their acidity, alkalinity, hardness, and dissolved oxygen (DO).
CO2	To determine the amount of metal ions through volumetric and spectroscopic techniques.
CO3	To analyze and determine the composition of alloys.
CO4	To learn simple methods for the synthesis of nanoparticles.
CO5	To quantitatively analyze impurities in solutions using electro analytical techniques.

Textbooks:	
1.	J. Mendham.,R.C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogfel's Textbook of Qualitative Chemical Anaysis, 2009.

PO & PSO / CO	**CO-PO Mapping**											**CO-PSO Mapping**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	1	-	-	2	-	-	-	-	2	-	-	-
CO2	3	1	2	-	-	1	-	-	-	-	1	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO4	2	1	2	-	-	2	-	-	-	-	-	-	-	-
CO5	2	1	2	-	1	2	-	-	-	-	1	-	-	-
Average	2.6	1.3	1.6	1	1	1.8	-	-	-	-	1.3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
GE24112	ENGLISH LABORATORY	EEC	0	0	2	1

COURSE OBJECTIVES:

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT – I	**INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION**	**6**

Listening for general information-specific details- conversation: Introduction to classmates - Audio /video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies-making polite requests, making polite offers, replying to polite requests and offers understanding basic instructions (filling out a bank application for example).

UNIT – II	**NARRATION AND SUMMATION**	**6**

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings engaging in small talk- describing requirements and abilities.

UNIT– III	**DESCRIPTION OF A PROCESS / PRODUCT**	**6**

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking - Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights-talking about quantities(large & small)-talking about precautions.

UNIT – IV	**CLASSIFICATIONS AND RECOMMENDATIONS**	**6**

Listening - Listening to TED Talks; Listening to lectures - and educational videos. Speaking - Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT – V	**EXPRESSION**	**6**

Listening - Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking -making predictions- talking about a given topic-giving opinions- understanding a website describing processes.

Total Contact Hours: 30

Course Outcomes	Upon completion of the course students should be able to:
CO1	To listen to and comprehend general as well as complex academic information.
CO2	To listen to and understand different points of view in a discussion.
CO3	To speak fluently and accurately in formal and informal communicative contexts.
CO4	To describe products and processes and explain their uses and purposes clearly and accurately.
CO5	To express their opinions effectively in both formal and informal discussions.

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PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO2	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO3	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO4	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO5	3	3	3	3	1	3	3	3	3	3	3	-	-	-
Average	3	3	3	3	1	3	3	3	3	3	3	-	-	-

SEMESTER – II

Subject Code	Subject Name	Category	L	T	P	C
HS24201	PROFESSIONAL ENGLISH - II	HSMC	2	0	0	2

Course Objectives:

- To engage learners in meaning full language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT – I	**MAKING COMPARISONS**	**6**
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette-Compare and Contrast Essay; Grammar–Mixed Tenses, Prepositional phrases.		
UNIT – II	**EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING**	**6**
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds		
UNIT – III	**PROBLEM SOLVING**	**6**
Reading-Case Studies, excerpts from literary texts, news reports etc. Writing–Letter to the Editor, Checklists, Problem solution essay/Argumentative Essay. Grammar–Error correction; If conditional sentences		
UNIT – IV	**REPORTING OF EVENTS AND RESEARCH**	**6**
Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions		
UNIT – V	**THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY**	**6**
Reading–Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing–Job/ Internship application–Cover letter& Resume; Grammar– Numerical adjectives, Relative Clauses		
		Total Contact Hours : 30

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Course Outcomes	Upon completion of the course students should be able to:
CO1	To compare and contrast products and ideas in technical texts
CO2	To identify and report cause and effects in events, industrial processes through technical texts
CO3	To analyse problems in order to arrive at feasible solutions and communicate them in the written format.
CO4	To present their ideas and opinions in a planned and logical manner
CO5	To draft effective resumes in the context of job search.

Textbooks:	
1.	English for Engineers &Technologists (2020 edition) Orient Black Swan Private Ltd. Department of English, Anna University
2.	English for Science & Technology Cambridge University Press 2021
3.	Authored by Dr. Veena Selvam, Dr.Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference books/other materials/web resources:	
1.	Raman.Meenakshi, Sharma Sangeeta (2019).Professional English. Oxford university press. New Delhi.
2.	Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3.	Learning to Communicate–Dr.V.Chellammal, Allied Publishers, New Delhi,2003
4.	Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5.	Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO2	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO4	3	3	3	3	2	3	3	2	3	3	3	-	-	-
CO5	-	-	-	-	-	-	-	3	3	3	3	-	-	-
Average	3	3	3	3	2.75	3	3	2.2	3	3	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
MA24201	STATISTICS AND NUMERICAL METHODS	BSC	3	1	0	4

Course Objectives:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration this plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT – I	**TESTING OF HYPOTHESIS**	**9+3**

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT – II	**DESIGN OF EXPERIMENTS**	**9+3**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 22 factorial design.

UNIT – III	**SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**	**9+3**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT – IV	**INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**	**9+3**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT – V	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**9+3**

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

Total Contact Hours : 60

Course Outcomes	Upon completion of the course students should be able to:
CO1	Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO2	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO3	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

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CO4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

Textbooks:	
1.	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

Reference books/other materials/web resources:	
1.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4.	Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	2	-	2	3	-	-	-
CO2	3	3	1	1	1	-	-	2	-	2	3	-	-	-
CO3	3	3	1	1	1	-	-	2	-	2	3	-	-	-
CO4	3	3	1	1	1	-	-	2	-	2	3	-	-	-
CO5	3	3	1	1	1	-	-	2	-	2	3	-	-	-
Average	3	3	1	1	1	-	-	2	-	2	3	-	-	-

Subject Code	Subject Name	Category	L	T	P	C
PH24202	PHYSICS FOR ELECTRICAL ENGINEERING	BSC	3	0	0	3

Course Objectives:

- To make the students to understand the basics of dielectric materials and insulation.
- To understand the electrical properties of materials including free electron theory, applications of quantum mechanics and magnetic materials.
- To instil knowledge on physics of semiconductors, determination of charge carriers and device applications.
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications

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• To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.

UNIT – I	**DIELECTRIC MATERIALS AND INSULATION**	**9**
Matter polarization and relative permittivity: definition – dipole moment and polarization vector polarization mechanisms: electronic, ionic, orientational, interfacial and total polarization – frequency dependence – local field and Causius - Mossetti equation – dielectric constant and dielectric loss – Gauss's law and boundary conditions – dielectric strength, introduction to insulation breakdown in gases, liquids and solids – capacitor materials – typical capacitor constructions – piezoelectricity, ferro electricity and pyro electricity – quartz oscillators and filters – piezo and pyro electric crystals.		
UNIT – II	**ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS**	**9**
Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Quantum free electron theory :Tunneling – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole. Magnetic materials: Dia, para and ferromagnetic effects – paramagnetism in the conduction electrons in metals – exchange interaction and ferromagnetism – quantum interference devices – GMR devices.		
UNIT – III	**SEMICONDUCTORS AND TRANSPORT PHYSICS**	**9**
Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode.		
UNIT – IV	**OPTICAL PROPERTIES OF MATERIALS**	**9**
Classification of optical materials – Optical processes in semiconductors: optical absorption and emission, charge injection and recombination, optical absorption, loss and gain. Optical processes in quantum wells – Optoelectronic devices: light detectors and solar cells – light emitting diode – laser diode - optical processes in organic semiconductor devices –excitonic state – Electro-optics and nonlinear optics: Modulators and switching devices – plasmonics.		
UNIT – V	**NANO DEVICES**	**9**
Density of states for solids - Significance between Fermi energy and volume of the material – Quantum confinement – Quantum structures – Density of states for quantum wells, wires and dots – Band gap of nanomaterials –Tunneling – Single electron phenomena – Single electron Transistor. Conductivity of metallic nanowires – Ballistic transport – Quantum resistance and conductance – Carbon nanotubes: Properties and applications - Spintronic devices and applications – Optics in quantum structures – quantum well laser.		
	Total Contact Hours : 45	

Course Outcomes	Upon completion of the course students should be able to:
CO1	Know basics of dielectric materials and insulation.
CO2	Gain knowledge on the electrical and magnetic properties of materials and their applications
CO3	Understand clearly of semiconductor physics and functioning of semiconductor devices
CO4	Understand the optical properties of materials and working principles of various optical devices.
CO5	Appreciate the importance of nanotechnology and nano devices.

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Textbooks:	
1.	S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.
2.	R.F.Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.
3.	G.W.Hanson. Fundamentals of Nanoelectronics. Pearson Education (Indian Edition), 2009.

Reference books/other materials/web resources:	
1.	Laszlo Solymar, Walsh, Donald, Syms and Richard R.A., Electrical Properties of Materials, Oxford Univ. Press (Indian Edition) 2015.
2.	Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw- Hill Education (Indian Edition), 2019.
3.	Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
4.	Mark Fox, Optical Properties of Solids, Oxford Univ.Press, 2001.
5.	Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	1	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	1	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	1	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	1	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	1	-	-	-	-	-	-	-	-
Average	3	2	1	-	-	1	-	-	-	-	-	-	-	-

Subject Code	Subject Name	Category	L	T	P	C
BE24202	BASIC CIVIL AND MECHANICAL ENGINEERING	ESC	3	0	0	3

Course Objectives:

- To provide the students an illustration of the significance of the Civil and Mechanical Engineering Profession in satisfying the societal needs.
- To help students acquire knowledge in the basics of surveying and the materials used for construction
- To provide an insight to the essentials of components of a building and the infrastructure facilities.
- To explain the component of power plant units and detailed explanation to IC engines their working principles.
- To explain the Refrigeration & Air-conditioning system.

UNIT – I	PART A: OVERVIEW OF CIVIL ENGINEERING	5
Civil Engineering contributions to the welfare of Society - Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering		

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– National building code – terminologists: Plinth area, Carpet area, Floor area, Buildup area, Floor space index - Types of buildings: Residential buildings, Industrial buildings.		
UNIT – I	**PART B: OVERVIEW OF MECHANICAL ENGINEERING**	**4**
Overview of Mechanical Engineering - Mechanical Engineering Contributions to the welfare of Society – Specialized sub disciplines in Mechanical Engineering – Manufacturing, Automation, Automobile and Energy Engineering - Interdisciplinary concepts in Mechanical Engineering.		
UNIT – II	**SURVEYING AND CIVIL ENGINEERING MATERIALS**	**9**
Surveying: Objects – Classification – Principles – Measurements of Distances and angles – Leveling – Determination of areas– Contours. Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel - Timber - Modern Materials, Thermal and Acoustic Insulating Materials, Decorative Panels, Water Proofing Materials. Modern uses of Gypsum, Pre-fabricated Building component (brief discussion only)		
UNIT – III	**BUILDING COMPONENTS AND INFRASTRUCTURE**	**9**
Building plans – Setting out of a Building - Foundations: Types of foundations - Bearing capacity and settlement – Brick masonry – Stone Masonry – Beams – Columns – Lintels – Roofing – Flooring – Plastering. Types of Bridges and Dams – Water Supply Network - Rain Water Harvesting – Solid Waste Management - Introduction to Highways and Railways - Introduction to Green Buildings.		
UNIT – IV	**INTERNAL COMBUSTION ENGINES AND POWER PLANTS**	**9**
Classification of Power Plants- Working principle of steam, Gas, Diesel, Hydro -electric and Nuclear Power plants- Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines. Working principle of Boilers-Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps, Concept of hybrid engines. Industrial safety practices and protective devices		
UNIT – V	**REFRIGERATION AND AIR CONDITIONING SYSTEM**	**9**
Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner. Properties of air - water mixture, concepts of psychometric and its process.		
	Total Contact Hours : 45	

Course Outcomes	Upon completion of the course students should be able to:
CO1	Understanding profession of Civil and Mechanical engineering.
CO2	Summarize the planning of building, infrastructure and working of Machineries.
CO3	Apply the knowledge gained in respective discipline
CO4	Illustrate the ideas of Civil and Mechanical Engineering applications.
CO5	Appraise the material, Structures, machines and energy.

Textbooks:

1. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw-Hill Education; First edition, 2018

Reference books/other materials/web resources:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2018.
2. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd, 2013.

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3.	Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.
4.	Shantha Kumar SRJ., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	1	-	-	2	1	2	-	1	-	-	-
CO2	2	-	-	-	-	-	2	1	2	-	2	-	-	-
CO3	2	-	-	-	-	-	2	2	2	-	2	-	-	-
CO4	2	-	-	-	-	-	2	1	2	-	2	-	-	-
CO5	2	-	-	-	-	-	2	1	2	-	2	-	-	-
Average	2	-	-	0.2	-	-	2	1.2	2	-	1.8	-	-	-

Subject Code	Subject Name	Category	L	T	P	C
GE24201	ENGINEERING GRAPHICS	ESC	2	0	4	4

Course Objectives:

The main learning objective of this course is to prepare the students for:

- Drawing engineering curves.
- Drawing freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing development of solids.
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT –I	PLANE CURVES	6+12
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.		
UNIT – II	**PROJECTION OF POINTS, LINES AND PLANE SURFACE**	**6+12**
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		
UNIT–III	**PROJECTION OF SOLIDS AND FREEHAND SKETCHING**	**6+12**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from		

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pictorial views of objects. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)		
UNIT– IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**	**6+12**
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)		
UNIT – V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**6+12**
Principles of isometric projection — isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method. Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)		
		Total Contact Hours : 90

Course Outcomes	Upon completion of the course students should be able to:
CO1	Use BIS conventions and specifications for engineering drawing.
CO2	Construct the conic curves, involutes and cycloid
CO3	Solve practical problems involving projection of lines
CO4	Draw the orthographic, isometric and perspective projections of simple solids.
CO5	Draw the development of simple solids.

Textbooks:	
1.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House,53rd Edition, 2019
2.	Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3.	Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

Reference books/other materials/web resources:	
1.	Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2.	Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore,27th Edition,2017.
3.	Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4.	Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5.	Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
6.	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

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Publication of Bureau of Indian Standards:

1. IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4. IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO2	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO3	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO4	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO5	3	1	2	-	2	-	-	-	3	-	2	2	2	-
Average	3	1	2	-	2	-	-	-	3	-	2	2	2	-

Subject Code	Subject Name	Category	L	T	P	C
EE24201	ELECTRIC CIRCUIT ANALYSIS	PCC	3	1	0	4

Course Objectives:

- To introduce electric circuits and its analysis
- To provide key concepts to analyze and understand electrical circuits
- To impart knowledge on solving circuit equations using network theorems
- To educate on obtaining the transient response of circuits.
- To introduce the phenomenon of resonance in coupled circuits.
- To introduce Phasor diagrams and analysis of single &three phase circuits

UNIT – I	BASIC CIRCUITS ANALYSIS	9+3

Fundamentals concepts of R, L and C elements-Energy Sources - Ohm's Law - Kirchhoff 's Laws – DC Circuits – Resistors in series and parallel circuits - A.C Circuits – Average and RMS Value – Complex Impedance – Phasor diagram - Real and Reactive Power, Power Factor, Energy - Mesh current and node voltage methods of analysis D.C and A.C Circuits

UNIT – II	NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS	9+3

Network reduction: voltage and current division, source transformation – star delta conversion. Theorems – Superposition, Thevenin's and Norton's Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem - Tellegen's Theorem-Statement, application to DC and AC Circuits.

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UNIT – III	TRANSIENT RESPONSE ANALYSIS	9+3
Introduction – Laplace transforms and inverse Laplace transforms- standard test signals -Transient response of RL, RC and RLC circuits using Laplace transform for Source free, Step input and Sinusoidal input.		
UNIT – IV	**RESONANCE AND COUPLED CIRCUITS**	**9+3**
Series and parallel resonance –frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Dot rule-Analysis of coupled circuits– Single Tuned circuits.		
UNIT – V	**THREE PHASE CIRCUITS**	**9+3**
Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced and unbalanced – phasor diagram of voltages and currents – power measurement in three phase circuits– Power Factor Calculations.		
		Total Contact Hours : 60

Course Outcomes	Upon completion of the course, students should be able to:
CO1	Explain circuit's behavior using circuit laws.
CO2	Apply mesh analysis/ nodal analysis / network theorems to determine behavior of the given DC and AC circuit
CO3	Compute the transient response of first order and second order systems to step and sinusoidal input
CO4	Compute power, line/ phase voltage and currents of the given three phase circuit
CO5	Explain the frequency response of series and parallel RLC circuits
CO6	Explain the behavior of magnetically coupled circuits.

Textbooks:	
1.	William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9thedition, New Delhi, 2020
2.	Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2019.
3.	Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

Reference books/other materials/web resources:	
1.	Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpat Rai& Sons, New Delhi, 2020.
2.	Joseph A. Edminister, Mahmood Nahvi, "Electric circuits", Schaum's series, McGraw-Hill, First Edition, 2019.
3.	M E Van Valkenburg, "Network Analysis",Prentice-Hall of India Pvt Ltd, New Delhi, 2015.
4.	Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley Sons, Inc. 2018
5.	Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis", McGraw Hill, 2015.

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PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	-	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	-	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	-	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	-	1	-	-	-	3	3	3	3
CO6	3	3	3	3	2	-	1	-	-	-	3	3	3	3
Average	3	3	3	2.8	2	-	1	-	-	-	3	3	3	3

Subject Code	Subject Name	Category	L	T	P	C
	NCC Credit Course Level 1* (ARMY WING) NCC Credit Course Level - I		2	0	0	2
NCC GENERAL						**6**
NCC 1	Aims, Objectives & Organization of NCC					1
NCC 2	Incentives					2
NCC 3	Duties of NCC Cadet					1
NCC 4	NCC Camps: Types & Conduct					2
NATIONAL INTEGRATION AND AWARENESS						**4**
NI 1	National Integration: Importance & Necessity					1
NI 2	Factors Affecting National Integration					1
NI 3	Unity in Diversity & Role of NCC in Nation Building					1
NI 4	Threats to National Security					1
PERSONALITY DEVELOPMENT						**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving					2
PD 2	Communication Skills					3
PD 3	Group Discussion: Stress & Emotions					2
LEADERSHIP						**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code					3
L 2	Case Studies: Shivaji, Jhasi Ki Rani					2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT						**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth					3
SS 4	Protection of Children and Women Safety					1
SS 5	Road / Rail Travel Safety					1
SS 6	New Initiatives					2
SS 7	Cyber and Mobile Security Awareness					1
		TOTAL : 30 PERIODS				

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Subject Code	Subject Name	Category	L	T	P	C
	NCC Credit Course Level 1* (NAVAL WING) NCC Credit Course Level - I		**2**	**0**	**0**	**2**
NCC GENERAL						**6**
NCC 1	Aims, Objectives & Organization of NCC					1
NCC 2	Incentives					2
NCC 3	Duties of NCC Cadet					1
NCC 4	NCC Camps: Types & Conduct					2
NATIONAL INTEGRATION AND AWARENESS						**4**
NI 1	National Integration: Importance & Necessity					1
NI 2	Factors Affecting National Integration					1
NI 3	Unity in Diversity & Role of NCC in Nation Building					1
NI 4	Threats to National Security					1
PERSONALITY DEVELOPMENT						**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving					2
PD 2	Communication Skills					3
PD 3	Group Discussion: Stress & Emotions					2
LEADERSHIP						**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code					3
L 2	Case Studies: Shivaji, Jhasi Ki Rani					2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT						**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth					3
SS 4	Protection of Children and Women Safety					1
SS 5	Road / Rail Travel Safety					1
SS 6	New Initiatives					2
SS 7	Cyber and Mobile Security Awareness					1
		TOTAL : 30 PERIODS				

Subject Code	Subject Name	Category	L	T	P	C
	NCC Credit Course Level 1* (AIR FORCE WING) NCC Credit Course Level - I		**2**	**0**	**0**	**2**
NCC GENERAL						**6**
NCC 1	Aims, Objectives & Organization of NCC					1
NCC 2	Incentives					2
NCC 3	Duties of NCC Cadet					1
NCC 4	NCC Camps: Types & Conduct					2
NATIONAL INTEGRATION AND AWARENESS						**4**
NI 1	National Integration: Importance & Necessity					1
NI 2	Factors Affecting National Integration					1
NI 3	Unity in Diversity & Role of NCC in Nation Building					1
NI 4	Threats to National Security					1
PERSONALITY DEVELOPMENT						**7**

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PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
	TOTAL : 30 PERIODS	

Subject Code	Subject Name	Category	L	T	P	C
GE24202	TAMILS AND TECHNOLOGY	HSMC	1	0	0	1

UNIT – I	**WEAVING AND CERAMIC TECHNOLOGY**	**3**
Weaving Industry during the Sangam Age– Ceramic Technology–Black and Red Ware Potteries (BRW) – Graffiti on Potteries.		
UNIT – II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**3**
Design and Structural Construction: Houses and household materials during the Sangam Age – Building Materials and Hero Stones of the Sangam Age–Stage Constructions in Silappathikaram–Sculptures and Temples of Mamallapuram–Great Temples of the Chola Period and Other Worship Places–Temples of the Nayaka Period Type Study: Madurai Meenakshi Temple–Thirumalai Nayakar Mahal–Chettinad Houses – Indo-Saracenic Architecture during the British Period (e.g., Madras).		
UNIT– III	**MANUFACTURING TECHNOLOGY**	**3**
Art of Ship Building–Metallurgical Studies: Iron Industry, Smelting, Steel, Copper, and Gold–Coins as Historical Sources – Minting of Coins–Bead-Making Industries: Stone, Glass, Terracotta, Shell/Bone Beads–Archaeological Evidence of Bead Industry–Gemstone Varieties described in Silappathikaram.		
UNIT– IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**3**
Water Management: Dams, Tanks, Ponds, Sluice Systems – **KumizhiThoompu** of the Chola Period– Animal Husbandry: Cattle-use Wells–Agriculture and Agro Processing–Knowledge of the Sea: Fisheries, Pearl and Conch Diving: Ancient Oceanographic Knowledge–Knowledge-Specific Societies		
UNIT – V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3**
Development of Scientific Tamil -Tamil Computing–Digitalization of Tamil Books–Development of Tamil Software–Tamil Virtual Academy–Tamil Digital Library–Online Tamil Dictionaries–Sorkuvai Project.		
	Total Contact Hours : 15	

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

Subject Code	Subject Name	Category	L	T	P	C
GE24202	தமிழரும் தொழில்நுட்பமும்	HSMC	1	0	0	1

அலகு– I	நெசவு மற்றும் செராமிக் தொழில்நுட்பம்	3
சங்ககால நெசவுதொழில் – செராமிக் தொழில்நுட்பம் – கருநிறமும் சிவப்பும் கலந்த பானைகள் (BRW) – பானைகளில் கறுப்புகு றியீடுகள்		
அலகு –II	வடிவமைப்பு மற்றும் கட்டுமான நுட்பம்	3
சங்ககால வீடுகள் மற்றும் வீட்டு உபகரணங்களின் வடிவமைப்பு – கட்டுமானப்பொருட்கள் மற்றும் வீரக்கற்கள் – சிலப்பதிகாரத்தில் மேடைக்கட்டுமானம் – மாமல்லபுரம் சிற்பங்கள் மற்றும் கோவில்கள் – சோழர் மகாகோவில்கள் மற்றும் பிறவழிபாட்டு தலங்கள் – நாயக்கர் காலக்கோவில்கள் – **விவரஆய்வு**: மதுரை மீனாட்சியம்மன் கோவில், திருமலை நாயக்கர் மஹால், செட்டிநாடு வீடுகள், பிரிட்டிஷ் கால மதராசில் இஸ்லாமிய-ஐரோப்பிய கலப்பு கட்டிடக்கலை.		
அலகு –III	உற்பத்தி தொழில்நுட்பம்	3
கப்பல் கட்டும் கலை – உலோகம் குறித்த ஆய்வுகள்: இரும்பு, உருகுதல், ஸ்டீல், வெள்ளி, தங்கம் – வரலாற்று ஆதாரமாக நாணயங்கள் – நாணயங்களை உற்பத்தி செய்வது – மணிக்கலன் தொழில்கள்: கல், கண்ணாடி, டெர்ராக்கோட்டா, சிப்பி/ எலும்பு மணிகள் – தொல்லியல் ஆதாரங்கள் – சிலப்பதிகாரத்தில் குறிப்பிடப்பட்ட ரத்தினக்கற்கள்.		
அலகு- IV	வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம்	3
தண்ணீர் மேலாண்மை: அணைகள், ஏரிகள், குளங்கள், மதகு – சோழர் கால 'குமிழித்தூம்பு' – மாடுகள் பராமரிப்பு: மாடுகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் விவசாய இயந்திரங்கள் – கடல் அறிவு: மீன்வளம், முத்து மற்றும் சிப்பிக்கற்கள் – கடலியல் அறிவு கொண்ட சமூகம்.		

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அலகு –V	அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்	3
அறிவியல் தமிழின் வளர்ச்சி – கணினித் தமிழ் – தமிழ் நூல்களை மின்மயமாக்கல் – தமிழ் மென் பொருட்கள் உருவாக்கம் – தமிழ் மெய்நிகர் கல்விக்கழகம் – தமிழ் மின்நூலகம் – இணைய தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.		
		Total Contact Hours : 15

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

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**C**
GE24211	**ENGINEERING PRACTICES LABORATORY**	**ESC**	**0**	**0**	**4**	**4**

Course Objectives:

The main learning objective of this course is to provide hands on training to the students in:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

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GROUP–A (CIVIL & ELECTRICAL)

PART – I	CIVIL ENGINEERING PRACTICES	15

PLUMBING WORK:

a. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b. Preparing plumbing line sketches.
c. Laying pipe connection to the suction side of a pump
d. Laying pipe connection to the delivery side of a pump.
e. Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a. Sawing,
b. Planing and
c. Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a. Studying joints in door panels and wooden furniture
b. Studying common industrial trusses using models.

PART – II	ELECTRICAL ENGINEERING PRACTICES	15

a. Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b. Staircase wiring
c. Fluorescent Lamp wiring with introduction to CFL and LED types.
d. Energy meter wiring and related calculations/ calibration
e. Study of Iron Box wiring and assembly
f. Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
g. Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART – III	MECHANICAL ENGINEERING PRACTICES	15

WELDING WORK:

a. Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b. Practicing gas welding.

BASIC MACHINING WORK:

a. (simple)Turning.
b. (simple)Drilling.
c. (simple)Tapping.

ASSEMBLY WORK:

a. Assembling a centrifugal pump.
b. Assembling a household mixer.
c. Assembling an air-conditioner.

SHEET METAL WORK:

a. Making of a square tray

FOUNDRY WORK:

a. Demonstrating basic foundry operations.

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PART – IV	ELECTRONIC ENGINEERING PRACTICES	15
SOLDERING WORK: a. Soldering simple electronic circuits and checking continuity. **ELECTRONIC ASSEMBLY AND TESTING WORK:** **a.** Assembling and testing electronic components on a small PCB. **ELECTRONIC EQUIPMENT STUDY:** a. Study the elements of smart phone. b. Assembly and dismantle of LED TV. c. Assembly and dismantle of computer/ laptop		
	Total Contact Hours :	**60**

Course Outcomes	Upon completion of the course students should be able to:
CO1	Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
CO2	Wire various electrical joints in common household electrical wire work.
CO3	Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
CO4	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	1	-	-	-	-	2	2	1	1
CO2	3	2	-	-	1	1	-	-	-	-	2	2	1	1
CO3	3	2	-	-	1	1	-	-	-	-	2	2	1	1
Average	3	2	-	-	1	1	-	-	-	-	2	2	1	1

Subject Code	Subject Name	Category	L	T	P	C
EE24213	ELECTRIC CIRCUITS LABORATORY	PCC	0	0	4	4
Course Objectives:						
• To simulate various electric circuits using PSPICE/ MATLABE/E-Sim / SCILAB						
• To gain practical experience on electric circuits and verification of theorems						

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LIST OF EXPERIMENTS:

Familiarization of various electrical components, sources and measuring instruments.

1. Simulation and experimental verification of series and parallel electrical circuit using fundamental laws.
2. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
3. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
4. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
5. Simulation and experimental verification of Maximum Power transfer theorem.
6. Simulation and Experimental validation of R-C, R-L and RLC electric circuit transients.
7. Simulation and Experimental validation of frequency response of RLC electric circuit.
8. Design and implementation of series and parallel resonance circuit.
9. Simulation and experimental verification of three phase balanced and unbalanced star, delta networks circuit (Power and Power factor calculations).

Course Outcomes	Upon completion of the course students should be able to:
CO1	Use simulation and experimental methods to verify the fundamental electrical laws for the given DC/AC circuit (Ex 1)
CO2	Use simulation and experimental methods to verify the various electrical theorems (Superposition, Thevenin , Norton and maximum power transfer) for the given DC/AC circuit (Ex 2-5)
CO3	Analyze transient behavior of the given RL/RC/RLC circuit using simulation and experimental methods (Ex 6)
CO4	Analyze frequency response of the given series and parallel RLC circuit using simulation and experimentation methods (Ex 7-8)
CO5	Analyze the performance of the given three-phase circuit using simulation and experimental methods (Ex 9)

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	1.5	3	-	-	3	3	3	2
CO2	3	3	3	3	3	-	1.5	3	-	-	3	3	3	2
CO3	3	3	3	3	3	-	1.5	3	-	-	3	3	3	2
CO4	3	3	3	3	3	-	1.5	3	-	-	3	3	3	2
CO5	3	3	3	3	3	-	1.5	3	-	-	3	3	3	2
Average	3	3	3	3	3	-	1.5	3	-	-	3	3	3	2

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Subject Code	Subject Name	Category	L	T	P	C
GE24212	COMMUNICATION LABORATORY	EEC	0	0	4	2

Course Objectives:

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context

UNIT – I	**12**
Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal).	
UNIT – II	**12**
Speaking: discussing news stories-talking about frequency-talking about travel problems- discussing travel procedures- talking about travel problems- making arrangements-describing arrangements discussing plans and decisions- discussing purposes and reasons- understanding common technology terms-Writing: - writing different types of emails.	
UNIT – III	**12**
Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.	
UNIT – IV	**12**
Speaking: discussing the natural environment-describing systems-describing position and movement explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.	
UNIT – V	**12**
Speaking: describing things relatively-describing clothing-discussing safety issues(making recommendations) talking about electrical devices-describing controlling actions- Writing: job application(Cover letter + Curriculum vitae)-writing recommendations.	
	Total Contact Hours : 60

Course Outcomes	Upon completion of the course students should be able to:
CO1	Speak effectively in group discussions held in formal/semi-formal contexts
CO2	Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions
CO3	Write emails, letters and effective job applications.
CO4	Write critical reports to convey data and information with clarity and precision
CO5	Give appropriate instructions and recommendations for safe execution of tasks

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PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	3	1	3	3	3	3	3	3	-	-	-
CO2	2	3	3	3	1	3	3	3	3	3	3	-	-	-
CO3	2	2	3	3	1	3	3	3	3	3	3	-	-	-
CO4	3	3	3	3	3	3	3	3	3	3	3	-	-	-
CO5	3	3	3	3	3	3	3	3	3	3	3	-	-	-
Average	2.4	2.8	3	3	1.8	3	3	3	3	3	3	-	-	-

SEMESTER – III

Subject Code:	Subject Name	Category	L	T	P	C
MA24302	DIFFERENTIAL EQUATION AND TRANSFORMS	BSC	3	1	0	4

Course Objectives:

- To introduce the effective mathematical tools for the solutions of partial differential Equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- To acquaint the student with Fourier transform techniques used in wide variety of situations
- To acquaint the student with Laplace Transform techniques used in various situations.
- To acquaint the student with Congruence techniques used in various situations.

UNIT – I	**PARTIAL DIFFERENTIAL EQUATIONS**	**9+3**
Formation of PDE - Eliminating arbitrary constants- Eliminating arbitrary functions – First order nonlinear PDE: $f(p, q)= 0$, $f(z, p, q)= 0$, $f(x, p)= g(y, q)$, Clairaut's equation - Lagrange's linear equation – Homogeneous linear PDE of Higher order with constant coefficients.		
UNIT – II	**FOURIER SERIES**	**9+3**
Periodic function - Introduction to Fourier series - Dirichlet's conditions - Fourier series of odd and even functions - Parseval's identity - Harmonic analysis.		
UNIT – III	**FOURIER TRANSFORM**	**9+3**
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.		
UNIT – IV	**LAPLACE TRANSFORM**	**9+3**
Introduction to Laplace transforms – Sufficient conditions for existence - Properties of the Laplace transform - Transforms of derivatives and derivatives of transforms - Shifting theorems - Change of scale property – Periodic function - Convolution theorem - Inverse Laplace transforms – Solution of first and second order ordinary differential equations.		
UNIT – V	**CONGRUENCES**	**9+3**
Finite Fields -Linear Diophantine equations – Congruence's – Linear Congruence's – Applications: Divisibility tests – Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems.		
		Total Contact Hours : 60

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Course Outcomes	Upon completion of the course students should be able to:
CO1	Solve differential equations using Partial Differential Equations which plays a vital role in engineering applications
CO2	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications
CO3	Use the effective mathematical tools for the solutions of Fourier transform techniques.
CO4	Use the effective mathematical tools for the solutions of Laplace transform techniques .
CO5	Appreciate the effective of Congruence in engineering applications.

Textbooks:	
1.	Grewal B.S.,"Higher Engineering Mathematics", 44thEdition, Khanna Publishers, NewDelhi, 2018
2.	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016

Reference books/other materials/web resources:	
1.	Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt.Ltd, 2015.
2.	Narayanan. S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
3.	Ramana.B.V.,"Higher Engineering Mathematics",McGraw Hill Education Pvt.Ltd, New Delhi, 2018.
4.	Wylie.R.C.and Barrett.L.C.,"Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
5.	JW Leigh · 2008 · Cited by 227 — Systematic Biology, Volume 57, Issue 1, February 2008,

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO2	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO3	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO4	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO5	3	3	1	1	-	-	-	-	2	-	3	-	-	-
Average	3	3	1	1	-	-	-	-	2	-	3	-	-	-

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Subject Code:	Subject Name	Category	L	T	P	C
EE24301	ELECTROMAGNETIC THEORY	PCC	3	0	0	3

Course Objectives:

- To introduce the basic mathematical concepts related to electromagnetic vector fields.
- To impart knowledge on the concepts of Electrostatic fields, electric potential, energy density and their applications.
- To inculcate knowledge about Magneto static fields, magnetic flux density, vector potential and its applications.
- To understand different methods of emf generation and Maxwell's equations.
- To introduce the concepts of Electromagnetic waves and characterizing parameters.

UNIT – I	ELECTROSTATICS – I	9

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT – II	ELECTROSTATICS – II	9

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization –Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT – III	MAGNETOSTATICS	9

Lorentz force, magnetic field intensity (H) — Biot–Savart's Law - Ampere's Circuit Law — H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials — Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT – IV	ELECTRODYNAMIC FIELDS	9

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT – V	ELECTROMAGNETIC WAVES	9

Electromagnetic wave generation and equations — Wave parameters; velocity, intrinsic impedance, propagation constant — Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector — Plane wave reflection and refraction.

Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Understand the electromagnetic sources and their effects and the different co-ordinate systems used in the analysis of electrostatics fields.
CO2	Analyze electrostatic fields, electric potential and energy density along with their applications.
CO3	Analyze magnetostatic fields, magnetic flux density and vector potential along with their applications.
CO4	Explain different methods of emf generation and Maxwell's equations.

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CO5	Explain the concept of electromagnetic waves and characterizing parameters.

Textbooks:	
1.	Mathew N. O. Sadiku, S.V. Kulkarni 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc. Asian edition, 2015.
2.	William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.
3.	Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.

Reference books/other materials/webresources:	
1.	V.V.Sarwate, 'Electromagnetic fields and waves', Second Edition, Newage Publishers, 2018.
2.	J.P.Tewari, 'Engineering Electromagnetics - Theory, Problems and Applications', Second Edition, Khanna Publishers 2013.
3.	Joseph. A. Edminister, 'Schaum's Outline of Electromagnetics, Fifth Edition (Schaum's Outline Series), McGraw Hill, 2018.
4.	K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Sixteenth Edition Eighth Reprint :2015

PO & PSO / CO	**CO-PO Mapping**											**CO-PSO Mapping**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO2	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO3	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO4	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO5	3	2	2	1	-	-	-	-	-	-	1	3	2	1
Average	3	2	2	1	-	-	-	-	-	-	1	3	2	1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**C**
EE24302	**DC MACHINES AND TRANSFORMERS**	**PCC**	**3**	**0**	**0**	**3**

Course Objectives:

- To understand the concept of electromechanical energy conversion system.
- To identify the appropriate machine for a given application based on its characteristics.
- To identify the appropriate test to determine the performance parameters of a given machine.
- To familiarize with the procedure for parallel operation of generators and transformers.
- To deliberate the working of auto transformer and three phase transformers.

UNIT – I	**ELECTROMECHANICAL ENERGY CONVERSION**	**9**

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Fundamentals of Magnetic circuits- Statically and dynamically induced EMF - Principle of electromechanical energy conversion -forces and torque in magnetic field systems- energy balance in magnetic circuits- singly excited and multi excited magnetic field system- mmf of distributed windings – magnetic saturation and leakage fluxes.		
UNIT – II	**DC GENERATORS**	**9**
Principle of operation- constructional details- armature windings – types - EMF equation- armature reaction- demagnetizing and cross magnetizing- Ampere turns- commutation- methods of improving commutation - OCC and load characteristics of different types of DC Generators- Parallel operation of DC Generators.		
UNIT – III	**DC MOTORS**	**9**
Principle of operation- significance of back emf- torque equations - power developed by armature - speed control of DC motors - starting methods - load characteristics of DC motors - losses and efficiency in DC machine- condition for maximum efficiency. Testing methods - Brake test, Swinburne's test and Hopkinson's test-applications of DC motors.		
UNIT – IV	**SINGLE PHASE TRANSFORMER**	**9**
Construction - principle of operation - equivalent circuit - phasor diagrams - testing methods - polarity test - open circuit and short circuit test - back-to- back test - voltage regulation - losses and efficiency - all day efficiency - separation of core losses - parallel operation of single-phase transformers.		
UNIT – V	**AUTOTRANSFORMER AND THREE PHASE TRANSFORMER**	**9**
Construction – working of auto transformer - comparison with two winding transformers - applications of autotransformer - Three Phase Transformer – Construction - types of connections and their comparative features - Scott connection.		
		Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Apply the laws governing the electromechanical energy conversion for singly and multiple excited systems.
CO2	Explain the construction, working principle and performance parameters of DC Generator.
CO3	Interpret the construction, working principle, performance parameters and testing of DC motors.
CO4	Understand the construction, working principle, performance parameters and testing o single phase transformers.
CO5	Describe the working principle of auto transformer, three phase transformer with different types of connections.

Textbooks:	
1.	I.J.Nagrath and D.P.Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2017.
2.	P. S. Bimbhra, "Electric Machinery", Khanna Publishers, 2nd Edition, 2021.

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Reference books/other materials/web resources:	
1.	A.E.Fitzgerald and C.Kingsley, "Electric Machinery", New York, McGraw Hill Education, 6th Edition 2017.
2.	A.E.Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2018.
3.	M.G.Say, "Performance and design of AC machines", CBS Publishers, First Edition 2008.
4.	Sahdev S. K. "Electrical Machines", Cambridge University Press, 2018.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO2	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO3	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO4	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO5	3	2	2	1	-	-	-	-	-	-	1	3	2	1
Average	3	2	2	1	-	-	-	-	-	-	1	3	2	1

Subject Code	Subject Name	Category	L	T	P	C
EE24303	ANALOG ELECTRONICS	PCC	3	0	0	3

Course Objectives:

- To understand the structure of basic electronic devices.
- To be exposed to active and passive circuit elements.
- To familiarize the operation and applications of BJT and MOSFET.
- To explore the characteristics of amplifier gain and frequency response.
- To learn the required functionality of positive and negative feedback systems.

UNIT – I	PN JUNCTION DEVICES AND CIRCUITS	9
PN junction diode – structure, operation and V-I characteristics - diffusion and transition capacitance — Clipping & Clamping circuits - Rectifiers — Half Wave and Full Wave Rectifier – Display devices - LED, Laser diodes, Zener diode characteristics - Zener diode Reverse characteristics — Zener diode as regulator.		
UNIT – II	**TRANSISTORS AND THYRISTORS**	**9**
Structure, operation, characteristics and Biasing of BJT, JFET, MOSFET and UJT, Structure and characteristics of Thyristors and IGBT.		
UNIT – III	**AMPLIFIERS**	**9**
BJT small signal model – Analysis of CE, CB, CC amplifiers - Gain and frequency response – MOSFET small signal model – Analysis of CS and Source follower — Gain and frequency response - High frequency analysis.		

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UNIT – IV	MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER	9
BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET differential amplifier — Single tuned amplifiers — Gain and frequency response — power amplifiers – Types (Qualitative analysis).		
UNIT – V	**FEEDBACK AMPLIFIERS AND OSCILLATORS**	**9**
Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback – Condition for oscillations, oscillator types - phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.		
		Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Explain the structure and operation of PN junction devices (diode, Zener diode, LED and Laser diode) and their applications in clipper, clamper, rectifier, and regulator circuit.
CO2	Analyze the structure and characteristics BJT, FET, MOSFET, UJT, Thyristor and IGBT.
CO3	Analyze the performance of various configurations of BJT and MOSFET based amplifiers.
CO4	Understand the characteristics of MOS based cascade and differential amplifier.
CO5	Explain the operation of various feedback amplifiers and oscillators.

Textbooks:	
1.	David A. Bell , "Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2.	Sedra and Smith, "Microelectronic circuits",7th Edition., Oxford University Press, 2017
Reference books/other materials/web resources:	
1.	Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition 2014.
2.	Thomas L. Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2017.
3.	Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4.	Robert L. Boylestad, "Electronic devices and circuit theory", 11th edition, Pearson prentice Hall 2013.
5.	Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, Second edition, 2012.

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PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	-	-	-	-	1	3	-	-
CO2	3	-	2	-	-	-	-	-	-	-	1	3	-	-
CO3	3	-	2	-	-	-	-	-	-	-	1	3	-	-
CO4	3	-	2	-	-	-	-	-	-	-	1	3	-	-
CO5	3	-	2	-	-	-	-	-	-	-	1	3	-	-
Average	3	-	2	-	-	-	-	-	-	-	1	3	-	-

Subject Code	Subject Name	Category	L	T	P	C
EE24304	DIGITAL ELECTRONICS	PCC	3	0	0	3

Course Objectives:

- To impart knowledge on various number systems and logic functions.
- To inculcate the concepts of design and implement combinational logic circuits.
- To design synchronous logic circuits.
- To analyze and study asynchronous sequential circuits and programmable logic devices.
- To learn the logic families and VHDL

UNIT – I	NUMBER SYSTEMS AND LOGIC FUNCTIONS	9

Review of Number systems - Binary codes - Error detection and correcting codes (Parity and Hamming code) - Boolean laws - Logic gates - Representation of logic functions - SOP and POS forms - canonical forms - Min term and Max term

UNIT – II	COMBINATIONAL LOGIC CIRCUITS	9

Minimizing Boolean functions using K-map – implementation of Boolean expressions using Logic gates and Universal gates - Half and Full Adders, Binary parallel adder - Carry look ahead adder, BCD Adder, Magnitude comparator-Decoders and Encoders – Multiplexers and Demultiplexers, code converters.

UNIT – III	SYNCHRONOUS SEQUENTIAL CIRCUITS	9

Sequential logic circuits - SR, JK, D and T flip flops - level triggering and edge triggering - counters - Synchronous and Asynchronous types - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Mealy models - state assignment - state reduction - state diagram

UNIT – IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES	9

Asynchronous sequential logic Circuits - Transition stability, flow stability - race conditions, hazards & errors in digital circuits; analysis of asynchronous sequential logic circuits- introduction to Programmable Logic Devices: PROM - PLA - PAL - FPGA.

UNIT – V	DIGITAL LOGIC FAMILIES AND VHDL	9

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Digital logic families - Comparison of RTL, TTL, ECL and CMOS - Comparison of logic families RTL Design - Introduction to VHDL – Operators - Simple coding for combinational logic and sequential logic circuit. (Simulation: adders, counters, flip flops, Multiplexers & Demultiplexers).
Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Solve various number systems and logic functions.
CO2	Apply K-Map to simplify the Boolean expression and implementation of combinational logic circuits.
CO3	Design various synchronous sequential circuits using Flip Flops.
CO4	Understand the asynchronous sequential circuits and explain programmable logic devices.
CO5	Analyze different logic families and develop VHDL coding for digital logic circuits.

Textbooks:	
1.	Morris Mano. M and Michael D.Ciletti,"Digital Design with An introduction to VHDL", Pearson Education,8th edition 2013.
2.	Donald D.Givone, 'Digital Principles and Design', Tata McGraw Hill,1st Edition, 2003.
3.	Thomas L Floyd, 'Digital fundamentals', Pearson Education Limited, 11th Edition, 2018.
Reference books/other materials/webresources:	
1.	Tocci R.J., Neal S. Widmer, 'Digital Systems: Principles and Applications', Pearson Education Asia, 12th Edition, 2017.
2.	Charles H.Roth ,Jr.Lizy Kurian John,"Digital System Design using VHDL",Cengage , 3rd edition ,2017.
3.	Donald P Leach, Albert Paul Malvino, Goutam Sha, 'Digital Principles and Applications', Tata McGraw Hill, 7th Editi2010.

PO & PSO / CO	**CO-PO Mapping**											**CO-PSO Mapping**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2	-	-	-	-	-	-	1	3	3	1
CO2	3	2	2	2	-	-	-	-	-	-	1	3	3	1
CO3	3	2	2	2	-	-	-	-	-	-	1	3	3	1
CO4	3	2	2	2	-	-	-	-	-	-	1	3	3	1
CO5	3	2	2	2	-	-	-	-	-	-	1	3	3	1
Average	3	2	2	2	-	-	-	-	-	-	1	3	3	1

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Subject Code	Subject Name	Category	L	T	P	C
CS24331	C PROGRAMMING AND DATA STRUCTURES	PCC	3	0	0	3

Course Objectives:

- To introduce the basics of C programming language.
- To learn the concepts of advanced features of C.
- To understand the concepts of ADTs and linear data structures.
- To know the concepts of non-linear data structure and hashing.
- To familiarize the concepts of sorting and searching techniques.

UNIT – I	**C PROGRAMMING FUNDAMENTALS**	**9**
Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays.		
UNIT – II	**C PROGRAMMING - ADVANCED FEATURES**	**9**
Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Preprocessor Directives.		
UNIT – III	**LINEAR DATA STRUCTURES**	**9**
Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – doubly-Linked Lists – Circular Linked List – Stack ADT – Implementation of Stack – Applications – Queue ADT – Priority Queues – Queue Implementation – Applications.		
UNIT – IV	**NON-LINEAR DATA STRUCTURES**	**9**
Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.		
UNIT – V	**SORTING AND SEARCHING TECHNIQUES**	**9**
Insertion Sort – Quick Sort – Heap Sort – Merge Sort –Linear Search – Binary Search.		
		Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Develop C programs for any real world/technical application.
CO2	Apply advanced features of C in solving problems.
CO3	Write functions to implement linear and non–linear data structure operations.
CO4	Suggest and use appropriate linear/non–linear data structure operations for solving a given problem.
CO5	Appropriately uses sort and search algorithms for a given application and apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.

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Textbooks:	
1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 1997.
2.	Reema Thareja, "Programming in C", Second Edition, Oxford University Press, 2016.

Reference books/other materials/web resources:	
1.	Brian W. Kernighan, Rob Pike, "The Practice of Programming", Pearson Education, 1999.
2.	Paul J. Deitel, Harvey Deitel, "C How to Program", Seventh Edition, Pearson Education, 2013.
3.	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education,1983.
4.	Ellis Horowitz, SartajSahni and Susan Anderson, "Fundamentals of Data Structures", Galgotia, 2008.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	2	2	1	1	-	1	2	1	2	1	3
CO2	1	2	1	2	2	-	-	-	1	1	1	2	2	2
CO3	2	3	1	2	3	-	-	-	1	1	1	2	1	2
CO4	2	1	-	1	1	-	-	-	2	1	1	2	3	1
CO5	1	2	1	2	2	1	1	-	1	2	1	2	2	3
Average	1.6	2.2	1	1.8	2	1	1	-	1.2	1.4	1	2	1.8	2.2

Subject Code	Subject Name	Category	L	T	P	C
EE24311	DC MACHINES AND TRANSFORMERS LABORATORY	PCC	0	0	3	1.5

Course Objectives:

- To expose the students to determine the characteristics of DC machines and transformers by performing experiments on these machines.
- To provide hands on experience to evaluate the performance parameters of DC machines and transformer by conducting suitable tests.

LIST OF EXPERIMENTS:

1. Open circuit and load characteristics of DC shunt generator- calculation of critical resistance and critical speed.
2. Load characteristics of DC compound generator.
3. Load test on DC shunt motor.
4. Load test on DC compound motor.
5. Load test on DC series motor.
6. Predetermination of efficiency characteristics in DC machines-Swinburne's test
7. Speed control of DC shunt motor.
8. Hopkinson's test on DC motor – generator set.

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9. Load test on single-phase transformer and three phase transformers.
10. Open circuit and short circuit tests on single phase transformer.
11. Sumpner's test on single phase transformers.
12. Separation of no-load losses in single phase transformer.
Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Construct the circuit with appropriate connections for the given DC machine/transformer.
CO2	Experimentally determine the characteristics of different types of DC machines.
CO3	Demonstrate the speed control techniques for a DC motor for industrial applications.
CO4	Identify suitable methods for testing of transformer and DC machines.
CO5	Predetermine the performance parameters of transformers and DC motor.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	2	2	-	2	2	-	-	1	3	2	-
CO2	3	-	-	2	2	-	2	2	-	-	1	3	2	-
CO3	3	-	-	2	2	-	2	2	-	-	1	3	2	-
CO4	3	-	-	2	2	-	2	2	-	-	1	3	2	-
CO5	3	-	-	2	2	-	2	2	-	-	1	3	2	-
Average	3	-	-	2	2	-	2	2	-	-	1	3	2	-

Subject Code	Subject Name	Category	L	T	P	C
EE24312	ANALOG AND DIGITAL ELECTRONICS LABORATORY	PCC	0	0	3	1.5

Course Objectives:

- To understand and analyze the characteristics and applications of semiconductor devices.
- To design and evaluate common electronic circuits using transistors, diodes, and logic gates.
- To gain hands-on experience in implementing rectifiers, amplifiers, and oscillators.
- To design and implement digital circuits using flip-flops, registers, and counters.
- To develop problem-solving skills in the design and implementation of integrated electronic systems.

LIST OF EXPERIMENTS:

1. Characteristics of Semiconductor diode, Zener diode, photo diode, and photo transistor.
2. Characteristics of NPN Transistor under common emitter configurations.
3. Characteristics of UJT and generation of saw tooth waveforms.

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4. Design and frequency response characteristics of a Common Emitter amplifier.
5. Characteristics of light activated relay circuit.
6. Characteristics of Single Phase half-wave and full wave rectifiers with inductive and capacitive filters.
7. Study of basic and universal logic gates.
8. Implementation of 4 bit binary Adder/ Subtractor circuits.
9. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa.
10. Implementation of BCD adder, Encoders and Decoders.
11. Counters: Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types.
12. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Analyze and characterize semiconductor devices in various configurations, NPN Transistor, UJT, Rectifiers with filters.
CO2	Analyze the frequency response characteristics of a Common Emitter amplifier.
CO3	Analyze the characteristics of light activated relay circuit.
CO4	Design and implement combinational and sequential digital logic circuits.
CO5	Design and implement the digital systems with various encoding and decoding schemes.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	-	2	2	-	-	1	3	2	-
CO2	3	-	-	-	2	-	2	2	-	-	1	3	2	-
CO3	3	-	-	-	2	-	2	2	-	-	1	3	2	-
CO4	3	-	-	-	2	-	2	2	-	-	1	3	2	-
CO5	3	-	-	-	2	-	2	2	-	-	1	3	2	-
Average	3	-	-	-	2	-	2	2	-	-	1	3	2	-

Subject Code	Subject Name	Category	L	T	P	C
CS24332	C PROGRAMMING AND DATA STRUCTURES LABORATORY	PCC	0	0	3	1.5

Course Objectives:

- To develop applications in C.
- To implement linear and non-linear data structures.
- To understand the different operations of search trees.
- To get familiarized to sorting and searching algorithms.

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LIST OF EXPERIMENTS:	
1. Practice of C programming using statements, expressions, decision making and iterative statements	
2. Practice of C programming using Functions and Arrays	
3. Implement C programs using Pointers and Structures	
4. Implement C programs using Files	
5. Development of real time C applications	
6. Array implementation of List ADT	
7. Array implementation of Stack and Queue ADTs	
8. Linked list implementation of List, Stack and Queue ADTs	
9. Applications of List, Stack and Queue ADTs	
10. Implementation of Binary Trees and operations of Binary Trees	
11. Implementation of Binary Search Trees	
12. Implementation of searching techniques	
13. Implementation of Sorting algorithms : Insertion Sort, Quick Sort, Merge Sort	
14. Implementation of Hashing – any two collision techniques	
	Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Use different constructs of C and develop applications.
CO2	Write functions to implement linear and non-linear data structure operations.
CO3	Suggest and use the appropriate linear / non-linear data structure operations for a given problem.
CO4	Apply appropriate hash functions that result in a collision free scenario for data storage and Retrieval.
CO5	Implement Sorting and searching algorithms for a given application.

PO & PSO / CO	**CO-PO Mapping**											**CO-PSO Mapping**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	3	-	2	2	-	-	1	-	2	3
CO2	3	-	-	-	3	-	2	2	-	-	1	-	2	3
CO3	3	-	-	-	3	-	2	2	-	-	1	-	2	3
CO4	3	-	-	-	3	-	2	2	-	-	1	-	2	3
CO5	3	-	-	-	3	-	2	2	-	-	1	-	2	3
Average	3	-	-	-	3	-	2	2	-	-	1	-	2	3

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SEMESTER – IV

Subject Code:	Subject Name	Category	L	T	P	C
MA24403	PROBABILITY AND COMPLEX FUNCTIONS	BSC	3	1	0	4

Course Objectives:

- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To learn the applications of statistics in business decision making.
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- To familiarize the students with complex integration techniques which can be used in real integrals.

UNIT – I	PROBABILITY AND RANDOM VARIABLES	9+3

Axioms of probability – Conditional probability - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Normal distributions.

UNIT – II	TWO-DIMENSIONAL RANDOM VARIABLES	9+3

Joint Probability distributions –Joint Probability Density function - Marginal Probability Distributions – Conditional probability distributions – Covariance – Correlation.

UNIT – III	REGRESSION & METHOD OF LEAST SQUARE	9+3

Rank Correlation - Regression – Estimation of Regression lines – Method of Least Squares: Straight Line $Y = aX + b$ - Parabola $Y = aX^2 + bX + c$.

UNIT – IV	COMPLEX VARIABLE	9+3

Analytic functions - Cauchy Riemann Equations and other properties - Harmonic functions – Construction of an Analytic function by Milne-Thomson method only – Bilinear Transformation.

UNIT – V	COMPLEX INTEGRATION	9+3

Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series –Types of Singularities – Calculus of Residues – Cauchy's Residue theorem.

Total Contact Hours : 60

Course Outcomes	Upon completion of the course students should be able to:
CO1	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
CO2	Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
CO3	Enable the students to apply the statistical techniques in a work setting
CO4	Develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
CO5	Familiarize the students with complex integration techniques which can be used in real integrals.

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Textbooks:	
1.	Johnson. R.A., Miller. I and Freund. J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
2.	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
3.	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.

Reference books/other materials/web resources:	
1.	Papoulis. A. and Unnikrishnapillai . S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
2.	Spiegel. M.R., Schiller. J. and Srinivasan . R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
3.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2010.
4.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
5	N. D. Vohra, Business Statistics, Tata McGraw Hill, 2017.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	2	-	2	-	-	-
CO2	3	3	2	2	1	-	-	-	2	-	2	-	-	-
CO3	3	2	3	2	1	-	-	-	2	-	2	-	-	-
CO4	3	3	2	1	-	-	-	-	2	-	2	-	-	-
CO5	3	3	2	2	1	-	-	-	2	-	2	-	-	-
Average	3	2.8	2	1.6	1	-	-	-	2	-	2	-	-	-

Subject Code	Subject Name	Category	L	T	P	C
EE24401	SYNCHRONOUS AND INDUCTION MACHINES	PCC	3	0	0	3

Course Objectives:

- To understand the Construction and performance of salient and non – salient type synchronous generators.
- To learn about the Principle of operation and performance of synchronous motor.
- To understand the Construction, principle of operation and performance of induction machines.
- To impart knowledge on Starting and speed control of three-phase induction motors.

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• To know about the Construction, principle of operation and performance of single phase induction motors and special machines.		
UNIT – I	**SYNCHRONOUS GENERATOR**	**9**
Constructional details - Types of rotors - winding factors - EMF equation - Synchronous reactance - Armature reaction - Phasor diagram of non-salient pole synchronous generator connected to infinite bus - Synchronizing – Synchronizing torque - excitation and input control- Voltage regulation - EMF, MMF and ZPF methods - parallel operation - steady state power angle characteristics - Two reaction theory - slip test.		
UNIT – II	**SYNCHRONOUS MOTOR**	**9**
Principle of operation - Torque equation - Operation on infinite bus bars - V and Inverted V curves - Power input and power output - Starting methods - Current loci for constant power input, constant excitation and constant power Developed - Hunting - damper windings - synchronous condenser.		
UNIT – III	**THREE PHASE INDUCTION MOTOR**	**9**
Constructional details - Types of rotors – slip - Principle of operation - cogging, crawling, stalling- Equivalent circuit - Torque-Slip characteristics - Condition for maximum torque - Losses and efficiency - Load test - No load and blocked rotor tests - Circle diagram - Separation of losses – applications - Double cage induction motors - Induction generators - Synchronous induction motor.		
UNIT – IV	**STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR**	**9**
Need for starting - Types - DOL, Rotor resistance, Autotransformer and Star delta starters - Speed control - Voltage control, Frequency control and pole changing - Cascaded Connection - V/f control - Slip power recovery Scheme - Braking methods - Plugging, dynamic and regenerative braking.		
UNIT – V	**SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES**	**9**
Constructional details of single phase induction motor - Double field revolving theory and operation - Equivalent circuit - No load and blocked rotor tests - Performance analysis - Starting methods - split phase, Capacitor start, capacitor start and capacitor run - Shaded pole qualitative treatment of Linear induction motor, Repulsion motor, Hysteresis motor, AC series motor, Servo motors, Stepper motors.		
	Total Contact Hours : 45	

Course Outcomes	Upon completion of the course students should be able to:
CO1	Understand the construction and working principle of Synchronous generator.
CO2	Understand the construction and working principle of Synchronous Motor.

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CO3	Understand the construction and working principle of Three Phase Induction Motor.
CO4	Acquire knowledge about the starting and speed control of three phase induction motors.
CO5	Gain knowledge about the basic principles and working of Single phase induction motors and Special Electrical Machines.

Textbooks:	
1.	A.E.Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', McGraw Hill publishing Company Ltd, 6th Education 2017.
2.	Stephen.J.Chapman, 'Electric Machinery Fundamentals'4th edition, McGraw Hill Education Pvt. Ltd, 4th Edition 2017.
3.	D.P.Kothari and I.J.Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 5th Edition 2017.
4.	P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, edition 2, 2021.

Reference books/other materials/webresources:	
1.	Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
2.	M.N.Bandyo padhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2011.
3.	B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers,3rd Edition, Reprint 2015.
4.	Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, First edition 2010.
5.	Alexander.S.Langsdorf, 'Theory of Alternating-Current Machinery', McGraw Hill Publications, 2001.

PO & PSO / CO	**CO-PO Mapping**											**CO-PSO Mapping**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	-	-	-	-	-	1	3	2	2
CO2	3	2	2	1	-	-	-	-	-	-	1	3	2	2
CO3	3	2	2	1	-	-	-	-	-	-	1	3	2	2
CO4	3	2	2	1	-	-	-	-	-	-	1	3	2	2
CO5	3	2	2	1	-	-	-	-	-	-	1	3	2	2
Average	3	2	2	1	-	-	-	-	-	-	1	3	2	2

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**C**
EE24402	**TRANSMISSION AND DISTRIBUTION**	**PCC**	**3**	**0**	**0**	**3**

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Course Objectives:		
• To impart knowledge about the configuration of the electrical power systems.		
• To study the line parameters and interference with neighbouring circuits.		
• To understand the mechanical design and performance analysis of transmission lines.		
• To learn about different insulators and underground cables.		
• To understand and analyze the distribution system.		
UNIT – I	**TRANSMISSION LINE PARAMETERS**	**9**
Structure of electric power system – Parameters - resistance of solid and stranded conductors -Inductance and capacitance of single and three phase lines - Symmetrical and unsymmetrical spacing and transposition - single and double circuits - conductor types - application of self and mutual GMD; skin and proximity effects - Effect of earth on line capacitance.		
UNIT – II	**MODELLING AND PERFORMANCE OF TRANSMISSION LINES**	**9**
Performance of Transmission lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - transmission efficiency and voltage regulation, real and reactive power flow in lines - Power Circle diagrams - Ferranti effect - Formation of Corona - Critical Voltages - Voltage Control and Power factor improvement.		
UNIT – III	**SAG CALCULATION AND LINE SUPPORTS**	**9**
Line Supports - Types of towers - Tension and Sag Calculation for level and unequal level supports under different weather conditions - Methods of grounding - Insulators: Types - voltage distribution and string efficiency - improvement of string efficiency - testing of insulators.		
UNIT – IV	**UNDERGROUND CABLES**	**9**
Types of cables - single-core and 3-core belted cables - Insulation Resistance - Potential Gradient - Capacitance of single-core and 3-core belted cables - Grading of cables - Power factor -heating of cables - DC cables.		
UNIT – V	**DISTRIBUTION SYSTEMS AND SUBSTATION**	**9**
General Aspects - Kelvin's Law - AC and DC distributions - Concentrated and uniform loading - Distribution Loss - Types of Substations - recent Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only)		
		Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Understand the structure of power system, computation of transmission line parameters for different configurations.
CO2	Model the transmission lines to determine the line performance and to understand the impact of Ferranti effect and corona on line performance.
CO3	Do Mechanical design of transmission lines, grounding and to understand about the insulators in transmission system.
CO4	Design the underground cables and understand the performance analysis of underground cable.
CO5	Understand the performance analysis and modern trends in distribution system.

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Textbooks:	
1.	D.P.Kothari, I.J. Nagarath, 'Power System Engineering', Mc Graw-Hill Publishing Company limited, New Delhi, Third Edition, 2019.
2.	C.L.Wadhwa, 'Electrical Power Systems', New Age International Ltd, seventh edition 2022.
3.	S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2008.

Reference books/other materials/web resources:	
1.	B.R.Gupta, 'Power System Analysis and Design' S. Chand, New Delhi, Sixth Edition, 2011.
2.	Luces M.Fualken berry, Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3.	Arun Ingole, "Power transmission and distribution" Pearson Education, first edition, 2018
4.	J.Brian Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2011.
5.	G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.
6.	V.K.Mehta, Rohit Mehta, 'Principles of power system', S. Chand & Company Ltd, New Delhi, 2013
7.	Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 23rd reprint, 2015.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1	-	-	1	-	-	-	1	3	3	1
CO2	3	2	2	1	-	-	1	-	-	-	1	3	3	1
CO3	3	2	3	1	-	-	1	-	-	-	1	3	3	1
CO4	3	2	3	1	-	-	1	-	-	-	1	3	3	1
CO5	3	1	1	1	-	-	1	-	-	-	1	3	3	1
Average	3	1.6	2	1	-	-	1	-	-	-	1	3	3	1

Subject Code	Subject Name	Category	L	T	P	C
EE24403	LINEAR INTEGRATED CIRCUITS	PCC	3	0	0	3

Course Objectives:

- To understand IC fabrication procedure.
- To learn about the Characteristics of OP-amp.
- To understand the Applications of Op-amp.
- To impart knowledge on Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- To know about the Applications of IC.

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UNIT – I	**IC FABRICATION**	**9**
IC classification - fundamental of monolithic IC technology - epitaxial growth - masking and etching - diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes-capacitance – resistance - FETs and PV Cell.		
UNIT – II	**CHARACTERISTICS OF OPAMP**	**9**
Ideal OP-AMP characteristics - DC characteristics - AC characteristics - differential amplifier - frequency response of OP-AMP – Voltage-shunt feedback and inverting amplifier - Voltage series feedback and Non-Inverting Amplifier.		
UNIT – III	**APPLICATIONS OF OPAMP**	**9**
Basic applications of op-amp - summer, differentiator and Integrator - V/I & I/V converters. Instrumentation amplifier - Log and Antilog Amplifiers - Analog multiplier & Divider - first and second order active filters – comparators - multi vibrators - waveform generators - clippers – clampers - peak detector - S/H circuit.		
UNIT – IV	**SPECIAL ICs**	**9**
Functional block - characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC 565 - phase locked loop IC, AD633 Analog multiplier ICs.		
UNIT – V	**APPLICATION ICs**	**9**
AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators - LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator - SMPS - ICL 8038 function generator IC.		
	Total Contact Hours : 45	

Course Outcomes	Upon completion of the course students should be able to:
CO1	Explain monolithic IC fabrication process, fabrication of diodes, capacitance, resistance, FETs and PV Cell.
CO2	Analyze the characteristics and basic applications of Op-Amp.
CO3	Explain circuit and applications of op-amp based instrumentation amplifier, log/antilog amplifier, analog multiplier /divider, active filters, comparators, waveform generators.
CO4	Explain Functional blocks, characteristics and applications of Timer, PLL, analog multiplier ICs.
CO5	Explain the applications of ICs in Instrumentation amplifier, fixed and variable voltage regulator, SMPS and function generator.

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Textbooks:	
1.	David A. Bell, 'Op-amp & Linear ICs', Oxford, Third Edition, 2011
2.	D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', New Age, Fourth Edition, 2018.
3.	Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, PHI 2021.

Reference books/other materials/web resources:	
1.	Fiore,"Opamps & Linear Integrated Circuits Concepts & applications", Cengage, 2010.
2.	Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3.	Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2nd Edition, 2017.
4.	Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', Pearson, 6th edition, 2012.
5.	Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', McGraw Hill, 2016 – Fourth Edition.
6.	Muhammad H. Rashid,' Microelectronic Circuits Analysis and Design' Cengage Learning, 2nd Edition, 2012.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	2	1	-	-	-	-	-	-	1	3	2	-
CO2	3	-	2	1	-	-	-	-	-	-	1	3	2	-
CO3	3	-	2	1	-	-	-	-	-	-	1	3	2	-
CO4	3	-	2	1	-	-	-	-	-	-	1	3	2	-
CO5	3	-	2	1	-	-	-	-	-	-	1	3	2	-
Average	3	-	2	1	-	-	-	-	-	-	1	3	2	-

Subject Code	Subject Name	Category	L	T	P	C
EE24404	ANALOG AND DIGITAL INSTRUMENTATION	PCC	3	0	0	3

Course Objectives:

- To educate the fundamental concepts and characteristics of measurement and errors
- To impart the knowledge on the functional aspects of measuring instruments.
- To infer the importance of various bridge circuits used with measuring instruments.
- To educate the fundamental working of sensors and transducers and their applications.

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• To summarize the overall measurement and instrumentation with the knowledge on digital instrumentation principles.

UNIT – I	**CONCEPTS OF MEASUREMENTS**	**9**
Instruments: classification – Elements of a generalized measurement system - Static and dynamic characteristics - Errors in measurement - Instrument standards -Statistical evaluation of measurement data.		
UNIT – II	**MEASUREMENT OF PARAMETERS IN ELECTRICAL SYSTEMS**	**9**
Classification of instruments – moving coil and moving iron meters – Induction type, dynamometer type watt meters – Energy meter – Megger– Instrument transformers (CT& PT).		
UNIT – III	**AC/DC BRIDGES**	**9**
Wheatstone bridge, Kelvin double bridge - Maxwell, Hay, Wien and Schering bridges —Errors and compensation in A.C. bridges.		
UNIT – IV	**TRANSDUCERS FOR MEASUREMENT OF NON-ELECTRICAL PARAMETERS**	**9**
Classification of transducers – Measurement of pressure, temperature, displacement, flow, angular velocity – Digital transducers – Smart Sensors.		
UNIT – V	**DIGITAL INSTRUMENTATION**	**9**
A/D converters: types and characteristics - Measurement of voltage, Current, frequency and phase - D/A converters: types and characteristics – DSO - Data Loggers – Basics of PLC programming and Introduction to Virtual Instrumentation.		
		Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Understand the fundamental art of measurement in engineering.
CO2	Understand the structural elements of various instruments.
CO3	Acquire knowledge about the structure of bridge circuits.
CO4	Understand about various transducers and their characteristics by experiments.
CO5	Explain the concept of digital instrumentation and virtual instrumentation by experiments.

Textbooks:	
1.	A.K.Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation ', Dhanpat Rai and Co, New Delhi, Edition 2011.
2.	H.S.Kalsi,'ElectronicInstrumentation',TataMcGraw-Hill,NewDelhi,2010

Reference books/other materials/web resources:	
1.	M.M.S.Anand, 'Electronics Instruments and Instrumentation Technology', Prentice Hall India, New Delhi, 2009
2.	J.J. Carr, 'Elements of Electronic Instrumentation and Measurement', Pearson Education India, New Delhi, 2011

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3.	W.Bolton, Programmable Logic Controllers,6th Edition, Elseiver, 2015.
4.	R.B. Northrop, 'Introduction to Instrumentation and Measurements', Taylor &Francis, NewDelhi, 3rd Edition 2014.
5.	E.O.Doebelin and D.N.Manik, "Measurement Systems — Application and Design", Tata McGraw-Hill, NewDelhi, 6th Edition 2017.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	2	1	-	-	-	-	-	-	1	3	2	-
CO2	3	-	2	1	-	-	-	-	-	-	1	3	2	-
CO3	3	-	2	1	-	-	-	-	-	-	1	3	2	-
CO4	3	-	2	1	-	-	-	-	-	-	1	3	2	-
CO5	3	-	2	1	-	-	-	-	-	-	1	3	2	-
Average	3	-	2	1	-	-	-	-	-	-	1	3	2	-

Subject Code	Subject Name	Category	L	T	P	C
GE24901	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	BSC	2	0	0	2

Course Objectives:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and the role of sustainable urbanization.

UNIT – I	ENVIRONMENT AND BIODIVERSITY	6

Definition, scope and importance of environment — need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation — hot-spots of biodiversity — threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife

conflicts — endangered and endemic species of India — conservation of biodiversity: In-situ and ex-situ.		
UNIT – II	**ENVIRONMENTAL POLLUTION**	**6**
Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts		
UNIT – III	**RENEWABLE SOURCES OF ENERGY**	**6**
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.		
UNIT – IV	**SUSTAINABILITY AND MANAGEMENT**	**6**
Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols - Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.		
UNIT – V	**SUSTAINABILITY PRACTICES**	**6**
Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio- economical and technological change.		
		Total Contact Hours : 30

Course Outcomes	Upon completion of the course students should be able to:
CO1	Understand the functions of environment, ecosystems and biodiversity and their conservation.
CO2	Identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
CO3	Understand the renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
CO4	Recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
CO5	Demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

Textbooks:	
1.	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2.	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.

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3.	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4.	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5.	Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6.	Environment Impact Assessment Guidelines, Notification of Government of India, 2006.

Reference books/other materials/webresources:	
1.	R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38.
2.	Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3.	Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4.	Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

PO & PSO / CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO2	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO3	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO4	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO5	3	2	2	1	-	-	-	-	-	-	1	3	2	1
Average	3	2	2	1	-	-	-	-	-	-	1	3	2	1

Subject Code	Subject Name	Category	L	T	P	C
EE24411	SYNCHRONOUS AND INDUCTION MACHINES LABORATORY	PCC	0	0	3	1.5

Course Objectives:

- To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

LIST OF EXPERIMENTS:

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF method.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.

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6. Load test on three-phase induction motor.
7. No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction Motor Starters
12. Regulation of three phase alternator by EMF and MMF methods.
Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Analyze the regulation of three phase alternator by using EMF, MMF and ZPF methods
CO2	Analyze the characteristics of V and Inverted V curves
CO3	Acquire hands on experience by conducting various tests on alternators to obtain their performance indices.
CO4	Understand the performance of single and three phase Induction motors by conducting various tests.
CO5	Acquire knowledge on losses and efficiency of Induction motors.

PO & PSO / CO	**CO-PO Mapping**											**CO-PSO Mapping**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	2	-	-	2	2	-	-	1	3	2	-
CO2	3	3	-	2	-	-	2	2	-	-	1	3	2	-
CO3	3	-	-	2	-	-	2	2	-	-	1	3	2	-
CO4	3	-	-	2	-	-	2	2	-	-	1	3	2	-
CO5	3	-	-	2	-	-	2	2	-	-	1	3	2	-
Average	3	3	-	2	-	-	2	2	-	-	1	3	2	-

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**C**
EE24412	**LINEAR INTEGRATED CIRCUITS LABORATORY**	**PCC**	**0**	**0**	**3**	**1.5**

Course Objectives:

- To learn the applications of OP-AMP ICs.
- To expose the characteristics of Instrumentation amplifiers and active filters
- To design the circuit oscillators and digital to analog converter using op-amp
- To learn the special ICs like 555 timer, voltage to frequency converter and voltage regulators.

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LIST OF EXPERIMENTS:	
1. Application of Op-Amp: inverting and non-inverting amplifier,	
2. Application of Op-Amp: Adder, comparator,	
3. Application of Op-Amp: Integrator and Differentiator.	
4. Instrumentation amplifier	
5. Active low-pass, High pass & Band pass filters	
6. RC Phase shift oscillator and Wien Bridge Oscillator	
7. R-2R ladder type D-A converter using Op-Amp	
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.	
9. Voltage to frequency characteristics of NE/ SE 566 IC.	
10. Variability Voltage Regulator using IC LM317.	
	Total Contact Hours : 45

Course Outcomes	Upon completion of the course students should be able to:
CO1	Acquire knowledge on Application of Op-Amp.
CO2	Design instrumentation amplifiers and filters.
CO3	Design oscillators, D-A converters using operational amplifiers.
CO4	Design 555 timer in Astable and Monostable operation.
CO5	Design voltage to frequency converter and voltage regulator.

PO & PSO / CO	**CO-PO Mapping**											**CO-PSO Mapping**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	3	-	-	-	2	2	-	-	1	3	2	-
CO2	3	-	3	-	-	-	2	2	-	-	1	3	2	-
CO3	3	-	3	-	-	-	2	2	-	-	1	3	2	-
CO4	3	-	3	-	-	-	2	2	-	-	1	3	2	-
CO5	3	-	3	-	-	-	2	2	-	-	1	3	2	-
Average	3	-	3	-	-	-	2	2	-	-	1	3	2	-

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