



The Kavery Engineering College

Mecheri, Mettur Tk. Salem Dt – 636 453.

(An Autonomous Institution Approved by AICTE, New Delhi & Affiliated to Anna University)
An ISO 9001:2015 certified Institution and accredited by NAAC with A+ grade.



B.E. ELECTRICAL & ELECTRONICS ENGINEERING CHOICE BASED CREDIT SYSTEM CURRICULUM FOR SEMESTER I TO VIII

(Applicable to the students admitted from the Academic year 2024-2025 onwards)

VISION

To render services to meet the growing global challenges of Engineering Industries by educating students to become exemplary Professional Electrical and Electronics Engineers of high ethics.

MISSION

- To establish quality learning facilities to produce Quality Electrical Engineers to compete globally.
- To nurture innovative research on cutting edge technologies and inculcate the positive attitude and the spirit of ethical practices.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Our Graduates will

- ❖ Find employment in Core Electrical and Electronics Engineering and service sectors.
- ❖ Get elevated to technical lead position and lead the organization competitively.
- ❖ Enter into higher studies leading to post-graduate and research degrees. Become consultant and provide solutions to the practical problems of core organization.
- ❖ Become an entrepreneur and be part of electrical and electronics product and service industries.

PROGRAMME OUTCOMES (POS)

After going through the four years of study, our graduates will exhibit ability to:

PO	Graduate attribute	Programme outcome
1.	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2.	Problem analysis	Identify, formulate, review research literature, and analyse Complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

3.	Design/development of solutions	Design solutions for complex engineering problems and design System components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4.	Conduct Investigations of Complex Problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5.	Modern Tool Usage	Create, select, and apply appropriate techniques, resources, and Modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
6.	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
7.	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
8.	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
9.	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
10.	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
11.	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSOs)

On completion of Electrical & Electronics Engineering program, the student will have the following Program Specific outcomes

- ❖ Ability to understand the principles and working of electrical components, circuits, systems and control that are forming a part of power generation, transmission, distribution, utilization, conservation and energy saving. Students can assess the power management, auditing, crisis and energy saving aspects.
- ❖ Ability to apply mathematical methodologies to solve problems related with electrical engineering using appropriate engineering tools and algorithms.
- ❖ Ability to use knowledge in various domains to identify research gaps and hence to provide solution which leads to new ideas and innovations.



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B.E. ELECTRICAL & ELECTRONICS ENGINEERING

CHOICE BASED CREDIT SYSTEM

CURRICULUM FOR SEMESTER I TO VIII

(Applicable to the students admitted from the Academic year 2024-2025 onwards)

SEMESTER – I									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
UENT24101	Professional English -I	3	0	0	3	40	60	100	HSMC
UMAT24102	Matrices and Calculus	3	1	0	4	40	60	100	BSC
UPHT24103	Engineering Physics	3	0	0	3	40	60	100	BSC
UCHT24104	Engineering Chemistry	3	0	0	3	40	60	100	BSC
UPST24105	Problem Solving and Python Programming	3	0	0	3	40	60	100	ESC
UTAT24106	Heritage of Tamils □ □ □ □ □ □ □ □ □ □	1	0	0	1	40	60	100	HSMC
Practical / Employability Enhancement									
UIPE24101	Induction Programme								MC
UPSL2413	Problem Solving and Python Programming Laboratory	0	0	4	2	60	40	100	ESC
UPCL2412	Physics and Chemistry Laboratory	0	0	4	2	60	40	100	BSC
UENL2411	English Laboratory	0	0	2	1	60	40	100	EEC
Total Credits to be earned					22				

SEMESTER – II									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
UENT24201	Professional English-II	2	0	0	2	40	60	100	HSMC
UMAT24201	Statistics and Numerical Methods	3	1	0	4	40	60	100	BSC
UPHT24203	Physics for Electrical Engineering	3	0	0	3	40	60	100	BSC
UBET24201	Basic Civil and Mechanical Engineering	3	0	0	3	40	60	100	ESC
UGET24201	Engineering Graphics	2	0	4	4	50	50	100	ESC
UEET24201	Electric Circuit Analysis	3	1	0	4	40	60	100	PCC
UTAT24201	Tamils and Technology/ □	1	0	0	1	40	60	100	HSMC

UNCC24001	NSS/YRC/Clubs	2	0	0	0	-	-	-	-
Practical / Employability Enhancement									
UGEL24201	Engineering Practices Laboratory	0	0	4	2	60	40	100	ESC
UEEL24201	Electric Circuits Laboratory	0	0	4	2	60	40	100	PCC
UGEL24202	Communication Laboratory /Foreign Language	0	0	4	2	60	40	100	EEC
Total Credits to be earned					27				

SEMESTER – III									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory									
UMAT24306	Probability Complex Functions and Transforms	3	1	0	4	40	60	100	BSC
UEET24301	Digital Logic Circuits	3	0	0	3	40	60	100	PCC
UEET24302	Electron Devices and Circuits	3	0	0	3	40	60	100	PCC
UEET24303	Electrical Machines - I	3	0	0	3	40	60	100	PCC
UCST24304	C Programming and Data Structures	3	0	0	3	40	60	100	ESC
Theory with Practical									
UEETL24301	Electromagnetic Fields	2	0	2	3	50	50	100	PCC
Practical / Employability Enhancement									
UEEL24301	Electronic Devices and Circuits Laboratory	0	0	3	1.5	60	40	100	PCC
UEEL24302	Electrical Machines- I Laboratory	0	0	3	1.5	60	40	100	PCC
UCSL24304	C Programming and Data	0	0	3	1.5	60	40	100	ESC
	Structures Laboratory								
USD24301	Soft Skill 1	2	0	0	0	100	-	100	MC
Total Credits to be earned					23.5				

SEMESTER – IV									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory									
UESST24401	Environmental Sciences and Sustainability	2	0	0	2	40	60	100	BSC
UEET24401	Transmission and Distribution	3	1	0	4	40	60	100	PCC
UEET24402	Linear integrated Circuits	3	0	0	3	40	60	100	PCC
UEET24403	Microprocessor and microcontroller	3	0	0	3	40	60	100	PCC
UEET24404	Electrical Machines- II	3	0	0	3	40	60	100	PCC
Theory with Practical									
UEETL24401	Measurements and Instrumentation	2	0	2	3	50	50	100	PCC

Practical / Employability Enhancement									
UEEL24401	Electrical Machines- II Laboratory	0	0	3	1.5	60	40	100	PCC
UEEL24402	Linear and Digital Circuits Laboratory	0	0	3	1.5	60	40	100	PCC
UEEL24403	Microprocessor and Microcontroller laboratory	0	0	3	1.5	60	40	100	PCC
USD24401	Soft Skill 2	2	0	0	0	100	-	100	MC
Total Credits to be earned					22.5				

SEMESTER – V									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory									
UEET24501	Power System Analysis	3	1	0	4	40	60	100	PCC
UEET24502	Power Electronics	3	0	0	3	40	60	100	PCC
	Professional Elective I	3	0	0	3	40	60	100	PEC
	Professional Elective II	3	0	0	3	40	60	100	PEC
	Mandatory Course-I	2	0	0	-	-	-	-	MC
Theory with Practical									
UEETL24501	Control Systems Engineering	2	0	2	3	50	50	100	PCC
Practical / Employability Enhancement									
UEEL24501	Power Electronics Laboratory	0	0	3	1.5	60	40	100	PCC
USI24501	Summer Internship I *	0	0	0	1	-	-	100	EEC
UIDL24001	Idea Lab	0	0	2	1	-	100	100	EEC
USD24501	Soft Skill 3	2	0	0	0	100	-	100	MC
Total Credits to be earned					19.5				

*Two weeks summer internship carries one credit and it will be done during IV semester summer vacation and same will be evaluated in V semester

SEMESTER – VI									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory									
UEET24601	Protection & Switchgear	3	0	0	3	40	60	100	PCC
UEET24602	Power System Operation and Control	3	1	0	4	40	60	100	PCC
	Open elective – I	3	0	0	3	40	60	100	OEC
	Professional Elective – III	3	0	0	3	40	60	100	PEC
	Professional Elective –IV	3	0	0	3	40	60	100	PEC
	Mandatory Course-2	2	0	0	-	-	-	-	MC
Practical / Employability Enhancement									
UEEL24601	Power System Laboratory	0	0	3	1.5	60	40	100	PCC
UEEL24602	Mini Project	0	0	4	2	60	40	100	EEC
USD24601	Soft Skill- 4	2	0	0	0	100	-	100	MC

Total Credits to be earned	19.5
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SEMESTER – VII									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory									
UEET24701	High Voltage Engineering	3	0	0	3	40	60	100	PCC
UGET24707	Human Values and Ethics	2	0	0	2	40	60	100	HSMC
	Elective -Management	3	0	0	3	40	60	100	HSMC
	Professional Elective – V	3	0	0	3	40	60	100	PEC
	Open Elective – II	3	0	0	3	40	60	100	OEC
	Open Elective – III	3	0	0	3	40	60	100	OEC
Practical / Employability Enhancement									
USI24701	Summer Internship II [#]	0	0	0	1	-	-	100	EEC
Total Credits to be earned					18				

#Two weeks summer internship carries one credit and it will be done during VI semester summer vacation and same will be evaluated in VII semester.

SEMESTER – VIII										
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category	
		L	T	P		CA	ESE	Total		
Theory										
	Professional elective VI	3	0	0	3	40	60	100	PEC	
	Open Elective – IV	3	0	0	3	40	60	100	OEC	
Practical / Employability Enhancement										
UEEL24801	Project Work /Internship	---	---	20	10	60	40	100	EEC	
Total Credits to be earned					16					

TOTAL CREDITS:168

ELECTIVE – MANAGEMENT COURSES

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	UGET24701	Principles of Management	HSMC	3	0	0	3	3
2	UGET24702	Total Quality Management	HSMC	3	0	0	3	3
3	UGET24703	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	3
4	UGET24704	Human Resource Management	HSMC	3	0	0	3	3
5	UGET24705	Knowledge Management	HSMC	3	0	0	3	3
6	UGET24706	Industrial Management	HSMC	3	0	0	3	3

MANDATORY COURSES

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	UMC24001	Disaster Risk Reduction and Management	MC	2	0	0	3	0
2	UMC24002	Elements of Literature	MC	2	0	0	3	0
3	UMC24003	Film Appreciation	MC	2	0	0	3	0
4	UMC24004	Introduction to Gender Studies	MC	2	0	0	3	0
5	UMC24005	Industrial Safety	MC	2	0	0	3	0
6	UMC24006	Interpersonal Skills	MC	2	0	0	3	0
7	UMC24007	Personality and Character Development	MC	2	0	0	3	0
8	UMC24008	Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	MC	2	0	0	3	0
9	UMC24001	Disaster Risk Reduction and Management	MC	2	0	0	3	0

PROFESSIONAL ELECTIVE -STREAMS

Course Code	Course	Category	Hours /Week			Maximum Marks			
			L	T	P	C	CA	ESE	Total
STREAM-1 POWER SYSTEM ENGINEERING									
UEEPE2401	Utilization and Conservation of Electrical Energy	PEC	3	0	0	3	40	60	100
UEEPE2402	HVDC and FACTS	PEC	3	0	0	3	40	60	100
UEEPE2403	Energy Management and Auditing	PEC	3	0	0	3	40	60	100
UEEPE2404	Power System Transients	PEC	3	0	0	3	40	60	100
UEEPE2405	Power Quality	PEC	3	0	0	3	40	60	100
UEEPE2406	Design and Modelling of Renewable Energy Systems	PEC	3	0	0	3	40	60	100
STREAM-2 ADVANCED ELECTRONICS									
UEEPE2407	Special Electrical Machines	PEC	3	0	0	3	40	60	100
UEEPE2408	Design of Electrical Apparatus	PEC	3	0	0	3	40	60	100
UEEPE2409	Electrical Drives	PEC	3	0	0	3	40	60	100
UEEPE2410	Power Electronics for Renewable Energy systems	PEC	3	0	0	3	40	60	100
UEEPE2411	Hybrid Energy Technology	PEC	3	0	0	3	40	60	100
UEEPE2412	Multi level power converter	PEC	3	0	0	3	40	60	100
STREAM- 3 ELECTRIC VEHICLE TECHNOLOGY									
UEEPE2413	Electric Vehicle Architecture	PEC	3	0	0	3	40	60	100
UEEPE2414	Electric Vehicle Design, Mechanics and Control	PEC	3	0	0	3	40	60	100
UEEPE2415	Intelligent Control of Electric Vehicles	PEC	3	0	0	3	40	60	100
UEEPE2416	Grid Integration of Electric Vehicles	PEC	3	0	0	3	40	60	100
UEEPE2417	Testing of Electric Vehicles	PEC	3	0	0	3	40	60	100
UEEPE2418	Design of Electric Vehicle Charging System	PEC	3	0	0	3	40	60	100
STREAM- 4 CONTROL & AUTOMATION									
UEEPE2419	Microcontroller Based System Design	PEC	3	0	0	3	40	60	100
UEEPE2420	Embedded processors	PEC	3	0	0	3	40	60	100
UEEPE2421	Embedded Control for Electric Drives	PEC	3	0	0	3	40	60	100
UEEPE2422	PLC and SCADA system	PEC	3	0	0	3	40	60	100
UEEPE2423	SMPS and UPS	PEC	3	0	0	3	40	60	100
UEEPE2424	Smart Grids	PEC	3	0	0	3	40	60	100

OPEN ELECTIVE COURSES (For Other Branches)										
S. NO.	Course Code	Course	Category	Periods/Week			C	Maximum Marks		
				L	T	P		CA	ESE	Total
Theory Course(s)										
1	UEEOE2401	Electrical Safety	OEC	3	0	0	3	40	60	100
2	UEEOE2402	Introduction to Electrical Machines	OEC	3	0	0	3	40	60	100
3	UEEOE2403	Electrical Energy Generation Utilization and Conservation	OEC	3	0	0	3	40	60	100
4	UEEOE2404	Power Semiconductor Devices	OEC	3	0	0	3	40	60	100
5	UEEOE2405	Electrical Wiring, Estimation and Costing	OEC	3	0	0	3	40	60	100
6	UEEOE2406	Basics of Electrical Measurements and Instrumentation	OEC	3	0	0	3	40	60	100
7	UEEOE2407	Introduction to Control Engineering	OEC	3	0	0	3	40	60	100
8	UEEOE2408	Fundamentals of Electrical Drives and Control	OEC	3	0	0	3	40	60	100
9	UEEOE2409	Energy Conservation and Management	OEC	3	0	0	3	40	60	100
10	UEEOE2410	Automotive Electrical and Electronics Engineering	OEC	3	0	0	3	40	60	100
11	UEEOE2411	Introduction to Embedded System	OEC	3	0	0	3	40	60	100

**List of Open Elective courses offered by Other Engineering Branches for EEE Branch
(OPEN ELECTIVES – I, II & III)**

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Agricultural Engineering									
UAIOE2401	Introduction to Food processing	3	0	0	3	40	60	100	OEC
UAIOE2402	Traditional Indian Foods	3	0	0	3	40	60	100	OEC
UAIOE2403	Fundamentals of Food Engineering	3	0	0	3	40	60	100	OEC
UAIOE2404	Remote Sensing Concepts	3	0	0	3	40	60	100	OEC
UAIOE2405	Basics of Integrated Water Resources Management	3	0	0	3	40	60	100	OEC
Biomedical Engineering									
UBMOE2401	Basics of Microbial Technology	3	0	0	3	40	60	100	OEC
UBMOE2402	Radiological Equipment	3	0	0	3	40	60	100	OEC
UBMOE2403	Fundamentals of Cell and Molecular Biology	3	0	0	3	40	60	100	OEC
UBMOE2404	Human Physiology	3	0	0	3	40	60	100	OEC
UBMOE2405	Lifestyle Diseases	3	0	0	3	40	60	100	OEC
UBMOE2406	Pathology and Microbiology	3	0	0	3	40	60	100	OEC
UBMOE2407	Medical Electronics	3	0	0	3	40	60	100	OEC
UBMOE2408	Assist Devices	3	0	0	3	40	60	100	OEC
Chemical Engineering									
UCHOE2401	Nano materials and applications.	3	0	0	3	40	60	100	OEC
UCHOE2402	Polymer Technology	3	0	0	3	40	60	100	OEC
UCHOE2403	Enzyme engineering	3	0	0	3	40	60	100	OEC
UCHOE2404	Bio Energy Resources	3	0	0	3	40	60	100	OEC
UCHOE2405	Chemical Process Safety	3	0	0	3	40	60	100	OEC
Civil Engineering									
UCEOE2401	Architectural Heritage of India	3	0	0	3	40	60	100	OEC
UCEOE2402	Building Planning and Construction	3	0	0	3	40	60	100	OEC
UCEOE2403	Elementary Civil Engineering	3	0	0	3	40	60	100	OEC
UCEOE2404	Energy and Environment	3	0	0	3	40	60	100	OEC
UCEOE2405	Global Warming and Climate Change	3	0	0	3	40	60	100	OEC
UCEOE2406	Introduction to Disaster Management and Mitigation	3	0	0	3	40	60	100	OEC
Computer Science and Engineering									

UCSOE2401	Introduction to C Programming	2	0	2	3	50	50	100	OEC
UCSOE2402	Introduction to Data Structures	2	0	2	3	50	50	100	OEC
UCSOE2403	Data Science Fundamentals	2	0	2	3	50	50	100	OEC
UCSOE2404	Introduction of Data Analytics	2	0	2	3	50	50	100	OEC
UCSOE2405	Artificial Intelligence and Machine Learning Fundamentals	2	0	2	3	50	50	100	OEC
UCSOE2406	IoT Concepts and Applications	2	0	2	3	50	50	100	OEC
Electronics and Communication Engineering									
UECOE2401	Industrial Electronics	3	0	0	3	40	60	100	OEC
UECOE2402	Image Processing and Computer Vision	3	0	0	3	40	60	100	OEC
UECOE2403	4G/5G Communication Networks	3	0	0	3	40	60	100	OEC
UECOE2404	Wireless Communication	3	0	0	3	40	60	100	OEC
UECOE2405	Embedded and Real Time Systems	3	0	0	3	40	60	100	OEC
UECOE2406	Robotics and its Industrial Application	3	0	0	3	40	60	100	OEC
UECOE2407	Industrial IoT	3	0	0	3	40	60	100	OEC
UECOE2408	Sensors and Transducers	3	0	0	3	40	60	100	OEC
UECOE2409	Space Science	3	0	0	3	40	60	100	OEC
Mechanical Engineering									
UMEOE2401	Reverse Engineering	2	0	2	3	50	50	100	OEC
UMEOE2402	Non - Destructive Testing	2	0	2	3	50	50	100	OEC
UMEOE2403	Additive Manufacturing Technology	2	0	2	3	50	50	100	OEC
UMEOE2404	Energy Technology	3	0	0	3	40	60	100	OEC
UMEOE2405	Renewable Energy Technologies	3	0	0	3	40	60	100	OEC
UMEOE2406	Introduction to Industrial Engineering	3	0	0	3	40	60	100	OEC
UMEOE2407	Fiber Reinforced Plastics	3	0	0	3	40	60	100	OEC
UMEOE2408	NANO Technology and its Applications	3	0	0	3	40	60	100	OEC

CREDITS SUMMARY

S.NO	CATEGORY	CREDITS SUMMARY								TOTAL CREDITS	PERCENTAGE
		I	II	III	IV	V	VI	VII	VIII		
1	HSMC	4	3					5		12	7.14
2	BSC	12	11	4	2					29	17.16
3	ESC	5	5	4.5						14.5	8.63
4	PCC		6	15	20.5	11.5	8.5	3		64.5	38.39
5	PEC					6	6	3	3	18	10.65
6	OEC						3	6	3	12	7.1
7	EEC	1	2			2	2	1	10	18	10.65
8	MC			√	√	√	√				
TOTAL		22	27	23.5	22.5	19.5	19.5	18	16	168	100%

HSMC – Humanities, Social Sciences and Management Courses

BSC – Basic Sciences Courses

ESC – Engineering Sciences Course

PCC – Professional Core Courses

PEC – Professional Elective Courses

OEC – Open Elective Courses

EEC – Employment Enhancement Course

MC – Mandatory course

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

VERTICAL FOR HONOURS

VERTICAL I - BIO MEDICAL TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	UBMPE2420	Wearable Devices	PEC	3	0	0	3	3
2.	UBMPE2415	Human Assist Devices	PEC	3	0	0	3	3
3.	UBMPE2418	Therapeutic Equipment	PEC	3	0	0	3	3
4.	UBMT24601	Medical Imaging Systems	PEC	3	0	0	3	3
5.	UBMPE2441	Brain Computer Interface and Applications	PEC	3	0	0	3	3
6.	UBMPE2421	Body Area Networks	PEC	3	0	0	3	3

VERTICAL II – RF AND HIGH SPEED TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	UECPE2437	VLSI Testing and Design For Testability	PEC	3	0	0	3	3
2.	UECPE2438	Wireless Sensor Network Design	PEC	3	0	0	3	3
3.	UECPE2439	Radar Technologies	PEC	3	0	0	3	3
4.	UECPE2440	Underwater Instrumentation System	PEC	3	0	0	3	3
5.	UECPE2441	Underwater Navigation Systems	PEC	3	0	0	3	3
6.	UECPE2442	Avionics Systems	PEC	3	0	0	3	3

VERTICALS FOR MINOR DEGREE
(In addition to all the verticals of other programmes)

Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Public Administration	Vertical IV Business Data Analytics	Vertical V Environment and Sustainability
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Data mining for Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Introduction to Block chain and its Applications	Principles of Marketing Management For Business	Administrative Theories	Marketing and Social Media Web Analytics	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis
-	-	-	-	Integrated Energy Planning for Sustainable Development
-	-	-	-	Energy Efficiency for Sustainable Development

(choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

VERTICAL 1: FINTECH AND BLOCK CHAIN

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	UCMG2401	Financial Management	PEC	3	0	0	3	3
2.	UCMG2402	Fundamentals of Investment	PEC	3	0	0	3	3
3.	UCMG2403	Banking, Financial Services and Insurance	PEC	3	0	0	3	3
4.	UCMG2404	Introduction to Block chain and its	PEC	3	0	0	3	3
5.	UCMG2405	Fintech Personal Finance and	PEC	3	0	0	3	3
6.	UCMG2406	Introduction to Fintech	PEC	3	0	0	3	3

VERTICAL 2: ENTREPRENEURSHIP

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT	CREDITS
				L	T	P		
1.	UCMG2407	Foundations of Entrepreneurship	PEC	3	0	0	3	3
2.	UCMG2408	Team Building & Leadership	PEC	3	0	0	3	3
3.	UCMG2409	Creativity & Innovation in	PEC	3	0	0	3	3
4.	UCMG2410	Principles of Marketing Management For Business	PEC	3	0	0	3	3
5.	UCMG2411	Human Resource Management for Entrepreneurs	PEC	3	0	0	3	3
6.	UCMG2412	Financing New Business	PEC	3	0	0	3	3

VERTICAL 3: PUBLIC ADMINISTRATION

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	UCMG2413	Principles of Public Administration	PEC	3	0	0	3	3
2.	UCMG2414	Constitution of India	PEC	3	0	0	3	3
3.	UCMG2415	Public Personnel Administration	PEC	3	0	0	3	3
4.	UCMG2416	Administrative Theories	PEC	3	0	0	3	3
5.	UCMG2417	Indian Administrative System	PEC	3	0	0	3	3
6.	UCMG2418	Public Policy Administration						

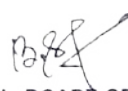
VERTICAL 4: BUSINESS DATA ANALYTICS

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	UCMG2419	Statistics for Management	PEC	3	0	0	3	3
2.	UCMG2420	Data mining for Business Intelligence	PEC	3	0	0	3	3
3.	UCMG2421	Human Resource Analytics	PEC	3	0	0	3	3

4.	UCMG2422	Marketing and Social Media Web Analytics	PEC	3	0	0	3	3
5.	UCMG2423	Operation and Supply Chain Analytics	PEC	3	0	0	3	3
6.	UCMG2424	Financial Analytics	PEC	3	0	0	3	3

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	UCES2425	Sustainable Infrastructure Development	PEC	3	0	0	3	3
2.	UCES2426	Sustainable Agriculture and Environmental Management	PEC	3	0	0	3	3
3.	UCES2427	Sustainable Bio Materials	PEC	3	0	0	3	3
4.	UCES2428	Materials for Energy Sustainability	PEC	3	0	0	3	3
5.	UCES2429	Green Technology	PEC	3	0	0	3	3
6.	UCES2430	Environmental Quality Monitoring and Analysis	PEC	3	0	0	3	3
7.	UCES2431	Integrated Energy Planning for Sustainable Development	PEC	3	0	0	3	3
8.	UCES2432	Energy Efficiency for Sustainable Development	PEC	3	0	0	3	3


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Department	S&H	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UENT24101	PROFESSIONAL ENGLISH - I	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To improve the communicative competence of learners • To learn to use basic grammatic 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?		
Unit-I	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: Why/ 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 biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar -Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.		
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).		



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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 No of Periods to be Taught		45 Periods

TEXT BOOK:	
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 Jeevani, Department of English, Anna University.

REFERENCES:	
1	Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2	A Course Book On Technical English By 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.

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	To use appropriate words in a professional context
CO2:	To gain understanding of basic grammatical structures and use them in right context.
CO3:	To read and infer the denotative and connotative meanings of technical texts
CO4:	To read and interpret information presented in tables, charts and other graphic forms
CO5:	To write definitions, descriptions, narrations and essays on various topics

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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	3	3	3	1	3	-	-	-	-
CO2	1	1	1	1	1	3	3	3	1	3	-	-	-	-
CO3	2	3	2	3	2	3	3	3	2	3	3	-	-	-
CO4	2	3	2	3	2	3	3	3	2	3	3	-	-	-
CO5	2	3	3	3	-	3	3	3	2	3	-	-	-	-
Avg.	1.6	2.2	1.8	2.2	1.5	3	3	3	1.6	3	3	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department	S&H	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMAT24102	MATRICES AND CALCULUS	L	T	P	C	100
		3	1	0	4	
Course Objectives	- To develop the use of matrix algebra techniques that is 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 and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications : Stretching of an elastic membrane.		
Unit-II	DIFFERENTIAL CALCULUS	(9+3)
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications : Maxima and Minima of functions of one variable.		
Unit-III	FUNCTIONS OF SEVERAL VARIABLES	(9+3)
Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.		
Unit-IV	INTEGRAL CALCULUS	(9+3)
Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications : Hydrostatic force and pressure, moments and centres of mass.		
Unit-V	MULTIPLE INTEGRALS	(9+3)
Double 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 and centres of mass, moment of inertia.		
Total No of Periods to be Taught		60

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TEXT BOOK:

1	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3	James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 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].

REFERENCES:

1	Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
3	Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4	Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6	Srimantha Pal and Bhunia. S.C, " Engineering Mathematics " Oxford University Press, 2015.
7	Thomas. G. B., Hass. J, and Weir. M.D, " Thomas Calculus ", 14th Edition, Pearson India, 2018.

COURSE OUTCOMES:

On completion of the course, the students will 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.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	0	0	0	0	2	0	2	-	-	-
CO2	3	3	1	1	0	0	0	0	2	0	2	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	2	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	2	-	-	-
CO5	3	3	1	1	0	0	0	0	2	0	2	-	-	-
Avg.	3	3	1	1	0	0	0	0	2	0	2	-	-	-

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy


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Department	S&H	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPHT24103	ENGINEERING PHYSICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To make the students effectively to 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 be successfully understand the importance of quantum physics. • To motivate the students towards the applications of quantum mechanics.					

Unit-I	MECHANICS	(9)
Multiparticle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of 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 – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum – Introduction to nonlinear oscillations.		
Unit-II	ELECTROMAGNETIC WAVES	(9)
The 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 - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.		
Unit-III	OSCILLATIONS, OPTICS AND LASERS	(9)
Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference –Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO ₂ laser, semiconductor laser –Basic applications of lasers in industry.		
Unit-IV	BASIC QUANTUM MECHANICS	(9)
Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.		
Unit-V	APPLIED QUANTUM MECHANICS	(9)
The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

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 Univ.Press, 2013.
3	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.

REFERENCES:

1	R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2	Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3	K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.

COURSE OUTCOMES:

On completion of the course, the students will 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.

Mapping of COs with POs and PSOs

COs/POs	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	-	-	-	-	-	-	-	-
CO4	3	3	1	1	2	1	-	-	-	-	-	-	-	-
CO5	3	3	1	1	2	1	-	-	-	-	-	-	-	-
Avg.	3	3	1.6	1.2	1.8	1	-	-	-	-	-	-	-	-


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Department	S&H	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCHT24104	ENGINEERING CHEMISTRY	L	T	P	C	100
		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, Water quality parameters: Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming & foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralisation and zeolite process.		
Unit-II	NANOCHEMISTRY	(9)
Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and 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 system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.		


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Unit-IV	FUELS AND COMBUSTION	(9)
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), 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: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon foot print.		
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, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles-working principles; Fuel cells: H ₂ -O ₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.		
Total No of Periods to be Taught		Total: 45 periods

TEXT BOOK:	
1	P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.
2	Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3	S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

REFERENCES:	
1	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2	O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3	Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4	Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

COURSE OUTCOMES:	
On completion of the course, the students will 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.

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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	2	1	-	1	1	-	-	-	-	1	-	-
CO2	2	-	-	1	-	2	2	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	1	-	-	1	2	-	-	-	-	-	-	-
CO5	3	1	2	1	-	2	2	-	-	-	-	2	-	-
Avg.	2.8	1.3	1.6	1	-	1.5	1.8	-	-	-	-	1.5	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department	CSE	Programme Code & Name	Common to All
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Semester-I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPST24105	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C	100
		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, dictionaries to represent complex data. - To do input/output with files in Python.					

Unit-I	COMPUTATIONAL THINKING AND PROBLEM SOLVING	(9)
Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.		
Unit-II	DATA TYPES, EXPRESSIONS, STATEMENTS	(9)
Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.		
Unit-III	CONTROL FLOW, FUNCTIONS, STRINGS	(9)
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-Elif else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.		
Unit-IV	LISTS, TUPLES, DICTIONARIES	(9)
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation		
Unit-V	FILES, MODULES, PACKAGES	(9)
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).		
Total No of Periods to be Taught		TOTAL: 45 Periods

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TEXT BOOK:	
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.

REFERENCES:	
1	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2	G Venkatesh and Madhavan Mukund, "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,,Third Edition, MIT Press 2021

COURSE OUTCOMES:	
On completion of the course, the students will 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 looping 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

Mapping of COs with POs and PSOs														
Cos / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2	PSO 3
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	-	-
Avg.	2	3	3	3	2	-	-	-	-	2	2	3	3	-
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														


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Department	S&H	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UTAT24106	HERITAGE OF TAMIL	L	T	P	C	100
		1	0	0	1	
COURSE OBJECTIVES	• Understanding Sangam literature • Learning about the heritage of Tamil culture and the importance of rock art • Being able to recognize and identify the folk and martial art forms of Tamils • Understanding the principles of the Tamils • Understanding the contribution of Tamils to the Indian national movement and Indian culture					

UNIT 1	LANGUAGE AND LITERATURE	(3)
Language Families in India - Dravidian Languages –Tamil Classical Language - Classical Literature inTamil–Secular Nature of Sangam Literature– Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land-Bakthi Literature Azhwars and Nayanmars – Forms of minor Poetry – Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.		
UNIT 2	HERITAGE – ROCK ART PAINTINGS TO MODERN ART–SCULPTURE	(3)
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.		
UNIT 3	FOLK AND MARTIAL ARTS	(3)
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.		
UNIT 4	THINAI CONCEPT OF TAMILS	(3)
FloraandFaunaofTamils&AhamandPuramConceptfromTholkappiyamandSangamLiterature-Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		
UNIT 5	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	(3)
Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India — Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine — Inscriptions & Manuscripts — Print History of Tamil Books.		
Total No of Periods to be Taught		Total: 15 periods

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TEXT BOOK:

1	1. தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும் கல்வியியல் பணிகள்கழகம்).
2	கணினித்தமிழ் – முனைவர் இல, சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல்துறை வெளியீடு)
4	பொருநை - ஆற்றங்கரை நாகரிகம், (தொல்லியல்துறை வெளியீடு)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

REFERENCES:

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB& ESCandRMRL–(in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5	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)

COURSE OUTCOMES:

பாடநெறியின் முடிவில் மாணவர்கள்

CO1:	Gain The Knowledge About Various Literatures Of Tamil
CO2:	Learn The Uniqueness Of Tamil Cultural Heritage
CO3:	Find Various Art Forms Of Tamil Nadu
CO4:	Understand The Thina Cocept In Tamil
CO5:	Distinguish The Contribution Of Tamils To Indian National Movement And Indian Culture



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Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	-	-	-	-	-	1	1	-	-	1	-	1	-	-
CO2	-	-	-	-	-	1	1	-	-	1	-	1	-	-
CO3	-	-	-	-	-	1	1	-	-	1	-	1	-	-
CO4	-	-	-	-	-	1	1	-	-	1	-	1	-	-
CO5	-	-	-	-	-	1	1	-	-	1	-	1	-	-
Avg.	-	-	-	-	-	1	1	-	-	1	-	1	-	-
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														


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Department	S&H	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UTAT24106	தமிழர் மரபு	L	T	P	C	100
		1	0	0	1	
பாடநெறி நோக்கங்கள்	- சங்க இலக்கியத்தை புரிந்து கொள்ளுதல் - தமிழ் கலாச்சாரத்தின் பாரம்பரியத்தையும் மற்றும் பாறை ஓவியத்தின் சிறப்பினையும் கற்றுத் தெளிதல் - தமிழர்களின் நாட்டுப்புற மற்றும் தற்காப்பு கலை வடிவங்களை அங்கீகரிக்கவும் அடையாளம் காண முடியும் - தமிழர்களின் திணைக் கோட்பாடுகள் உணர்தல் - இந்திய தேசிய இயக்கம் மற்றும் இந்திய கலாச்சாரத்திற்கு தமிழர்களின் பங்களிப்பை புரிதல்					

அலகு 1	மொழி மற்றும் இலக்கியம்	(3)
இந்திய மொழிக்குடும்பங்கள் - திராவிடமொழிகள் - தமிழ் ஒரு செம்மொழி தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம். ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிறுநிலக்கியங்கள் -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 - ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் நாட்டுப்புறத் தெய்வங்கள் - குமரி முனையில் திருவள்ளுவர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு		
அலகு 3	நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்	(3)
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஓயிலாட்டம். தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.		



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அலகு 4	தமிழர்களின் திணைக் கோட்பாடுகள்	(3)
தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் – சங்ககால நகரங்களும் துறை முகங்களும், சங்க கால தமிழர்களின் எழுத்தறிவும் கல்வி அறிவும் மற்றும் சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி		
அலகு 5	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	(3)
இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் சுயமரியாதை இயக்கம் இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு- கல்வெட்டு மற்றும் எழுத்துப் படிகள் தமிழ்ப்புத்தகங்களின் அச்ச வரலாறு.		
Total No of Periods to be Taught		Total: 15 periods

TEXT BOOK:

1	தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும் கல்வியியல்பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல, சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல்துறை வெளியீடு)
4	பொருநை - ஆற்றங்கரை நாகரிகம், (தொல்லியல்துறை வெளியீடு)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

REFERENCES:

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB& ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5	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)

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COURSE OUTCOMES:

பாடநெறியின் முடிவில் மாணவர்கள்

CO1:	தமிழ் இலக்கியங்களைப் பற்றிய அறிவைப் பெற முடியும்
CO2:	தமிழ் கலாச்சார பாரம்பரியத்தின் தனித்துவத்தைக் கற்றுக்கொள்ள முடியும்
CO3:	தமிழ்நாட்டின் பல்வேறு கலை வடிவங்களைக் கண்டறிதல்
CO4:	தமிழில் தினை கொள்கையைப் புரிந்துகொள்ளவும் முடியும்
CO5:	இந்திய தேசிய இயக்கத்திற்கும் இந்திய கலாச்சாரத்திற்கும் தமிழின் பங்களிப்பை அறிதல்

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	-	-	-	-	-	1	1	-	-	1	-	1	-	-
CO2	-	-	-	-	-	1	1	-	-	1	-	1	-	-
CO3	-	-	-	-	-	1	1	-	-	1	-	1	-	-
CO4	-	-	-	-	-	1	1	-	-	1	-	1	-	-
CO5	-	-	-	-	-	1	1	-	-	1	-	1	-	-
Avg.	-	-	-	-	-	1	1	-	-	1	-	1	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	CSE	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPSL2413	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C	100
		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 - lists, tuples, dictionaries. • To do input/output with files in Python.					

List of Exercises/Experiments	
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 No of Periods to be Taught	60 Periods


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COURSE OUTCOMES:

On completion of the course, the students will 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.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	ANACONDA JUPITER SOFTWARE	30
2	WINDOWS 10 OS, 6GB RAM	

Mapping of COs with POs and PSOs

COs/POs	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	-	-
Avg.	2	3	3	3	2	-	-	-	-	2	2	3	3	-
1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy														

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Department	S&H	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPCL2412	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C	100
		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 as an active participant in each part of all lab exercises.
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List of Exercises / Experiments

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 wave length of the laser using grating	
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 No of Periods to be Taught	30 periods


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COURSE OUTCOMES:

On completion of the course, the students will 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.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Torsional pendulum with accessories	5
2.	Simple harmonic oscillations of cantilever with accessories	5
3.	Non-uniform bending - Young's modulus with accessories	5
4.	Laser- Determination of the wave length of the laser using grating with accessories	5
5.	Air wedge with accessories	5
6.	Optical fibre with accessories Compact disc with accessories	5
7.	Ultrasonic interferometer	5

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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	-	-	-	-	-	-	-	-
Avg.	3	2.4	2.6	1	1								
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy													

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Department	S&H	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPCL2412	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C	100
		0	0	4	2	

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

Course Objectives	- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, 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
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List of Exercises/Experiments			
1	Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard		
2.	Determination of types and amount of alkalinity in water sample. Split the first experiment into two		
3.	Determination of total, temporary & permanent hardness of water by EDTA method.		
4.	Determination of DO content of water sample by Winkler's method.		
5.	Determination of chloride content of water sample by Argentometric method.		
6.	Estimation of copper content of the given solution by Iodometry.		
7.	Estimation of TDS of a water sample by gravimetry.		
8.	Determination of strength of given hydrochloric acid using pH meter.		
9.	Determination of strength of acids in a mixture of acids using conductivity meter.		
10.	Conductometric titration of barium chloride against sodium sulphate (precipitation titration) .		
11.	Estimation of iron content of the given solution using potentiometer		
12.	Estimation of sodium /potassium present in water using flame photometer.		
13.	Preparation of nanoparticles ($\text{TiO}_2/\text{ZnO}/\text{CuO}$) by Sol-Gel method		
14.	Estimation of Nickel in steel.		
15.	Proximate analysis of Coal		
<table> <tr> <td>Total No of Periods to be Taught</td><td>Total: 30 periods</td></tr> </table>		Total No of Periods to be Taught	Total: 30 periods
Total No of Periods to be Taught	Total: 30 periods		



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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO2:	To determine the amount of metal ions through volumetric and spectroscopic techniques
CO3:	To analyse and determine the composition of alloys.
CO4:	To learn simple method of synthesis of nanoparticles.
CO5:	To quantitatively analyse the impurities in solution by electroanalytical techniques”

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	PH meter	15 nos
2.	Conductivity meter	15 nos
3.	Potentiometer	15 nos
4.	Flame photometer	4 nos
5.	Electronic Balance (Four digit)	1 no
6.	Hotplate with temperature controller	5 nos
7.	Hot Air Oven	1 no
8.	Muffle furnace	1 no
9.	Magnetic stirrer	2 nos

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	1	-	-	2	2	-	-	-	-	2	-	-
CO2	3	1	2	-	-	1	2	-	-	-	-	1	-	-
CO3	3	2	1	1	-	-	1	-	-	-	-	-	-	-
CO4	2	1	2	-	-	2	2	-	-	-	-	-	-	-
CO5	2	1	2	-	1	2	2	-	-	-	-	1	-	-
Avg.	2.6	1.3	1.6	1	1	1.4	1.8	-	-	-	-	1.3	-	-
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy														

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Department	S&H	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UENL2411	ENGLISH LABORATORY	L	T	P	C	100
		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	CLASSIFICATION 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 No of Periods to be Taught		30 Periods

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ASSESSMENT PATTERN:

1.	One online / app based assessment to test listening /speaking
2.	End Semester ONLY listening and speaking will be conducted online.
3.	Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam .

COURSE OUTCOMES:

On completion of the course, the students will 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

Mapping of COs with POs and PSOs

COs/POs	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	3	-	-
CO2	3	3	3	3	1	3	3	3	3	3	3	3	-	-
CO3	3	3	3	3	1	3	3	3	3	3	3	3	-	-
CO4	3	3	3	3	1	3	3	3	3	3	3	3	-	-
CO5	3	3	3	3	1	3	3	3	3	3	3	3	-	-
Avg.	3	3	3	3	1	3	3	3	3	3	3	3	-	-

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Department	S&H	Programme Code & Name	Common to All
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UENT24201	PROFESSIONAL ENGLISH - II	L	T	P	C	100
		2	0	0	2	
Course Objectives	- To engage learners in meaningful 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 No of Periods to be Taught		30 Periods


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TEXT BOOK:

1	English for Engineers & Technologists (2020 edition) Orient Blackswan 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.

REFERENCES:

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.

COURSE OUTCOMES:

On completion of the course, the students will 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.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	2	3	3	-	-	-
CO2	3	3	3	3	3	3	3	3	2	3	3	-	-	-
CO3	3	3	3	3	3	3	3	3	2	3	3	-	-	-
CO4	3	3	3	3	2	3	3	3	2	3	3	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	3	-	-	-
Avg.	3	3	3	3	2.75	3	3	3	2.2	3	3	-	-	-

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Department	S&H	Programme Code & Name	Common to All
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMAT24201	STATISTICS AND NUMERICAL METHODS	L	T	P	C	100
		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 which 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 – 2^2 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 derivatives 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 No of Periods to be Taught		60 Periods


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TEXT BOOK:

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.

REFERENCES:

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

COURSE OUTCOMES:

On completion of the course, the students will 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.
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.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	0	0	0	2	0	2	-	-	-
CO2	3	3	1	1	1	0	0	0	2	0	2	-	-	-
CO3	3	3	1	1	1	0	0	0	2	0	2	-	-	-
CO4	3	3	1	1	1	0	0	0	2	0	2	-	-	-
CO5	3	3	1	1	1	0	0	0	2	0	2	-	-	-
Avg.	3	3	1	1	1	0	0	0	2	0	2	-	-	-

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPHT24203	PHYSICS FOR ELECTRICAL ENGINEERING	L	T	P	C	100
		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 - 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 P polarization mechanisms: electronic, ionic, orientational, interfacial and total polarization – frequency dependence – local field and Clausius-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 – piezo electricity, ferro electricity and pyro electricity – quartz oscillators and filters – piezo and pyroelectric 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 No of Periods to be Taught		60



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TEXT BOOK:

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.

REFERENCES:

1	Laszlo Solymar, Walsh, Donald, Syms and Richard R.A., Electrical Properties of Materials, Oxford Univ. Press (Indian Edition) 2015.
2	Jaspri Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Education (Indian Edition), 2019.
3	Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.

COURSE OUTCOMES:

On completion of the course, the students will 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 nanodevices.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2	PSO 3
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	1	2	1	1	-	-	-	-	-	-	-
CO4	3	-	2	1	3	-	1	-	-	-	-	-	-	-
CO5	3	2	2	2	2	1	2	-	-	-	-	-	-	-
Avg.	3	1.3	2	1.3	2.3	1	1.3	-	-	-	-	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	CIVIL	Programme Code & Name	105-EEE
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UBET24203	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C	100
		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	OVERVIEW OF CIVIL AND MECHANICAL ENGINEERING	(9)
PART A: OVERVIEW OF CIVIL ENGINEERING Civil Engineering contributions to the welfare of Society - Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering – National building code – terminologists: Plinth area, Carpet area, Floorarea, Buildup area, Floor space index - Types of buildings: Residential buildings, Industrial buildings.		
PART B: OVERVIEW OF MECHANICAL ENGINEERING 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. 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		


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Total No of Periods to be Taught	45 periods
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TEXT BOOK:	
1	G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018

REFERENCES:	
1	Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2018.
2	Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd, 2013
3	Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Understanding profession of Civil and Mechanical engineering.
CO2:	Summarise 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.

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	1	-	-	1	2		2	1	-	-	-
CO2	2	-	-	-	-	-	1	2		2	2	-	-	-
CO3	2	-	-	-	-	-	1	2		2	2	-	-	-
CO4	2	-	-	-	-	-	1	2		2	2	-	-	-
CO5	2	-	-	-	-	-	1	2		2	2	-	-	-
Avg.	2	-	-	0.2	-	-	1	2		2	1.8	-	-	-
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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Department	MECHANICAL	Programme Code & Name				114 - Mechanical	
Semester							
Course Code	Course Name		Hours/Week			Credit	Maximum Marks
UGET24201	ENGINEERING GRAPHICS		L	T	P	C	100
			2	0	4	4	
Course Objectives	1. Drawing engineering curves. 2. Drawing freehand sketch of simple objects. 3. Drawing orthographic projection of solids and section of solids. 4. Drawing development of solids 5. 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 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 modelling of isometric projection of simple objects by CAD Software (Not for Examination).							
Total No of Periods to be Taught				TOTAL: (L=30; P=60) 90 PERIODS			


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TEXT BOOK:

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

REFERENCES:

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,

COURSE OUTCOMES:

On completion of the course, the students will 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.

Mapping of COs with POs and PSOs

COs /POs	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
Avg.	3	1	2	-	2	-	-	-	-	3	-	2	2	2

1 – Slight, 2 – Moderate, 3 –Substantial, BT – Bloom's Taxonomy


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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEET24201	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C	100
		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		
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 No of Periods to be Taught		60


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TEXT BOOK:

1	William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9th edition, 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.

REFERENCES:

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.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain circuit's behaviour using circuit laws.
CO2:	Apply mesh analysis/ nodal analysis / network theorems to determine behaviour 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

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	3	2	2	1	-	-	-	3	3	3	3

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Department	S&H	Programme Code & Name	Common to All
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UTAT24201	TAMILS AND TECHNOLOGY	L	T	P	C	100
		1	0	0	1	
COURSE OBJECTIVES	• To Understand About Weaving And Ceramic Technology Of Tamils • To Compare The Design And Constructive Technology Of Cheras, Cholas, Pallavas And Nayakkars • To Gain Knowledge In Various Manufacturein Technology Of Tamils • To Analyse The Agriculture And Fishery Knowledge Of Tamils • To Learn About Scientic Tamils And Its And Use In Online Platforms					

UNIT 1	WEAVINGANDCERAMICTECHNOLOGY	(3)
Weaving Industry during Sangam Age –Ceramic technology – Black and Red Ware Potteries (BRW) — Graffition Potteries.		
UNIT 2	DESIGNANDCONSTRUCTIONTECHNOLOGY	(3)
Designing and Structural construction House & Designs in house hold materials during Sangam Age - Building materials and Hero stones of Sangam age —Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places – Temples of Nayaka Period-Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal-Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.		
UNIT 3	MANUFACTURINGTECHNOLOGY	(3)
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins—Beads making-industries Stone beads-Glass beads – Terra cotta beads – Shell beads / bone beats – Archeological evidences-Gem stone types described in Silappathikaram.		
UNIT 4	UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY	(3)
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoomp of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries — Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.		
UNIT 5	SCIENTIFICTAMIL&TAMILCOMPUTING	(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 No of Periods to be Taught		Total: 15 periods

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TEXT BOOK:	
1	தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல, சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி –வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருதை – ஆற்றங்கரை நாகரிகம், (தொல்லியல் துறை வெளியீடு)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

REFERENCES:	
1	Social Life of Tamils(Dr.K.K.Pillay) A joint publication of TNTB& ESC and RMRL–(in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5	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)

COURSE OUTCOMES:

பாடநெறியின் முடிவில் மாணவர்கள்

CO1:	Relate The Weaving Ceramic Technology Of Tamils
CO2:	Understand The Knowledge Of Tamils In design And stone Construction Technology
CO3:	Recognize The Manufacturing Technology Knowledge Of Tamils
CO4:	Criticize The Agriculture And Fishery Knowledge Of Tamil
CO5:	Apply Scientific Tamil In Various Online Plat form



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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	-	-	-	-	-	1	1	1	1	1	-	1	-	-
CO2	-	-	-	-	-	2	2	2	2	2	-	2	-	-
CO3	-	-	-	-	-	2	2	2	2	2	-	2	-	-
CO4	-	-	-	-	-	1	1	1	1	1	-	1	-	-
CO5	-	-	-	-	-	2	2	2	2	2	-	2	-	-
Avg.	-	-	-	-	-	2	2	2	2	2	-	2	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	S&H	Programme Code & Name				Common to All
Semester II						
Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UTAT24201	TAMILS AND TECHNOLOGY	L	T	P	C	100
		1	0	0	1	
பாடநெறி நோக்கங்கள்	• நெசவு மற்றும் பாணை தொழில்நுட்பத்தைப் புரிந்துகொள்ளல் • சேரர்கள், சோழர்கள், பல்லவர்கள் மற்றும் நாயக்கர்களின் கட்டுமான வடிவமைப்பு தொழில்நுட்பத்தை ஒப்பிடுதல் • தமிழர்களின் பல்வேறு உற்பத்தி தொழில்நுட்ப அறிவைப் பெறுதல். • தமிழர்களின் வேளாண்மை மற்றும் கடல்சார் அறிவை பகுப்பாய்வு செய்தல். • அறிவியல் தமிழையும் மற்றும் இணைய பயன்பாட்டையும் கற்றல்					

அலகு 1	நெசவுமற்றும்பாணைத்தொழில்நுட்பம்	(3)
சங்ககாலத்தில் நெசவுத்தொழில், பாணைத்தொழில்நுட்பம், கருப்பு சிவப்புபாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.		
அலகு 2	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்	(3)
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமான பொருட்களும், வீட்டுப் பொருட்களில் வடிவமைப்பும். சங்க காலத்தில் நடுகல்லும் சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் மாமல்லபுரச் சிற்பங்களும், கோவில்களும் சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழி பாட்டுத் தலங்கள், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் செட்டிநாட்டு வீடுகள் பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ- சாரோசெனிக் கட்டிடக்கலை.		
அலகு 3	உற்பத்தித்தொழில்நுட்பம்	(3)
கப்பல் கட்டும் கலை உலோகவியல் – இரும்புத் தொழிற்சாலை இரும்பை உருக்குதல், எஃகு வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் மணி உருவாக்கும் தொழிற்சாலைகள் கல்மணிகள். கண்ணாடி மணிகள் – சங்கு மணிகள் சுடுமண் மணிகள் எலும்புத் துண்டுகள் தொல்வியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.		
அலகு 4	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்	(3)





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அணை, ஏரி, குளங்கள், மதகு சோழர் காலக் குழுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு கால் நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் கடல்சார் அறிவு - மீன்வளம் – அறிவுசார் சமூகம் முத்து மற்றும் முத்துக் குளித்தல்.

அலகு 5	அறிவியல் தமிழ் மற்றும் கணித்தமிழ்	(3)
அறிவியல் தமிழின் வளர்ச்சி கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென் பொருட்கள் உருவாக்கம் தமிழ் இணையக் கல்விக்கழகம் தமிழ் மின் நூலகம் இணையத்தில் தமிழ் அகராதிகள் சொற்குவைத்திட்டம்.		
Total No of Periods to be Taught		Total: 15 periods

TEXT BOOK:	
1	தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
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4	பொருதை – ஆற்றங்கரை நாகரிகம், (தொல்லியல் துறை வெளியீடு)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

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2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5	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)

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COURSE OUTCOMES:

பாடநெறியின் முடிவில் மாணவர்கள்

CO1:	நெசவு மற்றும் பாணை தொழில்நுட்பத்தைப் புரிந்துகொள்ள
CO2:	வடிவமைப்பு மற்றும் கட்டிட தொழில்நுட்பத்தில் தமிழர்களின் அறிவை பெறுவார்கள்
CO3:	தமிழர்களின் பல்வேறு உற்பத்தி தொழில்நுட்ப அறிவை கண்டறிவார்கள்
CO4:	தமிழர்களின் வேளாண்மை மற்றும் கடல்சார் அறிவை விவாதிப்பார்கள்.
CO5:	இணைய பயன்பாடுகளின் அறிவியல் தமிழை பயன்படுத்திப் பார்ப்பார்கள்

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	1	1	1	1	-	1	-	-
CO2	-	-	-	-	-	2	2	2	2	2	-	2	-	-
CO3	-	-	-	-	-	2	2	2	2	2	-	2	-	-
CO4	-	-	-	-	-	1	1	1	1	1	-	1	-	-
CO5	-	-	-	-	-	2	2	2	2	2	-	2	-	-
Avg.	-	-	-	-	-	2	2	2	2	2	-	2	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	EEE	Programme Code & Name	Common to 104 – CSE, 205 – IT 243 – AI&DS, 106 – ECE, 114 – MECH, 121 – BME
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGEL24201	ENGINEERING PRACTICES LABORATORY	L	T	P	C	100
		0	0	4	2	
Course Objectives	• 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 house hold 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.					

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) Planning 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

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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.	
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 an elements of smart phone. b) Assembly and dismantle of LED TV. c) Assembly and dismantle of computer/ laptop	
Total No of Periods to be Taught	60 Periods

COURSE OUTCOMES: On completion of the course, the students will 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


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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	1	-	-	-	-	2	2	1	-
CO2	3	2	-	-	1	1	-	-	-	-	2	2	1	-
CO3	3	2	-	-	1	1	-	-	-	-	2	2	1	-
CO4	3	2	-	-	1	1	-	-	-	-	2	2	1	-
Avg.	3	2	-	-	1	1	-	-	-	-	2	2	1	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department	EEE	Programme Code & Name				105-B.E EEE	
Semester II							
Course Code	Course Name		Hours/Week			Credit	Maximum Marks
UEEL24201	ELECTRIC CIRCUITS LABORATORY	L	T	P	C	100	
		0	0	4	2		
Course Objectives	- To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab. - To gain practical experience on electric circuits and verification of theorems						

List of Exercises/Experiments	
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).	
Total No of Periods to be Taught	60

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Personal Computer with any Software	Minimum 10 Users
2	Regulated Power Supply (0-30V)	5
3	Function Generator (MHz Range)	5
4	Oscilloscope (20 MHz)	5
5	AC/DC – Voltmeters of required rating	10
6	AC/DC -Ammeters of required rating	10
7	Multimeters	2


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COURSE OUTCOMES:

On completion of the course, the students will 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)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	3	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	3	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	3	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	3	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	3	-	-	3	3	3	3
Avg.	3	3	3	3	2	2	1	3	-	-	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														

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Department	S&H	Programme Code & Name	Common to All
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGEL24202	COMMUNICATION LABORATORY	L	T	P	C	100
		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 No of Periods to be Taught		60 periods

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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Speak effectively in group discussions held in a 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

Mapping of COs with POs and PSOs

COs/POs	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	3	-	-
CO2	2	3	3	3	1	3	3	3	3	3	3	3	-	-
CO3	2	2	3	3	1	3	3	3	3	3	3	3	-	-
CO4	3	3	3	3	3	3	3	3	3	3	3	3	-	-
CO5	3	3	3	3	3	3	3	3	3	3	3	3	-	-
Avg.	2.4	2.8	3	3	1.8	3	3	3	3	3	3	3	-	-

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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMAT24306	PROBABILITY COMPLEX FUNCTIONS AND TRANSFORMS	L	T	P	C	100
		3	1	0	4	
Course Objectives	• To introduce the basic concepts of probability and random variables. • To develop an understanding of the standard techniques of complex variable theory in • Particular analytic function and its mapping property and familiarize the students with complex integration techniques and contour integration • Techniques which can be used in real integrals. • To acquaint the students with Differential Equations which are significantly used in engineering problems. • To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems. • Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.					

Unit-I	PROBABILITY AND RANDOM VARIABLES	(9+3)
Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Functions of a random variable.		
Unit-II	ANALYTIC FUNCTIONS AND COMPLEX INTEGRATION	(9+3)
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugate – Conformal mapping – Mapping by function $W=Z+C$, $CZ, 1/Z, Z^2$. - Cauchy's integral theorem – Cauchy's integral formula– Residues – Residue theorem – Application of residue theorem for evaluation of real integrals		
Unit-III	DIFFERENTIAL EQUATIONS	(9+3)
Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear first order- differential equations with constant coefficients – Basic concepts of partial differential equations -Applications		
Unit-IV	Z - TRANSFORMS AND DIFFERENCE EQUATIONS	(9+3)
Z-transforms - Elementary properties – Convergence of Z-transforms - – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.		
Unit-V	LAPLACE TRANSFORMS	(9+3)



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Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Initial and final value theorems – Inverse transforms – Convolution theorem – Application to solution of linear second order ordinary differential equations with constant coefficients

Total No of Periods to be Taught

60 periods

TEXT BOOK:

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	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCES:

1	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2	Papoulis. A. and Unnikrishnapillai . S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

COURSE OUTCOMES:

On completion of the course, the students will 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:	To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property and familiarize the students with complex integration techniques
CO3:	To acquaint the students with Differential Equations which are significantly used in engineering problems.
CO4:	Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.
CO5:	Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	0	0	0	0	0	0	2	0	0	-	-	-
CO2	3	3	0	0	0	0	0	0	2	0	0	-	-	-
CO3	3	3	0	0	0	0	0	0	2	0	0	-	-	-
CO4	3	3	0	0	0	0	0	0	2	0	0	-	-	-
CO5	3	3	0	0	0	0	0	0	2	0	0	-	-	-
Avg.	3	3	0	0	0	0	0	0	2	0	0	-	-	-

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name				105-B.E EEE
Semester III						
Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEET24301	DIGITAL LOGIC CIRCUITS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To introduce the fundamentals of combinational and sequential digital circuits. - To study various number systems and to simplify the mathematical expressions using Boolean functions word problems - To study implementation of combinational circuits using logic Gates. - To study the design of various synchronous and asynchronous circuits - To introduce digital simulation techniques for development of application oriented logic circuit					
Unit-I	INTRODUCTION TO NUMBER SYSTEM					(9)
Number system, Boolean algebra: De- Morgan’s theorem, switching functions and minimization using K- of logic functions- SOP and POS forms, K-map representations - minimization using K maps &QuineMcCluskey method.						
Unit-II	COMBINATIONAL CIRCUITS					(9)
Combinational logic - simplification and implementation of combinational logic circuits – (multiplexers and de multiplexers - code converters, adders, sub tractors, Encoders and Decoders) using logic gates-Design the Serial, Parallel adders and subtracters using multiplexer						
Unit-III	SYNCHRONOUS SEQUENTIAL CIRCUITS					(9)
Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Mealy models- Counters, state diagram; state reduction; state assignment						
Unit-IV	A SYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABILITY 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 Programmability Logic Devices: PROM – PLA –PAL, CPLD- FPGA						
Unit-V	VHDL					(9)
RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers & De multiplexers).						
Total No of Periods to be Taught		45				


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TEXT BOOK:

1	Morris Mano.M, 'Digital Logic and Computer Design', Prentice Hall of India, 3rd Edition, 2005
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

REFERENCES:

1	Tocci R.J., Neal S. Widmer, 'Digital Systems: Principles and Applications', Pearson Education Asia, 12th Edition, 2017.
2	Donald P Leach, Albert Paul Malvino, GoutamSha, 'Digital Principles and Applications', Tata McGraw Hill, 7th Edition, 2010.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain various number systems and characteristics of digital logic families
CO2:	Apply K-maps and Quine McCluskey methods to simplify the given Boolean expressions
CO3:	Explain the implementation of combinational circuit such as multiplexers and de-multiplexers - code converters, adders, subtractors, Encoders and Decoders
CO4:	Design various synchronous and asynchronous circuits using Flip Flops. Explain asynchronous sequential circuits and programmable logic devices
CO5:	Use VHDL for simulating and testing RTL, combinatorial and sequential circuits.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	-	1	-	-	-	1	3	-	1
CO2	3	3	3	1	3	-	1	-	-	-	1	3	-	1
CO3	3	3	3	1	3	-	1	-	-	-	1	3	-	1
CO4	3	3	3	1	3	-	1	-	-	-	1	3	-	1
CO5	3	3	3	1	3	-	1	-	-	-	1	3	-	1
Avg.	3	3	3	1	3	-	1	-	-	-	1	3	-	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEET24302	ELECTRON DEVICES AND CIRCUITS	L	T	P	C	100
		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 transistor like BJT and FET. - 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	(9)
PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - 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)
BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.		
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.		
Unit-IV	MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER	(9)
BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers		
Unit-V	FEEDBACK AMPLIFIERS AND OSCILLATORS	(9)
Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.		
Total No of Periods to be Taught	45	


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TEXT BOOK:

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.
3	Thomas L Floyd, 'Digital fundamentals', Pearson Education Limited, 11th Edition, 2018

REFERENCES:

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

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain the structure and operation of PN junction devices (diode, Zener diode, LED and Laser diode)
CO2:	Design clipper, clamper, half wave and full wave rectifier, regulator circuits using PN junction diodes
CO3:	Analyze the structure and characteristics BJT, FET, MOSFET, UJT, Thyristor and IGBT.
CO4:	Analyze the performance of various configurations of BJT and MOSFET based amplifier
CO5:	Explain the characteristics of MOS based cascade and differential amplifier Explain the operation of various feedback amplifiers and oscillators

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	-	1	-	-	-	1	3	-	1
CO2	2	2	3	2	2	-	1	-	-	-	1	3	-	1
CO3	2	2	3	2	2	-	1	-	-	-	1	3	-	1
CO4	2	2	3	2	2	-	1	-	-	-	1	3	-	1
CO5	2	2	3	2	2	-	1	-	-	-	1	3	-	1
Avg.	2	2	3	2	2	-	1	-	-	-	1	3	-	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEET24303	ELECTRICAL MACHINES - I	3	0	0	3	100
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 deliberate the working of auto transformer and three phase transformers.					

Unit-I	ELECTROMECHANICAL ENERGY CONVERSION	(9)
Fundamentals of Magnetic circuits- Statically and dynamically induced EMF - Principle of electromechanical energy conversion forces and torque in magnetic field systems - magnetic force- co-energy in singly excited and multi excited magnetic field system.		
Unit-II	DC GENERATORS	(9)
Principle of operation, constructional details, EMF equation, armature reaction, demagnetizing and cross magnetizing, compensating winding, commutation, methods of improving commutation, OCC and load characteristics of different types of DC Generators. Parallel operation of DC Generators, applications of DC Generators..		
Unit-III	DC MOTORS	(9)
Principle of operation, constructional details, significance of back emf, torque equations. Speed control of DC motors, starting methods of DC motors, load characteristics of DC motors, losses and efficiency in DC machine, condition for maximum efficiency. Testing of DC Machines: Brake test, Swinburne's test, Hopkinson's test, Field test, Retardation test, Separation of core losses..		
Unit-IV	SINGLE PHASE TRANSFORMER	(9)
Construction and principle of operation, EMF equation, equivalent circuit, phasor diagrams, testing - polarity test, open circuit and short circuit tests, voltage regulation, losses and efficiency, back-to back test, separation of core losses, parallel operation of single-phase transformers, applications of single-phase transformer.		
Unit-V	AUTOTRANSFORMER AND THREE PHASE TRANSFORMER	(9)
Construction and 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, applications of Scott connection..		
Total No of Periods to be Taught	45	


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TEXT BOOK:

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.

REFERENCES:

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.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Apply the laws governing the electromechanical energy conversion for singly and multiple excited systems.
CO2:	Explain the construction and working principle of DC Generator.
CO3:	Explain the construction and working principle of DC motor
CO4:	Compute various performance parameters of the machine, by conducting suitable tests. Draw the equivalent circuit of transformer and predetermine the efficiency and regulation
CO5:	Describe the working principle of auto transformer, three phase transformer with different types of connections.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	-	-	-	-	1	3	2	2
CO2	3	3	1	1	1	1	-	-	-	-	1	3	1	1
CO3	3	3	1	1	1	1	-	-	-	-	1	3	1	1
CO4	3	3	1	1	1	1	-	-	-	-	1	3	3	2
CO5	3	3	1	1	1	1	-	-	-	-	1	3	3	2
Avg.	3	3	1	1	1	1	-	-	-	-	1	3	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	CSE	Programme Code & Name	105-B.E EEE
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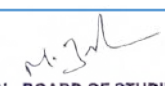
Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCST24304	C PROGRAMMING AND DATA STRUCTURES	L	T	P	C	100
		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 (8+1 SKILL)	(9)
Data Types – Variables – Operators – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays.		
Unit-II	C PROGRAMMING - ADVANCED FEATURES (8+1 SKILL)	(9)
Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Pre processor Directives.		
Unit-III	LINEAR DATA STRUCTURES (8+1 SKILL)	(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 (8+1 SKILL)	(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 (8+1 SKILL)	(9)
Insertion Sort – Quick Sort – Heap Sort – Merge Sort –Linear Search – Binary Search.		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

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.


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REFERENCES:

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, Sartaj Sahni and Susan Anderson, "Fundamentals of Data Structures", Galgotia, 2008.

COURSE OUTCOMES:

On completion of the course, the students will 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 apply appropriate linear/non-linear data structure operations to solve a given problem and design suitable hash functions to achieve collision free data storage and efficient retrieval.
CO5:	Appropriately use sort and search algorithms for a given application.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	2	2	1	-	1	2	1	3	2	1	3
CO2	1	2	1	2	2	-	-	1	1	1	2	2	2	2
CO3	2	3	1	2	3	-	-	1	1	1	2	2	1	2
CO4	2	1	-	1	1	-	-	2	1	1	2	2	3	1
CO5	1	2	1	2	2	1	-	1	2	1	3	2	2	3
Avg.	2	2	1	2	2	1	-	1	1	1	2	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department		Programme Code & Name	105-B.E EEE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEETL24301	ELECTROMAGNETIC FIELDS	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To introduce the basic mathematical concepts related to electromagnetic vector fields. • To impart knowledge on the concepts. • Electrostatic fields, electric potential, energy density and their applications. • Magneto static fields, magnetic flux density, vector potential • Different methods of emf generation and Maxwell’s equations • Application of Electromagnetic fields					

Unit-I	ELECTROSTATICS - I	(9)
Sources and effects of electromagnetic fields – Vector fields -Coordinate Systems-Gradient, Divergence, Curl – Stoke's theorem - Coulomb's Law – Electric field intensity – Types of charge distribution-Electric Field intensity due to point charge, Line charge, volume and surface charge distribution		
Unit-II	ELECTROSTATICS – II	(9)
Electric Flux Density – Gauss's Law – Limitation of Gauss's Law – Potential Difference – Potential due to point charge, line charge, surface and volume charge-Conservative field – Potential Gradient–Boundary Condition: Conductor-Dielectric and Dielectric-Dielectric – Parallel Plate capacitors– Poisson's and Laplace's Equations..		
Unit-III	MAGNETOSTATICS	(9)
Magnetic field intensity (H) – Biot-Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, Magnetic flux- Magnetic flux density (B) –Energy stored-Magnetic Force, Moving Charge in a Magnetic Field, Lorentz Force – Force Between Two Parallel Current Carrying Conductors – Magnetic Circuit – Self and Mutual Inductance – Inductance of Solenoid		
Unit-IV	ELECTRODYNAMIC FIELDS	(9)
Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current Maxwell's equations (differential and integral form)		
Unit-V	APPLICATION OF ELECTROMAGNETIC FIELDS	(9)
Domestic– SMPS, fans, induction cooking. Industry: Generator, sensors and actuators. Transport: magnetic levitation. Medical: Magnetic resonance imaging, magneto therapy. Communication: EM waves in different types of communication – Electromagnetic Spectrum (Block diagram approach)		
Total No of Periods to be Taught	30	


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TEXT BOOK:

1	Mathew N. O. Sadiku, S.V. Kulkarni 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc. Asian edition, 2021.
2	William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2020.
3	Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.

REFERENCES:

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 Electromagnetic, Fifth Edition (Schaum's Outline Series), McGraw Hill, 2018.
4	S.P.Ghosh, LipikaDatta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2017.
5	K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Sixteenth Edition Eighth Reprint :2015

List of Exercises/Experiments

1.Demonstration of divergence of three-dimensional vector field	
2.Demonstration of gradient of three-dimensional field	
3.Demonstration of Curl of three-dimensional vector field	
4. Calculation of the contour lines and gradient field of the scalar field	
5. Demonstration of linear polarized waves	
6. Experimentation of Magnetic field distribution corresponding to twin-lead transmission lines	
7. Simulation of Faradays Law of Electromagnetic induction.	
8.Calculation of mutual inductor in wireless power transmission system	
9.Drawing of magnetic dipole magnetic field lines	
10.Magnetic field distribution inside coaxial line	
Total No of Periods to be Taught	30

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Visualize and explain Gradient, Divergence, and Curl operations on Electro magnetic vector fields and identify the electromagnetic sources and their effects.
CO2:	Compute and analyse electrostatic fields, electric potential, energy density along with their applications.
CO3:	Compute and analyse magneto static fields, magnetic flux density, vector potential along with their applications.
CO4:	Explain different methods of emf generation and Maxwell's equations.
CO5:	Visualize various applications of electromagnetic fields.

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Personal Computers (Intel Core i5 or i7, 500 GB, 8 GB RAM)	30 Nos
2	Software: Matlab	1
3	Laser Printer	1 No

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	3	1	-	-	-	1	3	2	1
CO2	3	2	1	2	-	1	1	-	-	-	1	3	2	1
CO3	3	2	1	2	-	1	1	-	-	-	1	3	2	1
CO4	3	2	1	2	-	1	1	-	-	-	1	3	2	1
CO5	3	2	1	2	-	1	1	-	-	-	1	3	2	1
Avg.	3	2	1	2	-	1.4	1	-	-	-	1	3	2	1
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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Department		Programme Code & Name	105-B.E EEE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEL24301	ELECTRONIC DEVICES AND CIRCUITS LABORATORY	L	T	P	C	100
		0	0	3	1.5	
Course Objectives	- To enable the students to understand the behavior of semiconductor device based on experimentation. - Be exposed to active and passive circuit elements. - Familiarize the operation and characteristics of transistor like BJT and FET. - Explore the characteristics of amplifier gain and frequency response. - Learn the required functionality of positive and negative feedback systems.					

List of Exercises/Experiments

- 1.Characteristics of Semiconductor diode, Zener diode.
- 2.Characteristics of NPN Transistor under common emitter .
- 3.Characteristics of JFET and draw the equivalent circuit
- 4.Characteristics of UJT and generation of saw tooth waveforms
- 5.Design and frequency response characteristics of a Common Emitter amplifier
- 6.Design and testing of RC phase shift and LC oscillators
- 7.Characteristics of Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
- 8.Design of Differential amplifiers using FET
- 9.Measurement of frequency and phase angle using CRO

Total No of Periods to be Taught

45

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Analyze the characteristics of PN, Zener diode and BJT in CE, configurations experimentally, Analyze the characteristics of JFET and UJT experimentally
CO2:	Analyze frequency response characteristics of a Common Emitter amplifier experimentally
CO3:	Analyze the characteristics of RC phase shift and LC oscillators experimentally
CO4:	Analyze the characteristics of half-wave and full-wave rectifier with and without filters experimentally
CO5:	Analyze the characteristics of FET based differential amplifier experimentally

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
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1	Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor	10
2	Resistors, Capacitors and inductors	10
3	Necessary digital ICs	10
4	Function Generators	5
5	Regulated Power Supply (0-30V)	5
6	CRO	5
7	Bread boards	10

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	3	3	-	1.5	-	-	3	-	-	3	3
CO2	-	-	3	3	3	-	1.5	-	-	3	-	-	3	3
CO3	-	3	2	3	-	-	1.5	-	-	3	-	-	3	3
CO4	-	-	3	3	-	-	1.5	-	-	-	-	-	3	3
CO5	-	-	-	3	3	-	1.5	-	-	-	-	-	3	3
Avg.	-	3	2.7	3	3	-	1.5	-	-	3	-	-	3	3
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														

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Department		Programme Code & Name	105-B.E EEE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEL24302	ELECTRICAL MACHINES-1 LABORATORY	L	T	P	C	100
		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 Exercises/Experiments	
1. Open circuit and load characteristics of DC shunt generator	
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. Swinburne's test and speed control of DC shunt motor.	
7. Load test on and single phase transformer	
8. Load test on and three phase transformers	
9. Open circuit and short circuit tests on single phase transformer.	
10. Sumpner's test on single phase transformers.	
Total No of Periods to be Taught	45

COURSE OUTCOMES:	
On completion of the course, the students will 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, Understand DC motor starters and 3-phase transformer connections.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS


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S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	DC Shunt Motor with Loading Arrangement	2
2	Single Phase Transformer	1
3	DC Series Motor with Loading Arrangement	1
4	DC Compound motor with loading arrangement	1
5	DC Shunt Motor Coupled With DC Compound Generator	1
6	DC Shunt Motor Coupled With DC Shunt Generator	1
7	Tachometer -Digital	4
8	Single Phase Auto Transformer	4
9	Three Phase Auto Transformer	1
10	Single Phase Resistive Load	2
11	Three Phase Resistive Load	2
12	Three phase Transformer	1
13	Rheostat(As per the requirements for the machines)	-

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	1	-	-	-	3	1	1
CO2	3	3	1	1	-	-	-	1	-	-	-	3	3	2
CO3	3	3	1	1	-	-	-	1	-	-	-	3	3	2
CO4	3	3	1	1	-	-	-	1	-	-	-	3	3	2
CO5	3	3	1	1	-	-	-	1	-	-	-	3	3	2
Avg.	3	3	1	1	-	-	-	1	-	-	-	2.5	2.6	1.6
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														

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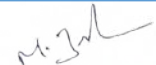


Department	CSE	Programme Code & Name	105-B.E EE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSL24304	C PROGRAMMING AND DATA STRUCTURES LABORATORY	L	T	P	C	100
		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					

List of Exercises/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. 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 No of Periods to be Taught	45 Periods


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COURSE OUTCOMES:

On completion of the course, the students will 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

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	30
2.	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3.	Standalone desktops PC	15 Nos

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	2	2	1	-	1	2	1	3	2	1	2
CO2	1	2	1	2	2	-	-	1	1	1	2	2	2	1
CO3	2	3	1	2	3	-	-	1	1	1	2	2	1	2
CO4	2	1	-	1	1	-	-	2	1	1	2	2	3	2
CO5	1	2	1	2	2	1	-	1	2	1	3	2	2	1
Avg.	2	2	1	2	2	1	-	1	1	1	2	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	Mechanical	Programme Code & Name	105-B.E EEE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
USD24301	SOFT SKILL 1	L	T	P	C	100
		2	0	0	0	
Course Objectives	1. To understand oneself and manage own emotions					
	2. To include the Grooming and mannerism					
	3. To know different methods for faster numerical computations					
	4. To learn logical reasoning skills.					
	5. To Enhance Problem – Solving Skills					

Unit-I	NUMBER SYSTEM/PHONETICS	(6)
Introduction –Discussing Divisibility Rule-HCF –LCM –Decimal Fraction Introduction-Standard Phonetic Alphabet-Introduction to vowel & Consonant accent neutralization		
Unit-II	AVERAGE AND DIRECTION SENSE/ONE WORD SUBSTITUTES	(6)
Introduction-Basic Problem in Average-Direction Sense Problem Introduction-The One which can be substituted for the given word/Sentence.		
Unit-III	TIME AND WORK/PERSONAL COMMUNICATION	(6)
Basic Concept of Time and Work-Efficiency Related Sums on Time and Work Day to day conversation with family members-Neighbors-Friends-Relatives		
Unit-IV	PROFIT AND LOSS/PUBLIC SPEAKING	(6)
Introduction-Problem on Profit and Loss Introduction –Anchoring /Master of ceremony –Welcome address –Proposing vote of Thanks- Introducing Speaker – Conducting Meetings- Making Announcements		
Unit-V	AREA, SURFACE AREA AND VOLUME PROBLEMS/ERROR CORRECTION	(6)
Introduction about the Area Problems – Area, Surface Area and Volume for Square Rectangle –Triangle, Cylinder Introduction –Spot the Error in the sentence and correct it.		
Total No of Periods to be Taught		30


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TEXT BOOK:

1	Training And Placement Book [TKEC]
2	Quantitative Aptitude by R. S. Aggarwal

REFERENCES:

1	R.S. Aggarwal, "Quantitative Aptitude", Seventh edition, S.Chand Publication.
2	http://www.mastguru.com/arithmatic-aptitude-questions-answers
3	https://prepinsta.com

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Practice manners and etiquettes in day-to-day life.
CO2:	Be confident and motivated to plan the activities according to personality types.
CO3:	Build Confidence in Mathematics.
CO4:	Solve mathematical problems by applying logical thinking.
CO5:	Apply different techniques for faster calculations.

Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	1	1	2	-	-	-	-	-	3	3	1
CO2	2	2	2	2	1	2	-	-	-	-	-	2	3	2
CO3	3	2	2	2	1	1	-	-	-	-	-	1	2	3
CO4	3	3	2	2	1	1	-	-	-	-	-	2	1	3
CO5	2	1	2	1	3	2	-	-	-	-	-	2	2	3
Avg.	2.4	1.8	2	1.6	1.4	1.6	-	-	-	-	-	2	2.2	2.4

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Department	S & H	Programme Code & Name	105-B.E EEE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UESST24401	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	L	T	P	C	100
		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 analyze 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		


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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- Socioeconomical and technological change		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

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.
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.
7	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES:

1	R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . edition 2010.
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, Third Edition, 2015.
5	Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.


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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
CO2:	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
CO3:	To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
CO4:	To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
CO5:	To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	3	-	-	-	-	2	-	-	-
CO2	3	2	-	-	-	3	-	-	-	-	2	-	-	-
CO3	3	-	1	-	-	2	-	-	-	-	2	-	-	-
CO4	3	2	1	1	-	2	-	-	-	-	2	-	-	-
CO5	3	2	1	-	-	2	-	-	-	-	1	-	-	-
Avg.	2.8	1.8	1	1	-	2.4	-	-	-	-	1.8	-	-	-

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy


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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester IV

Course Code	Course Name	Hours/Week				Credit	Maximum Marks
		L	T	P	C		
UEET24401	TRANSMISSION AND DISTRIBUTION	3	1	0	4		100
Course Objectives	- To impart knowledge about the configuration of the electrical power systems. - To study the line parameters and interference with neighboring 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+3)
Structure of electric power system – Parameters of Transmission Line – Skin and Proximity Effects – Inductance and Capacitance of Single and Three Lines with Single Circuit – Double Circuit (Solid conductor): Symmetrical and Unsymmetrical Spacing and Transposition		
Unit-II	MODELLING AND PERFORMANCE OF TRANSMISSION LINES	(9+3)
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-Ferranti effect – Corona: Phenomena of Corona – Factors Affecting Corona –Critical Voltages		
Unit-III	SAG CALCULATION AND LINE SUPPORTS	(9+3)
Mechanical design of overhead lines – Line Supports –Types of towers – Tension and Sag– Towers at Equal Heights – Towers at Unequal Heights-Insulators: Types, voltage distribution in insulator string, improvement of string efficiency		
Unit-IV	UNDERGROUND CABLES	(9+3)
Underground cables – Types of cables – Construction of single-core and 3-core belted cables – Insulation Resistance – Potential Gradient – Capacitance of single-core and 3-core belted cables – Grading of cables		
Unit-V	DISTRIBUTION SYSTEMS	(9+3)
Distribution Systems – General Aspects – Kelvin's Law – AC and DC distributions –Concentrated and Distributed loading- Techniques of Voltage Control and Power factor improvement – Distribution Loss – Types of Substations – Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only).		
Total No of Periods to be Taught		60

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TEXT BOOK:	
1	D.P.Kothari, I.J. Nagarath, 'Power System Engineering', McGraw-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

REFERENCES:	
1	B.R.Gupta, 'Power System Analysis and Design' S. Chand, New Delhi, Sixth Edition, 2011.
2	Luces M.Fualken berry, Walter Coffey, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3	ArunIngle, "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	HadiSaadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 23rd reprint, 2015.

COURSE OUTCOMES:	
On completion of the course, the students will 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 modelling, performance analysis and modern trends in distribution system.

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	1	1	-	-	-	-	3	1	1
CO2	3	2	1	1	-	1	2	-	-	-	-	3	2	1
CO3	3	2	1	1	-	1	2	-	-	-	-	3	3	1
CO4	3	2	1	1	-	1	2	-	-	-	-	3	3	1
CO5	3	2	1	1	-	1	2	-	-	-	-	3	3	1
Avg.	2.8	1.8	1	1	-	1	1.8	-	-	-	-	3	2.4	1
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														



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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester IV

Course Code	Course Name	Hours/Week				Credit	Maximum Marks
		L	T	P	C		
UEET24402	LINEAR INTEGRATED CIRCUITS	3	0	0	3		100
Course Objectives	- To impart knowledge on the following topics - Signal analysis using Op-amp based circuits. - Applications of Op-amp. - Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits. - IC fabrication procedure						

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 - Basic applications of op-amp – , summer, differentiator and Integrator-V/I & I/V converters.		
Unit-III	APPLICATIONS OF OPAMP	(9)
Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- comparators, multi vibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using OP-AMPs.		
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 – 78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.		
Total No of Periods to be Taught		45


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TEXT BOOK:	
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	RamakantA.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, PHI 2021

REFERENCES:	
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, 2ndEdition, 2012

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Explain monolithic IC fabrication process and working of fabrication of diodes, capacitance, resistance, FETs and PV Cell.
CO2:	Analyze the characteristics and basic applications (inverting/non-inverting amplifier, summer ,differentiator, integrator, V/I and I/V converter) 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, A/D and D/A converters
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.

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	-	1	-	-	-	1	3	2	1
CO2	2	2	3	2	2	-	1	-	-	-	1	3	2	1
CO3	2	2	3	2	2	-	1	-	-	-	1	3	2	1
CO4	2	2	3	2	2	-	1	-	-	-	1	3	2	1
CO5	2	2	3	2	2	-	1	-	-	-	1	3	2	1
Avg.	2	2	3	2	2	-	1	-	-	-	1	3	2	1
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														


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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEET24403	MICROPROCESSORAND MICROCONTROLLER	3	0	0	3	100
Course Objectives	- To study the basic concept of 8085 - To develop skills in instruction set of 8085 & simple program in assembly languages - To introduce commonly used peripheral/interfacing ICs. - To study and understand basic concept of 8051. - To study and understand the Interfacing and typical applications of micro-controllers					

Unit-I	INTRODUCTION TO 8085 ARCHITECTURE	(9)
Functional block diagram – Memory interfacing–I/O ports and data transfer concepts – Timing Diagram – Interrupt structure..		
Unit-II	8085 INSTRUCTION SET AND PROGRAMMING	(9)
Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions, stack.		
Unit-III	INTERFACING BASICS AND ICS	(9)
Study of Architecture and programming of ICs: 8255 PPI, 8259PIC, 8251USART, 8279 Keyboard display controller and 8254 Timer/Counter – Interfacing with 8085 -A/D and D/A converter interfacing		
Unit-IV	INTRODUCTION TO 8051 MICROCONTROLLER	(9)
Functional block diagram- Pin diagram of 8051 Microcontroller – Ports of 8051microcontroller- Program Status Register- Structure of Random Access Memory – Special Function Registers-Instruction format and addressing modes – Interrupt structure – Timer – I/O ports – Serial communication, Simple programming - Usage of IDE for assembly language programming		
Unit-V	INTERFACING TECHNIQUES FOR 8051 MICROCONTROLLER	(9)
Interfacing of Analog to Digital Converter – Digital to Analog Converter – Sensor Interface – Keypad Interface .Display Interface: 7 segment interface – LCD Temperature control system –stepper motor control. Communication Interface: GSM – Xbee – GPS – Bluetooth.		
Total No of Periods to be Taught	45	


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TEXT BOOK:	
1	Sunil Mathur&Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016
2	R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3	Muhammad Ali Mazidi& Janice GilliMazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003

REFERENCES:	
1	Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2	B.RAM," Computer Fundamentals Architecture and Organization" New age International Private Limited, Fifth edition, 2017
3	Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013
4	Ajay V.Deshmukh, 'Microcontroller Theory &Applications', McGraw Hill Edu,2016

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Ability to write assembly language program for microprocessor and microcontroller
CO2:	Ability to design and implement interfacing of peripheral with microprocessor and microcontroller
CO3:	Ability to analyze, comprehend, design and simulate microprocessor based systems used for control and monitoring.
CO4:	Ability to analyze, comprehend, design and simulate microcontroller based systems used for control and monitoring.
CO5:	Ability to understand and appreciate advanced architecture evolving microprocessor field

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	3	-	-	1	-	-	-	3	3	1	3
CO2	2	1	2	3	-	-	1	-	-	-	3	3	1	3
CO3	2	1	2	3	-	-	1	-	-	-	3	3	1	3
CO4	2	1	2	3	-	-	1	-	-	-	3	3	1	3
CO5	2	1	2	3	-	-	1	-	-	-	3	3	1	3
Avg.	2	1	2	3	-	-	1	-	-	-	3	3	1	3
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														


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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEET24404	ELECTRICAL MACHINES - II	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Construction and performance of salient and non – salient type synchronous generators. • Principle of operation and performance of synchronous motor. • Construction, principle of operation and performance of induction machines. • Starting and speed control of three-phase induction motors. • 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 –Synchronizing and parallel operation – Synchronizing torque - Voltage regulation – EMF, MMF, ZPF and A.S.A method.		
Unit-II	SYNCHRONOUS MOTOR	(9)
Principle of operation – Torque equation - V and Inverted V curves – Starting methods – constant excitation and constant power Developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.		
Unit-III	THREE PHASE INDUCTION MOTOR	(9)
Constructional details – Types of rotors – Principle of operation – Slip –cogging and crawling- Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram - 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 of starters – 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.		
Unit-V	SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES	(9)
Constructional details of single phase induction motor – Double field revolving theory and operation – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor.		
Total No of Periods to be Taught		45


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TEXT BOOK:

1	A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', McGraw Hill publishing Company Ltd, 6th Edition 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.

REFERENCES:

1	Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
2	M.N. Bandyopadhyay, 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.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to understand the construction and working principle of Synchronous generator
CO2:	Ability to understand the construction and working principle of Synchronous Motor
CO3:	Ability to understand the construction and working principle of Three Phase Induction Motor
CO4:	Acquire knowledge about the starting and speed control of induction motors.
CO5:	To gain knowledge about the basic principles and working of Single phase induction motors and Special Electrical Machines.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	-	1	-	-	-	-	3	3	2
CO2	3	3	2	3	3	-	1	-	-	-	-	3	3	2
CO3	3	3	2	3	3	-	1	-	-	-	-	3	3	2
CO4	3	3	2	3	3	-	1	-	-	-	-	3	3	2
CO5	3	3	1	1	2	-	1	-	-	-	-	3	3	2
Avg.	3	3	1.6	2.3	3	-	1	-	-	-	-	3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department		Programme Code & Name	105-B.E EEE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEETL24401	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C	100
		2	0	2	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 • To summarize the overall measurement and instrumentation with the knowledge on digital instrumentation principle.					

Unit-I	CONCEPTS OF MEASUREMENTS	(9)
Instruments: classification, applications – Elements of a generalized measurement system - Static and dynamic characteristics - Errors in measurement -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 AND INSTRUMENTATION AMPLIFIERS	(9)
Wheatstone bridge, Kelvin double bridge - Maxwell, Hay, Wien and Schering bridges – Errors and compensation in A.C. bridges - Instrumentation Amplifiers.		
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)
Measurement of voltage, Current, frequency and phase - DSO- Data Loggers – Basics of PLC programming and Introduction to Virtual Instrumentation - Instrument standards.		
Total No of Periods to be Taught		30

TEXT BOOK:

1	A.K. Sawhney, PuneetSawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', DhanpatRai and Co, New Delhi, Edition 2011.
2	H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

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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
3	W.Bolton, Programmable Logic Controllers, 6th Edition, Elsevier, 2015.
4	R.B. Northrop, 'Introduction to Instrumentation and Measurements', Taylor & Francis, New Delh

List of Exercises/Experiments	
1. Study of Displacement Transducer	
2. Pressure Transducer	
3. AC Bridge Maxwell's, Inductance, Capacitance	
4 DC Bridges Wheatstone, Kelvin's	
5. Instrumentation Amplifier	
6. A/D Converter and D/A Converter	
7. Calibration of Single Phase Energy Meter.	
8. Calibration of Current Transformer	
9. Measurement of Iron Loss	
10. Study of Transients	
Total No of Periods to be Taught	30

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Ability to understand the fundamental art of measurement in engineering.
CO2:	Ability to understand the structural elements of various instruments.
CO3:	Ability to understand the importance of bridge circuits.
CO4:	Ability to understand about various transducers and their characteristics by experiments.
CO5:	Ability to understand the concept of digital instrumentation and virtual instrumentation by log/antilog amplifier, analog multiplier /divider, active filters, comparators, waveform generators, A/D and D/Aconverters

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	Equipment	Quantity
	Power supply & Resistors	Sufficient number
1	Watt meter Volt meter, Ammeter, Multimeters & CRO	Each 5 Nos
2	Bread board	10 No
3	Decade Capacitance box, Decade resistance box, Decade Inductance box	Sufficient number
4	Digital Storage Oscilloscope & LVDT Kit	Each 1 No
5	AC Bridges Kits (Schering Bridge, Maxwell Inductance Bridge and Anderson Bridge)	1 No


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6	DC Bridges Kits(Wheat Stone Bridge and Kelvin Double Bridge)	Each 1 No
7	Instrumentation Amplifier	Each 1 No
8	Analog – Digital and Digital –Analog converters (ADC and DACs) Kit each one number	1 No
9	Power supply& Resistors	Sufficient number

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	-	3	2	-	-	-	-	3	3	3	3
CO2	3	2	3	2	-	-	-	-	3	-	3	3	3	3
CO3	3	2	3	-	3	-	-	-	-	-	3	3	3	3
CO4	3	2	3	-	-	2	-	-	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	3	-	3	3	3	3
Avg.	3	2	3	2	3	2	-	-	3	-	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														

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Department		Programme Code & Name	105-B.E EEE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEL24401	ELECTRICAL MACHINES-II LABORATORY	L	T	P	C	100
		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 Exercises/Experiments	
1. Regulation of three phase alternator by EMF and MMF methods.	
2. Regulation of three phase alternator by ZPF and ASA methods.	
3. V and Inverted V curves of Three Phase Synchronous Motor.	
4. Load test on three-phase induction motor.	
5. No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).	
6. Separation of No-load losses of three-phase induction motor.	
7. Load test on single-phase induction motor.	
8. No load and blocked rotor test on single-phase induction motor.	
9. Study of Induction Motor Starters	
Total No of Periods to be Taught	45

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Ability to understand and analyze EMF and MMF methods
CO2:	Ability to analyze the characteristics of V and Inverted V curves
CO3:	Acquire hands on experience of conducting various tests on alternators and obtaining their performance indices using standard analytical as well as graphical methods. To understand the importance of Synchronous machines
CO4:	Acquire hands on experience of conducting various tests on induction motors and obtaining their performance indices using standard analytical as well as graphical methods. to understand the importance of single and three phase Induction motors
CO5:	Ability to acquire knowledge on separation of losses.

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	DC Shunt Motor Coupled With Three phase Salient Pole Alternator	1
2	Three Phase Induction Motor with Loading Arrangement	2
3	Single Phase Induction Motor with Loading Arrangement	2
4	Tachometer –Digital	4
5	Single Phase Auto Transformer	4
6	Three Phase Auto Transformer	2
7	Single Phase Resistive Load	2
8	Three Phase Resistive Load	2
9	Three phase inductive load	1
10	Rheostats	As per the requirement for the machines

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	1.5	1	-	-	3	3	3	2
CO2	3	3	1	1	-	-	1.5	1	-	-	3	3	3	2
CO3	3	3	1	1	-	-	1.5	1	-	-	3	3	3	1
CO4	3	3	1	1	-	-	1.5	1	-	-	3	3	3	1
CO5	3	3	1	1	-	-	1.5	1	-	-	2	3	3	2
Avg.	3	3	1	1	-	-	1.5	1	-	-	2.8	3	3	1.6
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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Department		Programme Code & Name	105-B.E EEE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEL24402	LINEAR AND DIGITAL CIRCUITS LABORATORY	L	T	P	C	100
		0	0	3	1.5	
Course Objectives	• To learn design, testing and characterizing of circuit behavior with combinational logic gate ICs. • To learn design, testing and characterizing of circuit behavior with register/ counter and sequential logic ICs. • To learn design, testing and characterizing of circuit behavior with OPAMP ICs. • To learn design, testing and characterizing of circuit behavior with analog Ics like 555 timer VCO and regulators. • To learn design, testing and characterizing of circuit behavior with digital Ics like decoders, multiplexers					

List of Exercises/Experiments

1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa.
3. Parity generator and parity checking.
4. Encoders and Decoders.
5. Counters: Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
7. Study of multiplexer and de multiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.
9. Variability Voltage Regulator using IC LM317.

Total No of Periods to be Taught

45

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to understand and implement Boolean Functions.
CO2:	Ability to understand the importance of code conversion
CO3:	Ability to Design and implement circuits with digital ICs like decoders, multiplexers, register.
CO4:	Ability to acquire knowledge on Application of Op-Amp
CO5:	Ability to Design and implement counters using analog ICs like timers, VCOs and digital ICs like Flip-flops and counters.

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS														
S.N O	DESCRIPTION OF EQUIPMENT										REQUIRED NUMBERS			
1	Regulated Power supply (0-30V)										10			
2	Cathode Ray Oscilloscope (CRO)										10			
3	Function Generator										2			
4	Digital trainer kit										3			
Consumables:														
1	Bread Board										Sufficient number			
2	IC 741/ICNE555										Sufficient number			
3	Digital ICs										Sufficient number			
4	LED										Sufficient number			
5	LM317										Sufficient number			
6	Transistor										Sufficient number			
Mapping of COs with POs and PSOs														
COs/PO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO 3
CO1	-	-	-	3	-	-	1.5	-	-	3	3	2	1	2
CO2	-	-	3	3	-	-	1.5	-	-	3	3	2	1	2
CO3	-	3	2	3	3	-	1.5	-	-	3	3	2	1	2
CO4	-	3	3	3	3	-	1.5	-	-	3	3	2	1	2
CO5	-	-	-	-	-	-	1.5	-	-	-	3	-	-	-
Avg.	-	3	1.6	3	3	-	1.5	-	-	3	3	2	1	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														

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Department		Programme Code & Name	105-B.E EEE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEL24403	MICROPROCESSOR AND MICROCONTROLLER LABORATORY	L	T	P	C	100
		0	0	3	1.5	
Course Objectives	- To perform simple arithmetic operations using assembly language program and study the addressing modes & instruction set of 8085 & 8051 - To develop skills in simple program writing in assembly languages - To write an assembly language program to convert Analog input to Digital output and Digital input to Analog output. - To perform interfacing experiments with μP8085 - To perform interfacing experiments with μC8051.					

List of Exercises/Experiments

EXPERIMENTS WITH μ P8085:

- Simple arithmetic operations: Multi precision addition / subtraction /multiplication / division.
- Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD code conversions.
- Interface Experiments: A/D Interfacing. D/A Interfacing. Traffic light controller
- Stepper motor controller interface.
- Displaying a moving/ rolling message in the student trainer kit's output device

EXPERIMENTS WITH μ C8051:

- Simple arithmetic operations with 8051: Multi precision addition / subtraction / multiplication/ division.
- Programming with control instructions: Increment / Decrement, Ascending / Descending. order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD code conversions.
- Interface Experiments: A/D Interfacing. D/A Interfacing. Traffic light controller
- Stepper motor controller interface.
- Displaying a moving/ rolling message in the student trainer kit's output device.
- Programming PIC architecture with software tools.

Total No of Periods to be Taught

45

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to write assembly language program for microprocessor.
CO2:	Ability to write assembly language program for microcontroller
CO3:	Ability to design and implement interfacing of peripheral with microprocessor and microcontroller


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CO4:	Ability to analyze, comprehend, design and simulate microprocessor based systems used for control and monitoring.
CO5:	Ability to analyze, comprehend, design and simulate microcontroller based systems used for control and monitoring.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.N O	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	8085 Trainer kit with power supply	5
2	8051 Microcontroller trainer kit with power supply	5
3	ADC and DAC Interface boards	2
4	Stepper motor interface board	2
5	Traffic light interface board	2
6	Software tool for 8085,8051,PIC assemblers loaded in computers	5 nos.

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	3	-	-	1.5	-	-	-	3	3	1	3
CO2	2	1	2	3	-	-	1.5	-	-	-	3	3	1	3
CO3	2	1	2	3	-	-	1.5	-	-	-	3	3	1	3
CO4	2	1	2	3	-	-	1.5	-	-	-	3	3	1	3
CO5	2	1	2	3	-	-	1.5	-	-	-	3	3	1	3
Avg.	2	1	2	3	-	-	1.5	-	-	-	3	3	1	3
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														

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Department	Mechanical	Programme Code & Name	105-B.E EEE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
USD24401	SOFT SKILL 2	L	T	P	C	100
		2	0	0	0	
Course Objectives	1.	To learn the Number Series and develop Social Communication				
	2.	To learn Time Speed Distance and develop work glossary				
	3.	To develop Grammar usage and learn to solve problems on ages.				
	4.	To develop Personality development & Logical thinking.				
	5.	To learn email ethics and logical ability.				

Unit-I	NUMBER SERIES & SOCIAL COMMUNICATION	(6)
Introduction-Number Series-Simplification Introduction-Telephone Calls (Formal and Informal)- Colleagues in work spot -Sharing jokes.		
Unit-II	TIME, SPEED AND DISTANCE & WORK GLOSSARY	(6)
Introduction-Problem on Time & Distance-Problem on Trains Heteronym-Homonym-Homophone-Activity Based Learning.		
Unit-III	AGES AND SYLLOGISM & GRAMMER USAGE	(6)
Problem on Ages-Syllogism-Problem on Sets and Venn Diagram Introduction-Parts of Speech-Noun-Verb-Pronoun-Adverb-Adjective-Conjunction-Preposition-Interjection.		
Unit-IV	LOGICAL REASONING & PERSONALITY DEVELOPMENT	(6)
Introduction-Alphabet Coding and Decoding –Coding with Numbers-Seating Arrangement Analyzing Strength and Weakness-Time Management.		
Unit-V	FINGURE SERIES, ODD ONE OUT, VOCABULARY & EMAIL ETIQUETTE	(6)
Introduction-Figure Matrix-Figure Series Prefix-Suffix-Synonyms-Antonyms-Word Analogy.		
Total No of Periods to be Taught		30


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TEXT BOOK:

1	Training And Placement Book [TKEC]
2	Quantitative Aptitude By R.S.Aggarwal

REFERENCES:

1	R.S. Aggarwal, "Quantitative Aptitude", Seventh edition, S.Chand Publication.
2	http://www.mastguru.com/arithmetic-aptitude-questions-answers
3	https://prepinsta.com

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Cultural Competence
CO2:	Apply concepts real world scenarios
CO3:	Identify and explain grammatical concepts
CO4:	Identify and analyze logical fallacies
CO5:	Students will understand the importance of professionalism in email communication

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	-	1	2	2	-	-	-	1	-	-	-
CO2	2	2	2	-	1	1	1	-	-	-	1	-	-	-
CO3	2	2	2	-	1	1	1	1	1	-	1	-	-	-
CO4	2	2	2		1	1	1	1	1	-	1	-	-	-
CO5	2	2	2	-	1	1	1	1	1	-	1	-	-	-
Avg.	2	2	1.6	-	1	1.2	1.2	0.6	0.6	-	1	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEET24501	POWER SYSTEM ANALYSIS	L	T	P	C	100
		3	1	0	4	
Course Objectives	• Impact knowledge on need for operational studies, and To model the power system under steady state operating condition. • To understand and apply iterative techniques for power flow analysis. • To model of carry out short circuit studies for power system during symmetrical fault. • To model of carry out short circuit – studies during. • To study about the various methods for analyzing power system stability.					

Unit-I	POWER SYSTEM	(9+3)
Need for system planning and operational studies - Power scenario in India - Power system components, Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram, Network graph Theory - Bus incidence matrices, Primitive parameters, Formation of bus admittance matrix – Direct inspection method – Singular Transformation method.		
Unit-II	POWER FLOW ANALYSIS	(9+3)
Bus classification - Formulation of Power Flow problem in polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method – Flow charts – Comparison of methods.		
Unit-III	SYMMETRICAL FAULT ANALYSIS	(9+3)
Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Bus Impedance matrix building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level - Current limiting reactors.		
Unit-IV	UNSYMMETRICAL FAULT ANALYSIS	(9+3)
Symmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - unsymmetrical fault occurring at any point in a power system.		
Unit-V	STABILITY ANALYSIS	(9+3)
Classification of power system stability – Rotor angle stability - Power-Angle equation – Steady state stability - Swing equation – Solution of swing equation by step by step method - Swing curve, Equal area criterion - Critical clearing angle and time, Multi-machine stability analysis – modified Euler method.		
Total No of Periods to be Taught		60


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TEXT BOOK:

1	John J. Grainger, William D. Stevenson, Jr, 'Power System Analysis', McGraw Hill Education (India) Private Limited, New Delhi, 2017.
2	Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, 3rd edition 2019.
3	HadiSaadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

REFERENCES:

1	Pai M A, 'Computer Techniques in Power System Analysis', Tata McGraw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007.
2	J. Duncan Glover, MulukutlaS.Sarma, Thomas J. Overbye, 'Power System Analysis & Design', Cengage Learning, Fifth Edition, 2012
3	P. Venkatesh, B. V. Manikandan, A. Srinivasan, S. Charles Raja, "Electrical Power Systems: Analysis, Security and Deregulation" Prentice Hall India (PHI), second edition - 2017
4	Gupta B.R., 'Power System - Analysis and Design', S. Chand Publishing, Reissue edition 2005.
5	Kundur P., 'Power System Stability and Control', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to model the power system under steady state operating condition.
CO2:	Ability to carry out power flow analysis using..
CO3:	Ability to infer the significance of short circuit studies in designing circuit breakers.
CO4:	Ability to analyze the state of the power system for various unsymmetrical faults.
CO5:	Ability to analyze the stability of power system using different methods

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	1	-	-	1	-	2
CO2	3	3	3	2	1	-	-	-	1	-	-	1	1	1
CO3	3	3	3	2	1	-	-	-	1	-	1	1	1	1
CO4	3	2	2	2	2	-	-	-	1	-	1	1	1	2
CO5	3	3	2	2	2	-	-	-	1	-	1	1	1	1
Avg.	3	2.6	2.4	1.8	1.4	-	-	-	1	-	1	1	1	1.4

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEET24502	POWER ELECTRONICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand the characteristics of power semiconductor devices - To understand the operation, of AC-DC power converters - To understand the operation, of DC-DC power converters - To. understand the operation, of DC-AC power converters - To. understand the operation, of AC-AC power converters					

Unit-I	POWER SEMICONDUCTOR DEVICES	(9)
Steady state operation and static V-I Characteristics of SCR, TRIAC and IGBT -Switching characteristics of SCR, TRIAC, GTO, BJT, MOSFET, and IGBT-Design of gate drives and snubber circuits		
Unit-II	AC-DC CONTROLLED CONVERTERS	(9)
Single phase half and fully controlled converters with R, RL, RLE, loads-Three phase half and fully controlled converters-performance parameters-Effect of source inductance-Dual converters.		
Unit-III	DC-DC CONVERTERS	(9)
Step down and Step up chopper control strategy-Types of chopper-Four quadrant operation-Switched mode regulators-Buck, Boost, Buck Boost regulator-Applications: Battery operated vehicles..		
Unit-IV	DC-AC CONVERTERS	(9)
Single phase bridge inverters-Three phase voltage source inverters (both 120 degree mode and 180 degree mode)-Voltage control using PWM techniques: Single PWM, Multiple PWM, Sinusoidal PWM and Modified sinusoidal PWM-Single phase current source inverter.		
Unit-V	AC-AC CONVERTERS	(9)
Principle operation of AC voltage controller (phase control)-Control strategy (integral cycle control)-Single phase AC voltage controller-Introduction to Matrix converter.		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Ned Mohan, T.M. Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", John Wiley and Sons, 3rd Edition (reprint), 2009
2	Rashid M.H., Power Electronics Circuits, Devices and Applications, Prentice Hall India, 3rd Edition, New Delhi, 2004.

REFERENCES:

1	Cyril. W.Lander, Power Electronics, McGraw Hill International, Third Edition, 1993.
2	P.S.Bimbhra, Power Electronics, Khanna Publishers, Third Edition 2003
3	Philip T.Krein, Elements of Power Electronics, Oxford University Press, 2013.
4	P.C.Sen, Power Electronics, Tata McGraw

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Apply the knowledge of various power semiconductor devices in power conversions and controls based on their applications.
CO2:	Analyze the operations and performance parameters of different types of power converters.
CO3:	Design and develop power electronic circuits including phase controlled rectifier, DC-DC converters, inverters and AC-AC converters
CO4:	Apply techniques for controlling power flow and improving efficiency in power electronics system.
CO5:	Understand the operation of AC voltage controllers and its applications.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1.5	-	-	2	3	1.5	3	3	3
CO2	3	3	3	3	2	1.5	-	-	2	3	1.5	3	3	3
CO3	3	3	3	3	2	1.5	-	-	2	3	1.5	3	3	3
CO4	3	3	3	3	2	1.5	-	-	2	3	1.5	3	3	3
CO5	3	3	3	3	2	1.5	-	-	2	3	1.5	3	3	3
Avg.	3	3	3	3	2	1.5	-	-	2	3	1.5	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEETL24501	CONTROL SYSTEMSENGINEERING	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To make the students to familiarize with various representations of systems. - To make the students to analyze the stability of linear systems in the time domain and frequency domain. - To make the students to analyze the stability of linear systems in the frequency domain. - To make the students to design compensator based on the time and frequency domain specifications. - To develop linear models: mainly state variable model and Transfer function model					

Unit-I	MODELING OF LINEAR TIME INVARIANT SYSTEM (LTIV)	(6)
Control system: Open loop and Closed loop – Feedback control system characteristics – First principle modelling : Mechanical, Electrical and Electromechanical systems – Transfer function representations: Block diagram and Signal flow graph		
Unit-II	TIME DOMAIN ANALYSIS	(6)
Standard test inputs – Time response – Time domain specifications – steady state error and error constants- Stability analysis: Concept of stability – Routh Hurwitz stability criterion – Root locus: Construction and Interpretation. Effect of adding poles and zeros		
Unit-III	FREQUENCY DOMAIN ANALYSIS	(6)
Bode plot, Polar plot– Frequency domain specifications- Introduction to closed loop Frequency Response		
Unit-IV	STATE VARIABLE ANALYSIS	(6)
State variable formulation – Non uniqueness of state space model – State transition matrix –Eigen values – Eigen vectors - Free and forced responses for Time Invariant and Time Varying Systems – Controllability – Observability		
Unit-V	DESIGN OF FEED BACK CONTROL SYSTEM	(6)
Design specifications – Lead, Lag and Lag-lead compensators using Bode plot techniques –PID controller -PID control in State Feedback form.		
Total No of Periods to be Taught	30	



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TEXT BOOK:	
1	Benjamin C. Kuo, "Automatic Control Systems", 7th edition PHI Learning Private Ltd, 2010.
2	Nagarath, I.J. and Gopal, M., "Control Systems Engineering", International Publishers 2010

REFERENCES:	
1	Richard C.Dorf and Bishop, R.H., "Modern Control Systems", Education Pearson, Impression 2009.
2	John J.D., Azzo Constantine, H. and HoupisSttuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor& Francis Reprint 2009
3	Katsuhiko Ogata, "Modern Control Engineering", PHI Learning Private Ltd, 5thEdition, 2010

List of Exercises/Experiments	
1.	Study of Open-Loop and Closed-Loop Systems
2.	Modeling of Mechanical Systems
3.	Modeling of Electrical systems
4.	Time Response Analysis of First and Second Order Systems
5.	Simulation of Systems using root locus
6.	Stability Analysisof Systems using Bode plot
7.	Stability Analysisof Systems using polar plot
8.	Effect of Addition of Poles and Zeros on System Stability
9.	Designof Lag-Lead Compensators
10.	Effect of P, PI, PID Controller on DC Motor Speed Control
Total No of Periods to be Taught	
30	

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Represent simple systems in transfer function and state variable forms.
CO2:	Analyze simple systems in time domain.
CO3:	Analyze simple systems in frequency domain.
CO4:	Infer the stability of systems in time and frequency domain.
CO5:	Interpret characteristics of the system and find out solution for simple control problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.N O	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Computer with required software	Required nos.


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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	1	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	1	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	1	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	1	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	1	-	-	-	3	3	3	3
Avg.	3	3	3	3	3	-	1	-	-	-	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEL24501	POWER ELECTRONICS LABORATORY	L	T	P	C	100
		0	0	3	1.5	
Course Objectives	- To study the VI characteristics of SCR, TRIAC, MOSFET and IGBT. To analyze the performance of semi converter, full converter, step up, step down choppers by simulation and experimentation. - To study the behavior of voltage waveforms of PWM inverter applying various modulation techniques. - To design and analyze the performance of SMPS. - To study the performance of AC voltage controller by simulation and Experimentation.					

List of Exercises/Experiments	
1.Characteristics of SCR and TRIAC	
2.Characteristics of MOSFET and IGBT.	
3.AC to DC half controlled converter.	
4.AC to DC fully controlled converter.	
5.Step down and step up MOSFET based choppers.	
6.IGBT based single phase PWM inverter	
7. AC Voltage controller	
8.Switched mode power converter.	
9.Simulation of PE circuits (1 Φ & 3 Φ semi converter, 1 Φ & 3 Φ full converter, dc-dc converters, ac voltage controllers).	
Total No of Periods to be Taught	
45	

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Determine the characteristics of SCR, IGBT, TRIAC, MOSFET and IGBT
CO2:	Find the transfer characteristics of full converter, semi converter, step up and step down choppers by simulation experimentation.
CO3:	Analyze the voltage waveforms for PWM inverter using various modulation techniques.
CO4:	Design and experimentally verify the performance of basic DC/DC converter topologies used for SMPS.
CO5:	Understand the performance of AC voltage controllers by simulation and experimentation


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.N O	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Bread board 15	15 Nos
2	SCR Trainer Kit	1 Nos
3	TRIAC Trainer Kit	1 Nos
4	IGBT Trainer Kit	1 Nos
5	MOSFET Trainer Kit	1 Nos
6	Single phase Half converter	1 Nos
7	Single phase Full converter	1 Nos
8	Step down / Step up chopper	1 Nos
9	Single phase PWM Inverter	1 Nos
10	AC Voltage Controller	1 Nos
11	Patchchords	20
12	Multimeter	2 Nos
13	CRO	5 Nos
14	Computer	5 Nos

Mapping of COs with POs and PSOs														
COs/POs	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
CO2	3	3	3	3	3	-	1.5	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	1.5	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	1.5	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	1.5	-	-	-	3	3	3	3
Avg.	3	3	3	3	3	-	1.5	-	-	-	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEL24502	SUMMER INTERNSHIP I*	0	0	0	1	100
Course Objectives	- Get connected with industry/laboratory/research institute - Get practical knowledge on production process in the industry and develop skills to solve related problems - Develop skills to carry out research in the research institutes/laboratories - The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within 1 month from the commencement of next semester. The students will be evaluated as per the Regulations.					

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to identify industrial/ research problems by applying knowledge gained on basics of science and Engineering
CO2:	Analysis of industrial/ research problems and their solutions
CO3:	Documentation of system specifications, design methodologies, process parameters, testing parameters and results
CO4:	Preparing of technical report and presentation
CO5:	Ability to acknowledge the value of continuing education for oneself and to stay up with technology advancements

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	-	-	-	-	3	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	3	-	3	-	-	-	-	-	3
CO4	-	-	-	-	-	-	3	3	3	3	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	3	3	3	3
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department	Mechanical	Programme Code & Name				105-B.E EEE
Semester V						
Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UIDL24001	IDEA LAB	L	T	P	C	100
		0	0	2	1	
Course Objectives	- To learn all the skills associated with the tools and inventory associated with the IDEA Lab. - To familiarize with PCB design and prototyping - To explore design software and laser cutting for fabrication - To perform basic turning operation on a lathe machine - To introduce basic 3D modeling and additive manufacturing					

List of Exercises/Experiments	
1. To study the working principles and operation of wood lathe machine.	
2. To Study the 3D 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.	
3. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.	
4. Making of Models Using CNC Wood Router	
5. 3D Printing of Scanned Geometry Using FDM, SLA Printer, 3D Printing of Scanned Geometry	
Total No of Periods to be Taught	30 periods

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Apply basic design thinking principles to conceptualize and develop simple prototypes using digital fabrication tools such as 3D printers, scanners, and PCB machines.
CO2:	Demonstrate the ability to operate modern prototyping equipment like laser cutters, CNC machines, and lathes to fabricate mechanical and electronic components.
CO3:	Integrate mechanical design, electronics, and fabrication techniques to develop interdisciplinary solutions for real-world problems through hands-on experimentation


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	PCB Prototyping Machines	01 No
2	CNC Wood Router	01 No
3	CO ₂ Laser Cutter	01 No
4	3D Printer	05 No
5	3D Scanner	02 No

Mapping of COs with POs and PSOs														
COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	1	3	1	-	-	-	-	-	-	-	-
CO2	2	2	2	2	3	2	-	-	-	-	-	-	-	-
CO3	3	3	3	2	3	2	-	-	-	-	-	-	-	-
Avg.	2	2	2	2	3	2	-	-	-	-	-	-	-	-
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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Department	Mechanical	Programme Code & Name	105-B.E EEE
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
USD24501	SOFT SKILL 3	L	T	P	C	100
		2	0	0	0	
Course Objectives	1. To learn the Number Problem, Square and Cube Problems. 2. To learn Analytical and Interview Skills. 3. To develop Skills in Business Aptitude and Resume Building. 4. To develop Skills in Data Interpretation and Sufficiency. 5. To improve Mathematical Skill on Probability and Basic Grammer					

Unit-I	PROBLEMS ON NUMBERS & GROUP DISCUSSION	(6)
Introduction-Problem on Numbers –Square root Problems- Cube Root-Surds and Indices GD Introduction –GD gauge –Company’s Perspective-Preparation.		
Unit-II	ANALYTICAL REASONING &INTERVIEW SKILLS	(6)
Introduction, Problems on Analytical and Reasoning-Nonverbal Reasoning Introduction for Interview Skill-Before the Interview, During the Interview, After the Interview.		
Unit-III	BUSINESS APTITUDE & RESUME BUILDING	(6)
Introduction-Problem Percentage-Problem on Partnership Purpose of Resume Building –Types-Includes-Formal-Sample-Tips.		
Unit-IV	DATA INTERPRETATION AND SUFFICIENCY/BLOOD RELATION	(6)
Introduction-Table Charts-Bar Charts – Pie Charts- Line Charts-Data Sufficiency Introduction of Blood Relation-Objectives-Relation Ships –Example-Exercise		
Unit-V	PERMUTATION & COMBINATIONS, PROBABILITY/GRAMMER	(6)
Introduction - Problem on Permutation & Combination-Problems on Probability, Comparison of Ranks Introduction of Basic Grammar-Punctuation & Spelling.		
Total No of Periods to be Taught		30


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TEXT BOOK:

1	Training And Placement Book [TKEC]
2	Quantitative Aptitude by R. S. Aggarwal

REFERENCES:

1	R.S. Aggarwal, "Quantitative Aptitude", Seventh edition, S. Chand Publication.
2	http://www.mastguru.com/arithmetic-aptitude-questions-answers
3	https://prepinsta.com

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Advanced Mathematical Skills.
CO2:	Complex Problem-Solving Skill.
CO3:	Build Confidence in Mathematics.
CO4:	Solve mathematical problems by applying logical thinking.
CO5:	Apply different techniques for faster calculations.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	2	-	-	-	-	-	3	3	2
CO2	3	3	3	3	2	2	-	-	-	-	-	3	3	2
CO3	3	2	2	1	1	3	-	-	-	-	-	2	3	2
CO4	3	3	2	2	2	2	-	-	-	-	-	3	3	2
CO5	2	2	2	1	3	3	-	-	-	-	-	2	2	3
Avg.	2.8	2.4	2.2	1.8	1.8	2.4	-	-	-	-	-	2.6	2.8	2.2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

Department	EEE	Programme Code & Name	105-B.E EEE
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEET24601	PROTECTION AND SWITCHGEAR	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand the significance of protection, protection schemes and role of earthing. - To study the characteristics, functions and application areas of various relays. - To acquire practical knowledge about common faults in power system apparatus and applying suitable protective schemes. - To understand the functioning of static relays and Numerical protection concepts. - To understand the problems associated with circuit breaking and to discuss about various circuit breakers.					

Unit-I	PROTECTION SCHEMES	(9)
Significance and need for protective schemes – nature and causes of faults – types of faults Effects of faults - Zones of protection and essential qualities of protection – Types of Protection schemes - Power system Grounding and Methods of Grounding.		
Unit-II	BASICS OF RELAYS	(9)
Operating principles of relays –Universal torque equation - R-X diagram –Electromagnetic Relays – Over current, Directional and non-directional, Distance, Differential, Negative sequence and Under frequency relays.		
Unit-III	OVERVIEW OF EQUIPMENT PROTECTION	(9)
Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, bus bars and transmission line.		
Unit-IV	STATIC RELAYS AND NUMERICAL PROTECTION	(9)
Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Over current protection, transformer differential protection, and distanceprotection of transmission lines.		
Unit-V	CIRCUIT BREAKERS	(9)
Physics of arcing phenomenon and arc interruption – DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - current chopping - interruption of capacitive current - resistance switching - Types of circuit breakers – air blast, oil, SF6 and vacuum circuit breakers – comparison of different circuit breakers – HVDC Breaker		
Total No of Periods to be Taught	45	


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TEXT BOOK:	
1	Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, Four Edition, 2010.
2	BadriRam ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age International Pvt Ltd Publishers, Second Edition 2011.
3	B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., Second Edition, 2018
4	ArunIngle, 'Switch Gear and Protection' Pearson Education, 2018.

REFERENCES:	
1	Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition,Prentice Hall of India Pvt. Ltd., New Delhi, 2013.
2	C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2018
3	VK Metha," Principles of Power Systems", S. Chand, Reprint, 2013
4	BhaveshBhalja, R.P. Maheshwari, Nilesh G. Chotani,'Protection and Switchgear' Oxford University Press, 2nd Edition 2018.

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Understand and select proper protective scheme and type of earthing.
CO2:	Explain the operating principles of various relays.
CO3:	Suggest suitable protective scheme for the protection of various power system apparatus.
CO4:	Analyze the importance of static relays and numerical relays in power system protection.
CO5:	Summarize the merits and demerits and application areas of various circuit breakers.

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	2	1	2	1	1	1	2	-	3	1	-
CO2	3	1	1	2	1	2	1	1	1	2	-	3	1	-
CO3	3	1	1	2	1	2	1	1	1	2	-	3	2	-
CO4	3	1	1	2	1	2	1	1	1	2	-	3	2	1
CO5	3	1	1	2	2	2	1	1	1	2	-	3	1	1
Avg.	3	1	1	2	1.2	2	1	1	1	2	-	3	1.4	1
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														


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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEET24602	POWER SYSTEM OPERATION AND CONTROL	L	T	P	C	100
		3	1	0	4	
Course Objectives	• The significance of power system operation and control. • Real power– frequency interaction and design of power– frequency controller. • Reactive power– voltage interaction and the compensators for maintaining the voltage profile. • The generation scheduling and economic operation of power system. • SCADA and its application for real time operation and control of power systems					

Unit-I	INTRODUCTION	(9+3)
Power scenario in Indian grid – National and Regional load dispatching centres – Requirements of good power system – Necessity of voltage and frequency regulation – real power vs frequency and reactive power vs voltage control loops - System load variation, load curves – Load forecasting – Computational methods in load forecasting – Load shedding and Islanding.		
Unit-II	REAL POWER FREQUENCY CONTROL	(9+3)
Basics of speed governing mechanisms and modelling – Speed regulation of two generators in parallel Load Frequency Control (LFC) of single area system – Static and dynamic analysis – LFC of two area system –Tie line modelling – Block diagram representation of two area system – Static and dynamic analysis – Tie line with frequency bias control– Integration of economic dispatch control with LFC..		
Unit-III	REACTIVE POWER – VOLTAGE CONTROL	(9+3)
Generation and absorption of reactive power – Basics of reactive power control – Automatic Voltage Regulator (AVR) – Brushless AC excitation system – Block diagram representation of AVR loop static and dynamic analysis – Stability compensation – Voltage drop in transmission line – Methods of reactive power injection – Tap changing transformer, SVC and STATCOM for voltage control		
Unit-IV	ECONOMIC OPERATION OF POWER SYSTEM	(9+3)
Statement of economic dispatch problem – Input and output characteristics of thermal plant incremental cost curve – Optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) – Lambda–iteration method – Base point and participation factors method. Statement of Unit Commitment (UC) problem – Constraints on UC problem – Solution of UC problem using priority list..		
Unit-V	COMPUTER AIDED CONTROL OF POWER SYSTEM	(9+3)
Need of computer control of power system – Concept of energy control centers and functions – PMU system monitoring, Data acquisition and controls – System hardware configurations – SCADA and EMS functions – State estimation – Measurements and errors – Various operating states – State transition diagram.		
Total No of Periods to be Taught		60



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TEXT BOOK:

1	Olle. I. Elgerd, 'Electric Energy Systems theory – An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 2nd edition, 2017.
2	Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 3rd edition, 2013.
3	AbhijitChakrabarti and SunitaHalder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Fourth Edition, 2018.

REFERENCES:

1	Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw– Hill Education, Second Edition, Reprint 2018.
2	HadiSaadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 23rd reprint, 2015.
3	Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 12th reprint, 2015.
4	B.M. Weedy, B.J. Cory et al, 'Electric Power systems', Wiley, Fifth Edition, 2012.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understand the day – to – day operation of power system.
CO2:	Model and analyse the control actions that are implemented to meet the minute-tominute variation of system real power demand.
CO3:	Model and analyze the compensators for reactive power control and various devices used for voltage control.
CO4:	Prepare day ahead and real time economic generation scheduling.
CO5:	Understand the necessity of computer control of power systems.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	1	-	-	-	2	3	3	3
CO2	3	2	1	1	-	1	2	-	2	-	2	3	3	3
CO3	3	2	1	1	-	1	2	-	2	-	2	3	3	3
CO4	3	2	1	1	-	1	2	-	2	-	2	3	1	2.33
CO5	2	1	-	-	-	-	1	-	2	-	2	3	3	3
Avg.	2	1.6	1	1	-	1	1.6	-	2	-	2	3	2.2	2.86

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEL24601	POWER SYSTEM LABORATORY	L	T	P	C	100
		0	0	3	1.5	
Course Objectives	- To provide a better understanding of modelling of transmission lines in impedance and admittance forms. - To apply iterative techniques for power flow analysis and to carry out short circuit and stability studies on power system. - To analyze the load – frequency and voltage controls.					

List of Exercises/Experiments	
1.Computation and modelling of transmission Lines.	
2.Formation of Bus Admittance Matrices.	
3.Formation of Bus Impedance Matrices.	
4.Power Flow Analysis Using Gauss-Seidel Method.	
5.Power Flow Analysis Using Newton Raphson Method.	
6.Symmetric and Unsymmetrical Fault Analysis.	
7.Transient Stability Analysis of SMIB System.	
8.Load – Frequency Dynamics of Single- Area Power Systems.	
9.Load – Frequency Dynamics of Two-Area Power Systems.	
10.Economic Dispatch in Power Systems.	
Total No of Periods to be Taught	45

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Model and analyze the performance of the transmission lines.
CO2:	Perform impedance calculation for any power system network.
CO3:	Understand, design, and analyze the load frequency control mechanism.
CO4:	Perform optimal scheduling of generators and compute the state of the power system.
CO5:	Perform power flow, short circuit, and stability analysis for any power system network.


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List of Exercises/Experiments	
1. Personal Computer 30 Nos	
2. Software: Any Power system simulation software 1 No	
Total No of Periods to be Taught	45

Mapping of COs with POs and PSOs														
COs/ POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	2	3	-	2	1	2	-	3	3	3	3
CO2	3	3	1	2	3	-	2	1	2	-	3	3	3	3
CO3	3	3	1	2	3	-	2	1	2	-	3	3	3	3
CO4	3	3	1	2	3	-	2	1	2	-	3	3	3	3
CO5	3	3	1	2	3	-	2	1	2	-	3	3	3	3
Avg.	3	3	1	2	3	-	2	1	2	-	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEL24602	MINI PROJECT	L	T	P	C	100
		0	0	4	2	
Course Objectives	- To develop their own innovative prototype of ideas. - To train the students in preparing mini project reports and examination					

The students in a group of 4 to 6 works on a topic approved by the Head of the Department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report is evaluated by the examiners constituted by the Head of the Department

Total No of Periods to be Taught	45
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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to identify, formulate, design, interpret, analyze and provide solutions to complex engineering and societal issues by applying knowledge gained on basics of science and Engineering.
CO2:	Ability to choose, conduct and demonstrate a sound technical knowledge of their selected project topics in the field of power components, protection, high voltage, electronics, process automation, power electronics and drives instrumentation and control by exploring suitable engineering and IT tools.
CO3:	Ability to understand, formulate and propose new learning algorithms to solve engineering and societal problems of moderate complexity through multidisciplinary projects understanding commitment towards sustainable development.
CO4:	Ability to demonstrate, prepare reports, communicate and work in a team as a member/leader by adhering to ethical responsibilities.
CO5:	Ability to acknowledge the value of continuing education for oneself and to stay up with technology advancements.

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Mapping of COs with POs and PSOs														
COs/ POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	-	-	-	-	3	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	3	-	3	-	-	-	-	-	3
CO4	-	-	-	-	-	-	3	3	3	3	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	3	3	3	3
Avg.	2.4	2.4	2.8	1.8	3	1.8	1.5	-	-	-	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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Department	Mechanical	Programme Code & Name	105-B.E EEE
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
USD24601	SOFT SKILL 4	L	T	P	C	100
		2	0	0	0	
Course Objectives	1.	To learn the essence of Ratio and Proportion.				
	2.	To learn a problem related to Simple Interest and Compound Interest.				
	3.	To develop Skills in Solving Problems Related to Boats and Streams.				
	4.	To develop Skills in solving Problems Related to Height and Distance.				
	5.	To improve a Skill in Solving Problem on Allegation or Mixture.				

Unit-I	RATIO AND PROPORTION, PIPES AND CISTERNS	(6)
Introductions - Pipes & Outlet Problem - Problem on Ratio & Proportion.		
Unit-II	SIMPLE INTEREST AND COMPOUND INTEREST & SPEAKING ACTIVITY	(6)
Introduction-Simple Interest-Compound Interest-Different Rules-Present worth.		
Unit-III	BOAT AND STREAM, CALENDAR & LOGICAL ARRANGEMENT OF WORDS	(6)
Introduction-Upstream & Downstream Problems-Problems on Calendar Introduction of Classification-Logical Arrangement of Words.		
Unit-IV	HEIGHT AND DISTANCE, CLOCK	(6)
Introduction-Trigonometry Formulas- Angle of Elevation-Angle of Depression –Problem on Clock.		
Unit-V	ALLIGATION OR MIXTURE, STATEMENT & CONCLUSION	(6)
Introduction – Alligation -Mean Price-Rule of Allegation-Problem on Mixture Introduction to Statement and Conclusion –Exercise for Statement and Conclusion.		
Total No of Periods to be Taught		30


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TEXT BOOK:

1	Training And Placement Book [TKEC]
2	Quantitative Aptitude By R.S.Aggarwal

REFERENCES:

1	R.S. Aggarwal, "Quantitative Aptitude", Seventh edition, S.Chand Publication.
2	http://www.mastguru.com/arithmetric-aptitude-questions-answers
3	https://prepinsta.com

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Advanced Mathematical Skills.
CO2:	Complex Problem-Solving.
CO3:	Data Analysis.
CO4:	Real World Applications.
CO5:	Mathematical concepts on Statement and Conclusion.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1	1	2	1	1	3	3	2	2
CO2	3	3	3	3	2	1	1	2	2	2	3	3	3	3
CO3	2	2	2	3	3	1	1	2	2	2	2	2	3	2
CO4	3	2	3	2	2	2	1	2	2	2	3	3	2	2
CO5	3	3	2	2	2	1	2	2	2	1	3	3	2	3
Avg.	3	2.4	2.4	2.4	2	1.2	1.2	2	1.8	1.6	2.8	2.8	2.4	2.4

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Department	EEE	Programme Code & Name				105-B.E EEE
Semester VII						
Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEET24701	HIGH VOLTAGE ENGINEERING	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Various types of over voltages in power system and protection methods. - Generation of over voltages in laboratories. - Measurement of over voltages. - Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics. - Testing of power apparatus and insulation coordination					
Unit-I	OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS					(9)
Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages – Reflection and Refraction of Travelling waves- protection against over voltages-Insulation Coordination.						
Unit-II	DIELECTRIC BREAKDOWN					(9)
Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields –Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipment.						
Unit-III	GENERATION AND MEASUREMENTS OF HIGH VOLTAGES AND HIGH CURRENTS					(9)
Generation of High DC, AC, impulse voltages and currents - Analysis of DC/AC and Impulse generator circuits - Tripping and control of impulse generators, Measurement of High voltages and High currents – High Resistance with series ammeter – Dividers - Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters, Electrostatic Voltmeters – Sphere Gaps, High current shunts- Digital techniques in high voltage measurement.						
Unit-IV	HIGH VOLTAGE TESTING & INSULATION COORDINATION					(9)
High voltage testing of electrical power apparatus- International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers - Insulation Coordination						
Unit-V	APPLICATION IN INDUSTRY					(9)
Introduction – electrostatic applications- electrostatic precipitation, separation, painting / coating, spraying, imaging, printing, Transport of materials – manufacturing of sand paper – Smoke particle detector – Electrostatic spinning, pumping, propulsion – Ozone generation – Biomedical applications.						
Total No of Periods to be Taught		45				



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TEXT BOOK:

1	M.S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2	E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second Edition, Elsevier, New Delhi, 2005.
3	C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Fourth Edition, 2020.

REFERENCES:

1	L.L.Alston, High Voltage Technology, Oxford University Press, First Indian Edition 2006.
2	C.L.Wadhwa, High voltage Engineering, New Age International Publishers, Fourth Edition, 2020
3	Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, RoshdayRadwan, High Voltage Engineering – Theory & Practice, Second Edition, Taylor & Francis Group, 2019
4	Subir Ray.” An Introduction to High Voltage Engineering “PHI Learning Private Limited, New Delhi, Second Edition -2011

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain various overvoltage's and its effects on power systems.
CO2:	Understand the breakdown phenomena in different medium under uniform and non-uniform fields.
CO3:	Explain the methods of generating and measuring High DC, AC, Impulse voltage and currents.
CO4:	Suggest and Conduct suitable HV testing of Electrical power apparatus as per Standards
CO5:	Explain the Industrial Applications of Electrostatic Fields.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	-			-	-	-	-	-	3	2	-
CO2	3	2	-	1		-	-	-	-	-	-	3		-
CO3	2	2	3	1		-	-		-	2	3	3	2	-
CO4	1	2	3	1		-	1	1	-		3	3	2	-
CO5	2	2	1	-		2	-	-	-	2	-	3		2
Avg.	2	2	2.33	1		2	1	1	-	2	3	3	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester VII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UGET24707	HUMAN VALUES AND ETHICS	2	0	0	2	100
Course Objectives	- To create awareness about values and ethics enshrined in the Constitution of India - To sensitize students about the democratic values to be upheld in the modern society. - To inculcate respect for all people irrespective of their religion or other affiliations. - To instill the scientific temper in the students' minds and develop their critical thinking					

Unit-I	DEMOCRATIC VALUES	(9)
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Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance – World Democracies: French Revolution, American Independence, Indian Freedom Movement.

Reading Text: Excerpts from John Stuart Mills' On Liberty

Unit-II	SECULAR VALUES	(9)
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Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices.

Reading Text: Excerpt from Secularism in India: Concept and Practice by Ram Puniyani.

Unit-III	SCIENTIFIC VALUES	(9)
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Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing Hypothesis, Validating facts using evidence based approach – Skepticism and Empiricism – Rationalism and Scientific Temper.

Reading Text: Excerpt from The Scientific Temper by Antony Michaelis R

Unit-IV	SOCIAL ETHICS	(9)
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Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.

Reading Text: Excerpt from 21 Lessons for the 21st Century by Yuval Noah Hariri

Unit-V	SCIENTIFIC ETHICS	(9)
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Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.

Reading Text: Excerpt from American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer by Kai Bird and Martin J. Sherwin.

Total No of Periods to be Taught	45
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REFERENCES:

1	The Nonreligious: Understanding Secular People and Societies, Luke W. Galen Oxford University Press, 2016.
2	Secularism: A Dictionary of Atheism, Bullivant, Stephen; Lee, Lois, Oxford University.
3	The Oxford Handbook of Secularism, John R. Shook, Oxford University Press, 2017.
4	The Civic Culture: Political Attitudes and Democracy in Five Nations by Gabriel A. Almond and Sidney Verba, Princeton University Press,
5	Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January 2022

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Identify the importance of democratic, secular and scientific values in harmonious functioning of social life
CO2:	Practice democratic and scientific values in both their personal and professional life.
CO3:	Find rational solutions to social problems.
CO4:	Behave in an ethical manner in society
CO5:	Practice critical thinking and the pursuit of truth.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	--	3	2	-
CO2	3	2	-	1	-	-	-	-	-	-	-	3	-	-
CO3	2	2	3	1	-	-	-	-	-	2	3	3	2	-
CO4	1	2	3	1	-	-	1	1	-		3	3	2	-
CO5	2	2	1	-	-	2	-	-	-	2	-	3	-	2
Avg.	2	2	2.33	1	-	2	1	1	-	2	3	3	2	2

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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester VII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEL24701	SUMMER INTERNSHIP II [#]	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Get connected with industry/laboratory/research institute • Get practical knowledge on production process in the industry and develop skills to solve related problems • Develop skills to carry out research in the research institutes/laboratories • The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within 1 month from the commencement of next semester. The students will be evaluated as per the Regulations.					

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to identify industrial/ research problems by applying knowledge gained on basics of science and Engineering
CO2:	Analysis of industrial/ research problems and their solutions
CO3:	Documentation of system specifications, design methodologies, process parameters, testing parameters and results
CO4:	Preparing of technical report and presentation
CO5:	Ability to acknowledge the value of continuing education for oneself and to stay up with technology advancements

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	-	-	-	-	3	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	3	-	3	-	-	-	-	-	3
CO4	-	-	-	-	-	-	3	3	3	3	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	3	3	3	3
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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Department	EEE	Programme Code & Name	105-B.E EEE
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Semester VIII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEL24801	PROJECT WORK / INTERNSHIP	L	T	P	C	100
		0	0	20	10	
Course Objectives	• The student should be made to learn methodology to select a good project and able to work in a team leading to development of hardware/software product. prepare a good technical report. Gain Motivation to present the ideas behind the project with clarity. • A Project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen Comprehension of principles by applying them to a new problem which may be the design /fabrication of any power component / circuit / sensor / Activator / Controller, research investigation, a computer or management project or a design problem. • The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report					

Total No of Periods to be Taught	300
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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to identify, formulate, design, interpret, analyze and provide solutions to complex engineering and societal issues by applying knowledge gained on basics of science and Engineering.
CO2:	Ability to choose, conduct and demonstrate a sound technical knowledge of their selected project topics in the field of power components, protection, high voltage, electronics, process automation, power electronics and drives instrumentation and control by exploring suitable engineering and IT tools.
CO3:	Ability to understand, formulate and propose new learning algorithms to solve engineering and societal problems of moderate complexity through multidisciplinary projects understanding commitment towards sustainable development.
CO4:	Ability to demonstrate, prepare reports, communicate and work in a team as a member/leader by adhering to ethical responsibilities.
CO5:	Ability to acknowledge the value of continuing education for oneself and to stay up with technology advancements.



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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	-	-	-	-	3	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	3	-	3	-	-	-	-	-	3
CO4	-	-	-	-	-	-	3	3	3	3		-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	3	3	3	3
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGET24701	PRINCIPLES OF MANAGEMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Sketch the Evolution of Management. • Extract the functions and principles of management. • Learn the application of the principles in an organization. • Study the various HR related activities. • Analyze the position of self and company goals towards business.					

Unit-I	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	(9)
Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers- managerial roles and skills – Evolution of Management –Scientific, human relations, system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.		
Unit-II	PLANNING	(9)
Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.		
Unit-III	ORGANISING	(9)
Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.		
Unit-IV	DIRECTING	(9)
Foundations of individual and group behaviour– Motivation – Motivation theories –Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.		
Unit-V	CONTROLLING	(9)
System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control –Productivity problems and management –Control and performance – Direct and preventive control – Reporting.		
Total No of Periods to be Taught		45 periods

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TEXT BOOK:

- 1 Harold Koontz and Heinz Weihrich “ Essentials of management ”TataMcGrawHill, 1998.
- 2 Stephen P. Robbins and Mary Coulter, “Management”, Prentice Hall(India)Pvt.Ltd., 10th Edition, 2009.

REFERENCES:

- 1 Robert Kreitner and Mamata Mohapatra, “Management”, Biztantra, 2008.
- 2 Stephen A. Robbins and David A. Decenzo and Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
- 3 Tripathy P C and Reddy PN, “Principles of Management”, Tata McgrawHill, 1999.

COURSE OUTCOMES:

On completion of the course, the students will be able to

- | | |
|------|--|
| CO1: | Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling. |
| CO2: | Have same basic knowledge on international aspect of management. |
| CO3: | Ability to understand management concept of organizing. |
| CO4: | Ability to understand management concept of directing. |
| CO5: | Ability to understand management concept of controlling. |

Mapping of COs with POs and PSOs

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	-	-	-	-	1	-	-	-	-	-	-	2	1	1
CO2	-	1	1	-	-	-	-	-	-	-	-	-	2	1	-
CO3	1	-	-	2	1	-	1	-	2	-	1	1	-	-	2
CO4	-	1	1	1	1	-	-	1	2	-	-	-	1	1	1
CO5	1	-	-	-	1	1	-	-	-	3	-	1	1	-	1
Avg.	1. 6	1	1	1.5	1.5	1	1	1	2	3	1	1	1.5	1	1.25

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom’s Taxonomy

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Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGET24702	TOTAL QUALITY MANAGEMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM. - Explain the TQM Principles for application. Describe Taguchi's Quality Loss Function, performance measures and apply Techniques like QFD, TPM, COQ and BPR. - Illustrate and apply QMS and EMS in any organization. - Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.					

Unit-I	INTRODUCTION	(9)
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM - Gurus of TQM(Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.		
Unit-II	TQM PRINCIPLES	(9)
Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement –Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.		
Unit-III	TQM TOOLS & TECHNIQUES I	(9)
The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.		
Unit-IV	TQM TOOLS & TECHNIQUES II	(9)
Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.		
Unit-V	QUALITY MANAGEMENT SYSTEM	(9)
Introduction-BenefitsofISORegistration-ISO9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation- Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards— Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.		

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Total No of Periods to be Taught	45 periods
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TEXT BOOK:	
1	Dale H. Besterfield, Carol B.Michna, Glen H.Besterfield, Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES:	
1	Joel.E.Ross, "Total Quality Management-Text and Cases", Routledge, 2017.
2	Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth-Heinemann Ltd, 2016.
3	Oakland, J.S. "TQM-Text with Cases", Butterworth-Heinemann Ltd., Oxford, Third Edition, 2003.
4	Suganthi, Land An and Samuel, "Total Quality Management", Prentice Hall (India) Pvt.Ltd., 2006.

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Ability to apply TQM concepts in a selected enterprise.
CO2:	Ability to apply TQM principles in a selected enterprise.
CO3:	Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4:	Ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM
CO5:	Ability to apply QMS and EMS in any organization.

Mapping of COs with POs and PSOs															
COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO 11	PO1 2	PSO 1	PSO 2	PSO3
CO1	-	3	-	-	-	-	-	-	-	-	-	3	2	-	3
CO2	-	-	-	-	-	3	-	-	-	-	-	3	-	2	
CO3	-	-	-	-	3	-	-	-	3	-	-		-	2	3
CO4	-	2	-	-	3	2	3	2	-	-	-	3	3	2	
CO5			3			3	3	2							
Avg.	-	3	-	-	-	-	-	-	-	-	-	3	2	-	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy															

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Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGET24703	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Understanding the concept of Engineering Economics. • Implement various micro economics concept in real life. • Gaining knowledge in the field of macro economics to enable the students to have better understanding of various components of macroeconomics. • Understanding the different procedures of pricing. • Learn the various cost related concepts in microeconomics.					

Unit-I	DEMAND&SUPPLY ANALYSIS	(9)
Managerial Economics-Relationship with other disciplines-Firms: Types, objectives and goals - Managerial decisions - Decision analysis. Demand - Types of demand – Determinants of demand - Demand function – Demand elasticity - Demand forecasting - Supply – Determinants of supply - Supply function -Supply elasticity.		
Unit-II	PRODUCTIONANDCOST ANALYSIS	(9)
Production function>Returns to scale - Production optimization-Least cost input- Isoquants – Managerial uses of production function. Cost Concepts-Cost function-Determinants of cost-Short run and Long run cost curves - Cost Output Decision - Estimation of Cost.		
Unit-III	PRICING	(9)
DeterminantsofPrice-Pricingunderdifferentobjectivesanddifferentmarketstructures – Price discrimination-Pricing methods in practice.		
Unit-IV	FINANCIALACCOUNTING(ELEMENTARYTREATMENT)	(9)
Balance sheet and related concepts- Profit & Loss Statement and related concepts—Financial Ratio Analysis-Cash flow analysis-Funds flow analysis- Comparative financial statements-Analysis & Interpretation official statements.		
Unit-V	CAPITALBUDGETING(ELEMENTARYTREATMENT)	(9)
Investments- Risks and return evaluation of investment decision- Average rate of return- Payback Period- Net Present Value- Internal rate of return.		
Total No of Periods to be Taught		45 periods

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TEXT BOOK:

1	Paneer Selvam, R, “ Engineering Economics ”,Prentice Hall of India Ltd,NewDelhi,2001.
2	Managerial Economics: Analysis, Problems and Cases- P.L.Mehta,Edition,13.Publisher, Sultan Chand, 2007.

REFERENCES:

1	Chan S.Park, “ Contemporary Engineering Economics ”, Prentice Hall of India,2011.
2	Donald. G.Newman, Jerome. P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.
3	Degarmo, E.P.,Sullivan, W.G and Canada, J.R,“Engineering Economy”, Macmillan, New York, 2011.
4	Zahid Akhan: Engineering Economy, "Engineering Economy", Dorling Kindersley,2012
5	Dr. S.N.Maheswari and Dr. S.K.Maheshwari: Financial Accounting, Vikas, 2009

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions
CO2:	Evaluate the economic theories, cost concepts and pricing policies
CO3:	Understand the market structures and integration concepts
CO4:	Understand the measures of national income, the functions of banks and concepts of globalization
CO5:	Apply the concepts official management for project appraisal

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	2	-	-	1	3
CO2	-	3	-	-	-	-	-	-	-	-	-	-		2
CO3	-	2	-	-	-	-	-	-	-	-	-	-		0
CO4	2	3	3	-	2	-	-	-	-	-	-	-	2	3
CO5	3	3	3	-	2	-	-	-	-	-	-	-	2	0

1 – Slight, 2 – Moderate, 3 –Substantial, BT – Bloom’s Taxonomy

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Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGET24704	HUMAN RESOURCE MANAGEMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To provide knowledge about management issues related to staffing, • To provide knowledge about management issues related to training, • To provide knowledge about management issues related to performance • To provide knowledge about management issues related to compensation • To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements.					

Unit-I	INTRODUCTION TO HUMAN RESOURCE MANAGEMENT	(9)
The importance of human resources– Objective of Human Resource Management-Human resource policies - Role of human resource manager.		
Unit-II	HUMAN RESOURCE PLANNING	(9)
Importance of Human Resource Planning – Internal and External sources of Human Resources - Recruitment - Selection – Socialization.		
Unit-III	TRAINING AND EXECUTIVE DEVELOPMENT	(9)
Types of training and Executive development methods–purpose–benefits.		
Unit-IV	EMPLOYEE COMPENSATION	(9)
Compensation plan–Reward–Motivation–Career Development–Mentor–Protege relationships.		
Unit-V	PERFORMANCE EVALUATION AND CONTROL	(9)
Performance evaluation – Feedback - The control process – Importance –Methods – grievances – Causes – Redressal methods.		
Total No of Periods to be Taught		45 periods

TEXT BOOK:	
1	Decenzo and Robbins, "Human Resource Management", 8th Edition, Wiley, 2007.
2	John Bernardin. H., "Human Resource Management–An Experimental Approach", 5 th Edition, Tata McGraw Hill, 2013, New Delhi.

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REFERENCES:

1	Luis R., Gomez-Mejia, DavidB. Balkin and Robert L. Cardy, "ManagingHumanResources", 7 th Edition, PHI, 2012.
2	Dessler, "Human Resource Management", Pearson Education Limited, 2007.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Students would have gained knowledge on the various aspects of HRM
CO2:	Students will gain knowledge needed for success as a human resources professional.
CO3:	Students will develop the skills needed for a successful HR manager.
CO4:	Students would be prepared to implement the concepts learned in the workplace.
CO5:	Students would be aware of the emerging concepts in the field of HRM

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	2	2	1	1	2	1	1	1	1	1
CO2	3	3	2	3	2	2	2	2	3	1	2	1	1	2
CO3	3	3	3	3	3	3	2	2	3	1	2	1	1	2
CO4	3	3	2	3	3	2	2	2	2	1	1	1	1	1
CO5	3	3	1	2	2	2	2	2	2	1	1	1	1	1
Avg.	2.8	2.8	1.8	2.6	2.6	2.2	1.8	1.8	2.4	1	1.4	1	1	1.4

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	BME	Programme Code & Name				121-BE- BME
Semester						
Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGET24705	KNOWLEDGE MANAGEMENT	L	T	P	C	100
Course Objectives	The student should be made to: - Learn the Evolution of Knowledge management. - Be familiar with tools. - Be exposed to Applications. - Be familiar with some case studies.					
Unit-I	INTRODUCTION					(9)
Introduction: An Introduction to Knowledge Management - The foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.						
Unit-II	CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING					(9)
Organization and Knowledge Management –Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists–Tacit Knowledge and Quality Assurance.						
Unit-III	KNOWLEDGE MANAGEMENT – THE TOOLS					(9)
Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.						
Unit-IV	KNOWLEDGE MANAGEMENT APPLICATION					(9)
Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI						
Unit-V	RESPIRATORY DISEASES					(9)
Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life cycles of an organization.						
Total No of Periods to be Taught				45 periods		

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TEXT BOOK:

1	Srikantaiah, T.K., Koenig, M., "Knowledge Management for the Information Professional" Information Today, Inc., 2000.
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REFERENCES:

1	Nonaka, I., Takeuchi, H., "The Knowledge – Creating Company: How Japanese Companies Create the Dynamics of Innovation", Oxford University Press, 1995.
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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understand the process of acquiring knowledge from experts
CO2:	Understand the learning organization.
CO3:	Use the knowledge management tools.
CO4:	Develop knowledge management Applications.
CO5:	Design and develop enterprise applications.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1					1									
CO2					2								1	
CO3					2									2
CO4				1	1				1					1
CO5				1	1				1					1
Avg.				1	1.4				1				1	1.3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGET24706	INDUSTRIAL MANAGEMENT	L	T	P	C	100
		3	0	0	3	

Course Objectives	- To study the basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations. - To study the planning; organizing and staffing functions of management in professional organization. - To study the leading; controlling and decision-making functions of management in professional organization. - To learn the organizational theory in professional organization. - To learn the principles of productivity and modern concepts in management in professional organization.
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Unit-I	INTRODUCTION TO MANAGEMENT	(9)
Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Private Sector Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Merits & Demerits.		
Unit-II	FUNCTIONS OF MANAGEMENT - II	(9)
Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake – Mount on, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.		
Unit-III	FUNCTIONS OF MANAGEMENT - II	(9)
Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake – Mount on, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.		
Unit-IV	ORGANIZATION THEORY	(9)
Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory; McClelland's three needs motivation theory; Vroom's valence-expectancy theory – Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.		
Unit-V	PRODUCTIVITY AND MODERN TOPICS	(9)
Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Modern Topics (concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering (BPR); Bench		

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marking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems(MIS).

Total No of Periods to be Taught

45 periods

TEXT BOOK:

- | | |
|---|---|
| 1 | M. Govindarajan and S. Natarajan, "Principles of Management", Prentice Hall of India, New Delhi, 2009. |
| 2 | Koontz. H. and Weihrich. H., "Essentials of Management: An International Perspective", 8 th Edition, Tata McGrawhill, New Delhi, 2010. |

REFERENCES:

- | | |
|---|---|
| 1 | JosephJ, Massie, "Essentials of Management", 4 th Edition, Pearson Education, 1987. |
| 2 | Saxena, P.K., "Principles of Management: A Modern Approach", Global India Publications, 2009. |
| 3 | S. Chandran, "Organizational Behaviours", Vikas Publishing House Pvt. Ltd., 1994. |
| 4 | RichardL. Daft, "Organization Theory and Design", South Western College Publishing, 11 th Edition, 2012. |
| 5 | S.Trevis Certo, "Modern Management Concepts and Skills", Pearson Education, 2018. |

COURSE OUTCOMES:

On completion of the course, the students will be able to

- | | |
|------|---|
| CO1: | Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations. |
| CO2: | Discuss the planning; organizing and staffing functions of management in professional organization. |
| CO3: | Apply the leading; controlling and decision-making functions of management in professional organization. |
| CO4: | Discuss the organizational theory in professional organization. |
| CO5: | Apply principles of productivity and modern concepts in management in professional organization. |

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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	3	2	3	2	3	1	3	1	1
CO2	1	1	1	1	1	3	2	3	2	3	1	3	1	1
CO3	1	1	1	1	1	3	2	3	2	3	1	3	1	1
CO4	1	1	1	1	1	3	2	3	2	3	1	3	1	1
CO5	1	1	1	1	1	3	2	3	2	3	1	3	1	1
Avg.	1	1	1	1	1	3	2	3	2	3	1	3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	MECHANICAL	Programme Code & Name	Mandatory Courses- All Branches
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMC24001	DISASTER RISK REDUCTION AND MANAGEMENT	L	T	P	C	100
		2	0	0	0	
Course Objectives	✓ To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management ✓ To acquaint with the skills for planning and organizing disaster response					

Unit-I	HAZARDS, VULNERABILITY AND DISASTER RISKS	(9)
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies- Inter relations between Disasters and Sustainable development Goals		
Unit-II	DISASTER RISK REDUCTION (DRR)	(9)
Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.		
Unit-III	DISASTER MANAGEMENT	(9)
Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)		
Unit-IV	TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT	(9)
Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management		
Unit-V	DISASTER MANAGEMENT: CASE STUDIES	(9)


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Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill

Total No of Periods to be Taught

Total : 30 Periods

TEXT BOOK:

1	Taimpo (2016), Disaster Management and Preparedness, CRC Publications
2	Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications
3	Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN- 13: 978-9380386423
4	Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]

REFERENCES:

1	Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2	Government of India, National Disaster Management Policy, 2009.
3	Shaw R (2016), Community based Disaster risk reduction, Oxford University Press

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction
CO2:	To enhance understanding on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction
CO3:	To develop disaster response skills by adopting relevant tools and technology
CO4:	Enhance awareness of institutional processes for Disaster response in the country
CO5:	Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity


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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO2	3	3	3	3	-	-	2	1	-	-	2	-	2	-
CO3	3	3	3	3	-	-	2	2	-	-	-	-	2	-
CO4	3	3	2	3	-	-	2	1	-	-	2	-	2	-
CO5	3	3	2	3	-	-	2	2	-	-	2	-	3	-
Avg.	3	3	3	3	-	-	2	2	-	-	2	-	2	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	MECHANICAL	Programme Code & Name	Mandatory Courses- All Branches
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMC24002	ELEMENTS OF LITERATURE	L	T	P	C	100
		2	0	0	0	
Course Objectives	To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience					

COURSE CONTENTS

	Introduction to Elements of Literature	(5)
1.Relevance of literature		
a) Enhances Reading, thinking, discussing and writing skills. b) Develops finer sensibility for better human relationship. c) Increases understanding of the problem of humanity without bias. d) Providing space to reconcile and get a cathartic effect.		
2. Elements of fiction		(5)
a) Fiction, fact and literary truth. b) Fictional modes and patterns. c) Plot character and perspective.		
3. Elements of poetry		(5)
a) Emotions and imaginations. b) Figurative language. c) (Simile, metaphor, conceit, symbol, pun and irony) d) Personification and animation e) Rhetoric and trend.		
4.Elements of drama		(5)
a) Drama as representational art. b) Content mode and elements. c) Theatrical performance. d) Drama as narration, mediation and persuasion. e) Features of tragedy, comedy and satire.		
READINGS:		(5)
a) An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007. b) An Introduction to Literary Studies, Mario Klarer, Routledge, 2013. c) The Experience of Poetry, Graham Mode, Open college of Arts with Open Univ Press, 1991. d) The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114. e) The Elements of Drama, J.L.Styan, Literary Licensing, 2011.		

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OTHER SESSION:		(5)
	4.1 *Tutorials: 4.2 *Laboratory: 4.3 *Project: The students will write a term paper to show their understanding of a particular piece of literature	
4*ASSESSMENT:		
	5.1 HA: 5.2 Quizzes-HA: 5.3 Periodical Examination: one 5.4 Project/Lab: one (under the guidance of the teachers the students will take a volume of poetry, fiction or drama and write a term paper to show their understanding of it in a given context; sociological, psychological, historical, autobiographical etc. 5.5 Final Exam:	
	Total No of Periods to be Taught	Total: 30 periods

TEXT BOOK:	
1	3.1 Textbook: 3.2 *Reference Books:: To be decided by the teacher and student, on the basis of individual student so as to enable him or her to write the term paper.

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1	Recognize the relevance of literature in enhancing life skills and human understanding.
CO2	Identify and describe key elements of fiction, poetry, and drama.
CO3	Analyze the use of figurative language and rhetorical devices in poetry and prose.
CO4	Interpret and evaluate dramatic forms based on structure and performance.
CO5	Compose a term paper demonstrating critical understanding of a chosen literary work.


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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	-	-	-	-	-	-	-	3	3
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	3	2	2	3	2	-	-	-	-	-	-	-	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	MECHANICAL	Programme Code & Name	Mandatory Courses- All Branches
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMC24003	FILM APPRECIATION	L	T	P	C	100
		2	0	0	0	
Course Objectives	In this course on film appreciation, the students will be introduced broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved over a century. The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully.					

Unit-I	THE COMPONENT OF FILMS	(6)
The material and equipment, The story, screenplay and script, The actors, crew members, and the director, The process of film making, Structure of a film		
Unit-II	EVOLUTION OF FILM LANGUAGE	(6)
Film language, form, movement etc, Early cinema, Silent film (Particularly French), The emergence of feature films: Birth of a Nation, Talkies		
Unit-III	FILM THEORIES AND CRITICISM/APPRECIATION	(6)
Realist theory: Auteurists, Psychoanalytic, Ideological, Feminists, How to read films? Film Criticism / Appreciation		
Unit-IV	DEVELOPMENT OF FILM	(6)
Representative Soviet films, Representative Japanese films, Representative Italian films, Representative Hollywood film and the studio system.		
Unit-V	INDIAN FILMS	(6)
The early era, The important films made by the directors, The regional films, The documentaries in India		
READING: A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.		
Total No of Periods to be Taught		Total: 30 Periods


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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Gain a comprehensive understanding of filmmaking components and techniques
CO2:	Explore the historical evolution of film language and major milestones.
CO3:	Develop critical analysis skills through the study of various film theories.
CO4:	Broaden cultural awareness by analyzing representative films from diverse contexts.
CO5:	Appreciate the development and diversity of Indian cinema

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Department	MECHANICAL	Programme Code & Name	Mandatory Courses- All Branches
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMC24004	INTRODUCTION TO GENDER STUDIES	L	T	P	C	100
		2	0	0	0	
Course Objectives	✓ To introduce foundational concepts such as sex, gender, patriarchy, socialization, power, and stereotypes to understand gendered structures in society. ✓ To explore major feminist theories (Liberal, Marxist, Socialist, Radical, Psychoanalytic, Postmodernist, Ecofeminist) and their approaches to gender. ✓ To provide a historical and socio-political understanding of global and local women's movements and their impact on gender discourse. ✓ To examine how language constructs and reflects gender identities and power relations through narratives and linguistic forms. ✓ To analyze the representation of gender in mainstream, alternative, and social media, with emphasis on stereotypes and visual culture.					

Unit-I	CONCEPTS	(6)
Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.		
Unit-II	FEMINIST THEORY	(6)
Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.		
Unit-III	WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL	(6)
Rise of Feminism in Europe and America. Women's Movement in India.		
Unit-IV	GENDER AND LANGUAGE	(6)
Linguistic Forms and Gender. Gender and narratives		
Unit-V	GENDER AND REPRESENTATION	(6)
Advertising and popular visual media. Gender and Representation in Alternative Media. Gender and social media.		
Total No of Periods to be Taught		Total: 30 periods


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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	-	-	-	-	-	-	-	3	3
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	3	2	2	3	2	-	-	-	-	-	-	-	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department	MECHANICAL	Programme Code & Name	Mandatory Courses- All Branches
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMC24005	INDUSTRIAL SAFETY	L	T	P	C	100
Course Objectives	The course is intended to give knowledge of various safety management principles, various safety systems, various machine guarding devices, hazard identification techniques, energy sources, systems & applications and the need in the present context.					

Unit-I	SAFETY INTRODUCTION	(6)
Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization-objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.		
Unit-II	PERSONAL PROTECTION IN WORK ENVIRONMENT	(6)
Personal protection in the work environment, Types of PPEs, Personal protective equipment respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate.		
Unit-III	SAFETY ISSUES IN CONSTRUCTION	(6)
Introduction to construction industry and safety issues in construction Safety in various construction operations – Excavation and filling – Under-water works – Under-pinning & Shoring – Ladders & Scaffolds – Tunneling – Blasting – Demolition – Confined space – Temporary Structures.		
Unit-IV	SAFETY HAZARDS IN MACHINES	(8)
Machinery safeguard-Point-of-Operation, Principle of machine guarding -types of guards and devices. Safety in turning, and grinding. Welding and Cutting-Safety Precautions of Gas welding and Arc Welding. Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling equipment-operation & maintenance. Maintenance of common elements-wire rope, chains slings, hooks, clamps. Hearing Conservation Program in Production industries.		
Unit-V	HAZARD IDENTIFICATION AND ANALYSIS	(4)
Hazard and risk, Types of hazards –Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment.		
Total No of Periods to be Taught		30 periods
TEXT BOOK:		

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1	R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.
2	Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication

REFERENCES:

1	Krishnan, N.V. (1997). Safety management in Industry. Jaico Publishing House, New Delhi.
2	John V. Grimaldi and Rollin H.Simonds. (1989) Safety management. All India Traveller Book Seller, Delhi.
3	Ronald P. Blake. (1973). Industrial safety. Prentice Hall, New Delhi

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Describe the theories of accident causation and preventive measures of industrial accidents.
CO2:	Explain about personal protective equipment, its selection, safety performance & indicators and importance of housekeeping
CO3:	Explain different issues in construction industries.
CO4:	Describe various hazards associated with different machines and mechanical material handling.
CO5:	Utilise different hazard identification tools in different industries with the knowledge of different types of chemical hazards

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	-	1	2	2	2	-	-	-	1	-	-
CO2	2	2	2	-	1	1	1	1	-	-	-	1	-	-
CO3	2	2	2	-	1	1	1	1	1	1	-	1	-	-
CO4	2	2	2		1	1	1	1	1	1	-	1	-	-
CO5	2	2	2	-	1	1	1	1	1	1	-	1	-	-
Avg.	2	2	1.6	-	1	1.2	1.2	1.2	0.6	0.6	-	1	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department	MECHANICAL	Programme Code & Name	Mandatory Courses- All Branches
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMC24006	INTERPERSONAL SKILLS	L	T	P	C	100
		2	0	0	0	
Course Objectives	✓ Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills. ✓ Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities. ✓ improve general and academic listening skills ✓ Make effective presentations.					

Unit-I	(6)
Listening as a key skill- its importance- speaking- give personal information- ask for personal information- express ability- enquire about ability- ask for clarification Improving pronunciation pronunciation basics taking lecture notes- preparing to listen to a lecture- articulate a complete idea as opposed to producing fragmented utterances	
Unit-II	(6)
Listen to a process information- give information, as part of a simple explanation- conversation starters: small talk- stressing syllables and speaking clearly- intonation patterns- compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.	
Unit-III	(6)
Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk- greet- respond to greetings- describe health and symptoms- invite and offer- accept- decline- take leave- listen for and follow the gist- listen for detail	
Unit-IV	(6)
Being an active listener: giving verbal and non-verbal feedback- participating in a group discussion summarizing academic readings and lectures conversational speech listening to and participating in conversations- persuade	
Unit-V	(6)
Formal and informal talk- listen to follow and respond to explanations, directions and instructions in academic and business contexts- strategies for presentations and interactive communication group/pair presentations- negotiate disagreement in group work.	
Total No of Periods to be Taught	Total: 30 periods

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TEXT BOOK:

1	Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2	Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES:

1	Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2	Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3	Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
4	Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5	Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Demonstrate effective listening and speaking strategies to express and gather personal information clearly.
CO2:	Interpret process-based information and participate in informal conversation with correct pronunciation and intonation.
CO3:	Use lexical chunks and phrases to improve fluency and accuracy in short speeches and daily interactions.
CO4:	Apply active listening strategies and participate effectively in group discussions and academic contexts.
CO5:	Engage in formal/informal talk and deliver structured presentations in academic and professional environments.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	2	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3
CO3	3	2	3	2	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3
Avg.	3	2.6	3	2.2	2.6	-	-	-	-	-	-	-	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department	MECHANICAL	Programme Code & Name	Mandatory Courses- All Branches
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMC24007	PERSONALITY AND CHARACTER DEVELOPMENT	L	T	P	C	100
		2	0	0	0	
Course Objectives	To understand the dimensions of personality, theories of Freud and Erickson, and the importance of personality growth.					
	To develop positive attitudes and motivation through awareness of influencing factors and self-drive.					
	To build self-esteem and interpersonal effectiveness through self-awareness and behavior understanding.					
	To enhance problem-solving, leadership, and time management skills for overall personality refinement.					
	To improve employability skills like resume writing, group discussion, and interviews through practical engagement.					

Unit-I	INTRODUCTION TO PERSONALITY DEVELOPMENT	6
The concept of personality - Dimensions of personality – Theories of Freud & Erickson-Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analysis.		
Unit-II	ATTITUDE & MOTIVATION	6
Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude- Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation		
Unit-III	SELF-ESTEEM	6
Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.		
Unit-IV	OTHER ASPECTS OF PERSONALITY DEVELOPMENT	6
Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management Work ethics – Good manners and etiquette.		
Unit-V	EMPLOYABILITY QUOTIENT	6


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Resume building- The art of participating in Group Discussion – Facing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions

Total No of Periods to be Taught

Total: 30 periods

TEXT BOOK:

1	Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2	Stephen P. Robbins and Timothy A. Judge(2014), Organizational Behavior 16th Edition: Prentice Hall.

REFERENCES:

1	Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2	Heller, Robert.Effective leadership. Essential Manager series. Dk Publishing, 2002
3	Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4	Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5	Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6	Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7	Smith, B . Body Language. Delhi: Rohan Book Company. 2004

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain the concept and dimensions of personality and analyze theories of Freud and Erickson
CO2:	Identify the role of attitude and motivation in personal success and apply strategies to stay self-motivated
CO3:	Recognize types of self-esteem and behaviors; develop assertiveness and interpersonal relationship skills
CO4:	Demonstrate skills in body language, leadership, stress management, and decision-making for personality growth
CO5:	Apply practical techniques for enhancing employability including resume writing, interviews, and group discussion techniques


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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	2	-	-	-	-	-	2	2
CO2	3	3	3	3	2	2	3	-	-	-	-	-	3	3
CO3	2	2	3	3	2	2	3	-	-	-	-	-	3	3
CO4	3	3	3	3	3	3	3	-	-	-	-	-	3	3
CO5	2	2	3	2	3	3	3	-	-	-	-	-	3	3
Avg.	2.6	2.6	2.8	2.6	2.4	2.4	2.8	-	-	-	-	-	2.8	2.8

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom’s Taxonomy

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Department	MECHANICAL	Programme Code & Name	Mandatory Courses- All Branches
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMC24008	WELL-BEING WITH TRADITIONAL PRACTICES-YOGA, AYURVEDA AND SIDDHA	L	T	P	C	100
		2	0	0	0	
Course Objectives	To enjoy life happily with fun filled new style activities that help to maintain health also					
	To adapt a few lifestyle changes that will prevent many health disorders					
	To be cool and handbill every emotion very smoothly in every walk of life					
	To learn to eat cost effective but healthy foods that are rich in essential nutrients					
	To develop immunity naturally that will improve resistance against many health disorders					

Unit-I	HEALTH AND ITS IMPORTANCE	(6)
Health: Definition - Importance of maintaining health - More importance on prevention than treatment Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional health. Present health status - The life expectancy-present status - mortality rate - dreadful diseases - Non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease - cancer - diabetes - chronic pulmonary diseases - risk factors - tobacco - alcohol - unhealthy diet - lack of physical activities. Types of diseases and disorders - Lifestyle disorders - Obesity - Diabetes - Cardiovascular diseases - Cancer - Strokes - COPD - Arthritis - Mental health issues. Causes of the above diseases / disorders - Importance of prevention of illness - Takes care of health - Improves quality of life - Reduces absenteeism - Increase satisfaction - Saves time Simple lifestyle modifications to maintain health - Healthy Eating habits (Balanced diet according to age) Physical Activities (Stretching exercise, aerobics, resisting exercise) - Maintaining BMI-Importance and actions to be taken		
Unit-II	DIET	(6)
Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes - arthritis - hypertension - PCOD - infertility - ADHD - sleeplessness - helps to reduce the risk of heart diseases - keeps the teeth and bones strong. Balanced Diet and its 7 Components - Carbohydrates - Proteins - Fats - Vitamins - Minerals - Fibre and Water. Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions Definition of BMI and maintaining it with diet Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM Common cooking mistakes Different cooking methods, merits and demerits of each method		
Unit-III	ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH	(6)


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AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.
Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene
- Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Panchcheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (Tri- Dosha Theory) - Udal Thathukkal

Prevention of illness with our traditional system of medicine

Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

Unit-IV	MENTAL WELLNESS	(6)
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Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions. **Stress management** - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement.

Sleep - Sleep and its importance for mental wellness - Sleep and digestion.

Immunity - Types and importance - Ways to develop immunity

Unit-V	YOGA	(6)
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Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

Total No of Periods to be Taught	Total: 30 periods
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TEXT BOOK:

1	Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA
2	Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body,

REFERENCES:

1	WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts. A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England
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2	The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001
3	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/
4	Simple lifestyle modifications to maintain health https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-better-health#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20c ook.
5	Read more: https://www.legit.ng/1163909-classes-food-examples-functions.html
6	https://www.yaclass.in/p/science-state-board/class-9/nutrition-and-health-5926
7	Benefits of healthy eating https://www.cdc.gov/nutrition/resources-publications/benefits-of-healthy-eating.html
8	Food additives https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/food-additives
9	BMI https://www.hsph.harvard.edu/nutritionsource/healthy-weight/ https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who-recommendations
10	Yoga https://www.healthifyme.com/blog/types-of-yoga/ https://yogamedicine.com/guide-types-yoga-styles/ Ayurveda : https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-in-ayurveda
11	Siddha : http://www.tkdL.res.in/tkdL/langdefault/Siddha/Sid_Siddha_Concepts.asp
12	CAM : https://www.hindawi.com/journals/ecam/2013/376327/
13	Preventive herbs : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847409/

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Learn the importance of different components of health
CO2:	Gain confidence to lead a healthy life
CO3:	Learn new techniques to prevent lifestyle health disorders

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	3	2	-	-	-	-	-	-	-	3	2
CO2	2	2	2	3	3	-	-	-	-	-	-	-	2	3
CO3	3	3	1	3	3	-	-	-	-	-	-	-	2	3
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	2.7	2.3	1.3	3.0	2.7	2.3	2.7	2.3	2.7	2.3	1.3	3.0	2.7	2.3

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2401	UTILIZATION AND CONSERVATION OF ELECTRICAL ENERGY	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To know various electric drives and traction motors with applications - To introduce the energy saving concept by different ways of illumination. - To understand the different methods of electric heating and electric welding. - To know the conversion of solar and wind energies into electrical energy for different applications. - To study the domestic utilization of electrical energy.					

Unit-I	ELECTRIC DRIVES AND TRACTION	(9)
Fundamentals of electric drive - choice of an electric motor - application of motors for particular services traction generator set, traction motors, power transformers - characteristic features of traction motor - systems of railway electrification - train movement and energy consumption -traction motor cont		
Unit-II	ILLUMINATION	(9)
Introduction - definition and meaning of terms used in illumination engineering - classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps –design of illumination systems - indoor lighting schemes - outdoor lighting schemes - factory lighting halls -flood lighting - street lighting - energy saving lamps.		
Unit-III	HEATING AND WELDING	(9)
Introduction - advantages of electric heating – modes of heat transfer - methods of electric heating -resistance heating - arc furnaces - induction heating - dielectric heating - electric welding – types -resistance welding - arc welding - power supply for arc welding - radiation welding.		
Unit-IV	ENERGY CONSERVATION AND ITS IMPORTANCE	(9)
Energy conservation act 2001 and its Features-Review of Industrial Energy Conservation-Energy conservation in electrical Industries-Simulation study of energy conservation using power factor controller. (Three phase circuit simulation with and without capacitor)		
Unit-V	DOMESTIC UTILIZATION OF ELECTRICAL ENERGY	(9)
House wiring - working principle of air conditioning system, Induction based appliances, Online and OFF line UPS,Batteries - Power quality aspects – nonlinear and domestic loads – Earthing system for Domestic.		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	N.V. Suryanarayana, "Utilisation of Electric Power", Wiley Eastern Limited, New Age International Limited, 1994 & Second Edition 2017 Feb
2	J.B.Gupta, "Utilisation Electric power and Electric Traction", S.K.Kataria and sons, 2000 2012th Edition, 2013, January
3	G.D.Rai, "Non-Conventional Energy sources", Khanna publications Ltd., New Delhi 1998
4	D.P.Kothari, K.C.Singal, RakeshRanjan, "Renewable Energy Sources and Emerging Technologies", PHI Learning Private Limited, 3rd Edition 2022

REFERENCES:

1	R.K.Rajput, Utilisation of Electric Power, Laxmi publications 2nd Edition 2016.
2	H.Partab, Art and Science of Utilisation of Electrical Energy", Edition, Dhanpat Rai and Co., New Delhi-2004
3	C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International Pvt.Ltd., 3rd Edition, 2015 January.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to choose suitable electric drives for different applications
CO2:	Ability to design the illumination systems for energy saving
CO3:	Ability to demonstrate the utilization of electrical energy for heating and welding purposes
CO4:	Ability to know the effective usage of solar and wind energies for electrical applications
CO5:	Ability to do electric connection for any domestic appliance like refrigerator, battery charging circuit for a specific household application.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO4	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO5	2	1	1	-	-	-	1	-	-	-	-	-	-	-
Avg.	2	1	1	-	-	-	1	-	-	-	-	-	-	-

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2402	HVDC AND FACTS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To understand power control of transmission line • The problems in AC transmission systems and DC transmission systems • The operation and control of SVC and TCSC • The concepts of IGBT based FACTS controllers • The basic operation Line Commutated Converter(LCC) based HVDC links • The features of voltage source converter based HVDC link.					

Unit-I	INTRODUCTION	(9)
Reactive power control in electrical power transmission lines–load & system compensation, Uncompensated transmission line–shunt and series compensation. Need for HVDC Transmission, Comparison between AC & DC Transmission, , Types of HVDC transmission System		
Unit-II	STATIC VAR COMPENSATOR (SVC) AND THYRISTOR CONTROLLED SERIES COMPENSATOR (TCSC)	(9)
VI characteristics of FC+TSR, TSC+TSR, Voltage control by SVC–Advantages of slope in dynamic characteristics–Influence of SVC on system voltage- Thyristor Controlled Series Compensator (TCSC), Concept of TCSC, Operation of the TCSC–Different modes of operation, Applications		
Unit-III	VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS	(9)
Static Synchronous Compensator (STATCOM)–Principle of operation–V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC VI characteristics, Enhancement in Power transfer capability –UPSC – Operation Principle Applications		
Unit-IV	LINE COMMUTATED HVDC TRASMISSION	(9)
Operation of Gratz bridge - Effect of delay in Firing Angle – Effect of commutation overlap -Equivalent circuit,. Basic concept of HVDC transmission. Model of operations and control of power flow CC and CIA mode of operation.		
Unit-V	VSC BASED HVDC TRANSMISSION	(9)
Basic 2 level IGBT inverter operation- 4 Quadrant operation- phase angle control- dq control- Control of power flow in VSC based HVDC Transmission, Topologies of MTDC system		
Total No of Periods to be Taught		45



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TEXT BOOK:	
1	R.MohanMathur, Rajiv K.Varma ,“Thyristor–Based Facts Controllers for ElectricalTransmission Systems”, IEEE press andJohnWiley&Sons,Inc,2002.
2	NarainG.Hingorani, “Understanding FACTS-Concepts and Technology of Flexible ACTransmission Systems”, Standard Publishers Distributors,Delhi-110006,2011

REFERENCES:	
1	K.R.Padiyar,”FACTS Controllersin Power Transmission and Distribution”, New AgeInternational (P) Limited, Publishers, New Delhi, 2008
2	A.T.John,”FlexibleA.C.TransmissionSystems”,InstitutionofElectricalandElectronicEngineers(IEEE), 1999
3	V.K.Sood, HVDC and FACTS controllers–Applications of Static Converters in Power System,APRIL2004,KluwerAcademic Publishers,2004

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	To Identify and understand the problems in AC transmission systems and understand the need for Flexible AC transmission systems and HVDC Transmission
CO2:	To understand the operation and control of SVC and TCSC and its applications to enhance the stability and damping
CO3:	To Analyze basic operation and control of voltage source converter based FACTScontrollers
CO4:	To demonstrate basic operation and control of Line Commutated HVDC Transmission
CO5:	To explain the d-q control based operation of VSC based HVDC Transmission

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	3	1	-	-	-	-	-	-	2	3	3
CO2	2	3	1	2	3	-	-	-	-	-	-	2	3	3
CO3	3	3	1	3	1	-	-	-	-	-	-	2	3	3
CO4	2	3	1	2	3	-	-	-	-	-	-	2	3	3
CO5	3	3	1	3	1	-	-	-	-	-	-	2	3	3
Avg.	2.6	3	1	2.6	1.8	-	-	-	-	-	-	2	3	3
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														



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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2403	ENERGY MANAGEMENT AND AUDITING	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To study the concepts behind economic analysis and Load management. - To understand the basics of materials and energy balance. - To analyze the energy efficiency in thermal utilities. - To know the concept of compressed air system. - To illustrate the concept of lighting systems and cogeneration.					

Unit-I	GENERAL ASPECTS OF ENERGY MANAGEMENT AND ENERGY AUDIT	(9)
Commercial and Non-commercial energy - final energy consumption - energy needs of growing economy - energy pricing - energy conservation and its importance - Re-structuring of the energy supply sector - Energy Conservation Act 2001, Energy Conservation (Amendment) Act, 2010, and its features - electricity tariff - Thermal Basics - need and types of energy audit – Energy management/audit approach- understanding energy costs		
Unit-II	MATERIAL AND ENERGY BALANCE	(9)
Methods for preparing process flow - material and energy balance diagrams - Energy policy purpose - location of energy management - roles and responsibilities of energy manager –employees training and planning- Financial Management: financial analysis techniques, – Case Study		
Unit-III	ENERGY EFFICIENCY IN THERMAL UTILITIES	(9)
Introduction to fuels - properties of fuel oil, coal and gas - principles of combustion - combustion of oil, coal and gas - Boilers: Types, combustion in boilers, performances evaluation, analysis of losses - energy conservation opportunities - FBC boilers - Steam System: Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, condensate and flash steam recovery system, identifying opportunities for energy savings.		
Unit-IV	ENERGY EFFICIENCY IN COMPRESSED AIR SYSTEM	(9)
Compressed Air System -System: Vapour compression refrigeration cycle – refrigerants - coefficient of performance - factors affecting Refrigeration and Air conditioning system - savings opportunities working principle - types and comparison with vapour compression system – saving potential - Cooling Tower: Types and performance evaluation, efficient system operation – flow control strategies and energy saving .		
Unit-V	ENERGY EFFICIENCY IN ELECTRICAL UTILITIES	(9)
Electrical load management and maximum demand control - power factor improvement and its benefit - selection and location of capacitors Types - efficient system operation – flow control strategies -Lighting System: Light source, choice of lighting, luminance requirements – ballast – occupancy sensors - energy efficient lighting controls .		
Total No of Periods to be Taught	45	



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TEXT BOOK:

1	Mehmet Kanoglu, Yunus A Cengel, "Energy Efficiency and Management for Engineers", McGraw-Hill Education, First Edition, 2020.
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REFERENCES:

1	Moncef Krati, 'Energy Audit of Building Systems: An Engineering Approach', Third Edition, CRC Press, Dec.2020.
2	Sonal Desai, 'Handbook of Energy Audit', McGraw Hill Education (India) Private Limited, 2015
3	Michael P. Deru, Jim Kelsey, 'Procedures for Commercial Building Energy Audits, American Society of Heating, Refrigerating and Air conditioning Engineers, 2011
4	Energy Managers and Energy Auditors Guide book', Bureau of Energy Efficiency, 2006

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Students able to acquire knowledge in the field of energy management and auditing process.
CO2:	Learned the about basic concepts of economic analysis and load management
CO3:	Able to design the effective thermal utility system
CO4:	Able to improve the efficiency in compressed air system
CO5:	Acquired the design concepts in the field of lighting systems, light sources and various forms of cogeneration

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	2	-	-	1	-	-	-	2	3	2	3
CO2	3	-	-	-	-	2	1	3	-	1	2	3	2	3
CO3	3	-	1	2	3	-	1	-	-	-	2	3	2	3
CO4	3	3	-	-	-	-	1	3	-	-	2	3	2	3
CO5	3	-	1	2	-	-	1	-	-	2	2	3	2	3
Avg.	3	2.5	1	2	3	2	1	3	-	1.5	2	3	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2404	POWER SYSTEM TRANSIENTS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To study the generation of switching transients and their control using circuit -theoretical concept. • To study the mechanism of lightning strokes and the production of lightning surges. • To study the propagation, reflection and refraction of travelling waves. • To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.					

Unit-I	INTRODUCTION AND SURVEY	(9)
Sources of different types of transients - RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients - study of transients in system planning - Importance of grounding.		
Unit-II	SWITCHING TRANSIENTS	(9)
Basic concept of switching transients - resistance switching and equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - normal and abnormal switching transients. Current suppression - effective equivalent circuit - capacitance switching with a restrike, with multiple restriks - ferro resonance.		
Unit-III	LIGHTNING TRANSIENTS	(9)
Theories of cloud formation - mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design - protection using ground wires - tower footing resistance - Interaction between lightning and power system.		
Unit-IV	TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS	(9)
Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves. Computation of over voltages using EMTP.		
Unit-V	TRANSIENTS IN INTEGRATED POWER SYSTEM	(9)
The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - overvoltage induced by faults - switching surges on integrated system Qualitative application of EMTP for transient computation.		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2nd Edition, 1991.
2	Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.
3	C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients – A statistical approach', PHI Learning Private Limited, Second Edition, 2010.

REFERENCES:

1	M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2	R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.
3	Y.Hase, Handbook of Power System Engineering," Wiley India, 2012.
4	J.L.Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use," Wiley, 2012.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain the principles of transients and its concepts
CO2:	Know the different types of switching transients and the way to draw the necessary equivalent circuit.
CO3:	Explain the concepts behind lighting and the way to protect the same.
CO4:	Compute the transient behavior in transmission line
CO5:	Explain the behavior of the Circuit during switching and to learn the simulation tool.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	-	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	-	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	-	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	-	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	-	-	-	-	3	3	3	3
Avg.	3	3	3	3	2	2	-	-	-	-	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2405	POWER QUALITY	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To learn the basic definitions in Power Quality. • To study the power quality issues in Single Phase and Three Phase Systems. • To understand the principles of Power System Harmonics. • To know the way to use DSTATCOM for Harmonic Mitigation. • To learn the concepts related with Series Compensation.					

Unit-I	INTRODUCTION	(9)
Introduction – Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non-linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage –Power quality standards.		
Unit-II	ANALYSIS OF SINGLE PHASE AND THREE PHASE SYSTEM	(9)
phase linear and non-linear loads – single phase sinusoidal, non-sinusoidal source –supplying linear and nonlinear loads – three phase balanced system – three phase unbalanced system – three phase unbalanced and distorted source supplying non-linear loads – concept of power factor – three phase- three wire – three phase - four wire system		
Unit-III	MITIGATION OF POWER SYSTEM HARMONICS	(9)
Introduction - Principle of Harmonic Filters – Series-Tuned Filters – Double Band-Pass Filters –damped Filters – Detuned Filters – Active Filters – Power Converters – Impedance Plots for Filter Banks – Impedance Plots for a Three-Branch 33 kV Filter		
Unit-IV	LOAD COMPENSATION USING DSTATCOM	(9)
Compensating single – phase loads – Ideal three phase shunt compensator structure – generating reference currents using instantaneous PQ theory–Realization and control of DSTATCOM – DSTATCOM in Voltage control mode.		
Unit-V	SERIES COMPENSATION OF POWER DISTRIBUTION SYSTEM	(9)
Rectifier supported DVR – DC Capacitor supported DVR – DVR Structure – Voltage Restoration –Series Active Filter – Unified Power Quality Conditioner		
Total No of Periods to be Taught		45



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TEXT BOOK:	
1	Arindam Ghosh and Gerard Ledwich "Power Quality Enhancement Using Custom Power Devices", Kluwer Academic Publishers, First Edition, 2002
2	G.T. Heydt, "Electric Power Quality", Stars in a Circle Publications, Second Edition, 2011
3	George J. Wakileh, "Power System Harmonics – Fundamentals, Analysis and Filter Design" Springer – Verlag Berlin Heidelberg, New York, 2019.

REFERENCES:	
1	R.C. Duggan "Electric Power Systems Quality", Tata MC Graw Hill Publishers, Third Edition, 2012.
2	Arrillaga "Power System Harmonics", John Wiley and Sons, 2003 2nd Edition.
3	Derek A. Paice "Power Electronic Converter Harmonics" IEEE Press, 1995, Wiley – IEE Press 1999, 18th Edition

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Use various definitions of power quality for power quality issues
CO2:	Describe the concepts related with single phase / three phase, linear / nonlinear loads and single phase / three phase sinusoidal, non-sinusoidal source
CO3:	Solve problems related with mitigation of Power System Harmonics
CO4:	Use DSTATCOM for load compensation
CO5:	Demonstrate the role of DVR, SAFs UPQC in power distribution systems

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	3	3	-	3	-	3	3	3	3
CO2	3	3	3	3	-	3	3	-	3	-	3	3	3	3
CO3	3	3	3	3	-	3	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
Avg.	3	3	3	3	-	3	3	-	3	-	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														



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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2406	DESIGN AND MODELLING OF RENEWABLE ENERGY SYSTEMS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To review the renewable energy systems and technology • To learn the Single phase grid-connected photovoltaic systems and three photovoltaic systems • To illustrate the small wind energy systems • To simulate the Doubly-fed induction generator based WECS					

Unit-I	RENEWABLE ENERGY SYSTEMS: TECHNOLOGY OVERVIEW AND PERSPECTIVES	(9)
Introduction-State of the Art- Examples of Recent Research and Development Challenges and Future Trends		
Unit-II	SINGLE-PHASE GRID-CONNECTED PHOTOVOLTAIC SYSTEMS	(9)
Introduction- Demands for Grid-Connected PV Systems-Power Converter Technology for Single Phase PV Systems, Transformer less AC-Module Inverters DC-Module Converters in Transformer less Double-Stage PV Systems		
Unit-III	THREE-PHASE PHOTOVOLTAIC SYSTEMS: STRUCTURES, TOPOLOGIES	(9)
Introduction-PV Inverter Structures, Three-Phase PV Inverter Topologies- -Control Building Blocks for PV Inverters, Modulation Strategies for Three-Phase PV Inverters, Implementation of the Modulation Strategies., Grid Synchronization, Implementation of the Current Controllers, Maximum Power Point Tracking.		
Unit-IV	SMALL WIND ENERGY SYSTEMS	(9)
Introduction-Generator Selection for Small-Scale Wind Energy Systems- Turbine Selection for Wind Energy- Self-Excited Induction Generators for Small Wind Energy Applications- Permanent Magnet Synchronous Generators for Small Wind Power Applications- Grid-Tied Small Wind Turbine Systems-Magnus Turbine-Based Wind Energy System.		
Unit-V	DOUBLY-FED INDUCTION GENERATOR-BASED WECS	(9)
Introduction – modelling of induction machine in machine variable form and arbitrary reference frame, modelling of Doubly fed induction generator.		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Ahmad Azar, Nashwa Kamal, "Design, Analysis and Applications of Renewable Energy Systems", Academic Press, First Edition, 2021
2	Ahmad Azar, Nashwa Kamal, "Renewable Energy Systems", Academic Press, First Edition, 2021
3	Nabil Derbel, QuanminZhuModeling, "Identification and Control Methods in Renewable Energy Systems" , Springer, First Edition, 2019

REFERENCES:

1	Power Conversion and Control of Wind Energy Systems, Bin Wu, 2011, Wiley-IEEE, 1st Edition.
2	Wind Electrical Systems, S.N. Bhadra, 2005, Oxford, 7th Impression.
3	Wind Power Integration - Connection and System Operational Aspects, Brendan Fox, 2014, IET, 2ndEdition
4	Renewable Energy Devices and Systems with Simulations in MATLAB and ANSYS, FredeBlaabjerg, Dan M. Ionel, CRC press, 2017, 1st Edition.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Review the perspectives of renewable energy systems
CO2:	Integrate photovoltaic systems with grid
CO3:	Study inverter for PV systems
CO4:	Elaborate the working of small wind power systems
CO5:	Study the features of induction machine and doubly fed induction machine

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	3	2	-	-	-	-	-	-	-	3	-	2
CO2	3	2	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	2	3	3	2	-	-	-	-	-	-	3	3	3
CO4	3	2	3	3	-	-	-	-	-	-	-	3	3	3
CO5	3	2	3	3	2	-	-	-	-	-	-	3	3	3
Avg.	3	2	3	2.8	2	-	-	-	-	-	-	3	3	2.8

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2407	SPECIAL ELECTRICAL MACHINES	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand the working of special machines like stepper motor, switched reluctance motor, BLDC motor & PMSM - To derive torque equation and study the characteristics of special machines - To design the controller for special machines - To study the working principle of synchronous reluctance motor - To simulate closed loop operation of BLDC motor					

Unit-I	STEPPER MOTORS	(9)
Constructional features –Principle of operation –Types – Torque predictions – Linear and Non-linear analysis – Characteristics – Drive circuits – Closed loop control –Applications		
Unit-II	SWITCHED RELUCTANCE MOTORS	(9)
Constructional features –Principle of operation- Torque prediction–Characteristics–Power controllers –Control of SRM drive- Speed control-current control-design procedures- Sensor less operation of SRM – Current sensing- rotor position measurement and estimation methods- sensor less rotor position estimation-inductance based estimation.		
Unit-III	PERMANENT MAGNET BRUSHLESS DC MOTORS	(9)
Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis EMF and Torque equations- Characteristics- Controller design-Transfer function –Machine, Load and Inverter-Current and Speed Controller		
Unit-IV	PERMANENT MAGNET SYNCHROUNOUS MOTORS	(9)
Permanent Magnet ac Machines, Machine Configurations, PMSM - Principle of operation – EMF and Torque equations - Phasor diagram - Torque speed characteristics –evaluation of control characteristics- design of current and speed controllers- Constructional features, operating principle and characteristics of synchronous reluctance motor		
Unit-V	STUDY OF OTHER SPECIAL ELECTRICAL MACHINES	(9)
Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear motor –Applications		
Total No of Periods to be Taught		45



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REFERENCES:

1	Jacek F. Gieras, Dr.Rong-Jie Wang, Professor Maarten J. Kamper - Axial Flux PermanentMagnet Brushless Machines-Springer Netherlands 2008
2	Bilgin, BerkerEmadi, Ali Jiang, James Weisheng - Switched reluctance motor drives:fundamentals to applications-CRC 2019
3	Ramu Krishnan - Permanent Magnet Synchronous and Brushless DC Motor Drives -CRC Press,Marcel Applications -CRC Press 2009
4	T.J.E. Miller, 'Brushless magnet and Reluctance motor drives', Clarendon press, London, 1989
5	R. Krishnan - Switched Reluctance Motor Drives Modeling, Simulation, Analysis, Design, andApplications - CRC Press 2017

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to model and analyze power electronic systems and equipment using computational software
CO2:	Ability to optimally design magnetics required in special machines based drive systems using FEM based software tools
CO3:	Ability to analyse the dynamic performance of special electrical machines
CO4:	Ability to understand the operation and characteristics of other special electrical machines
CO5:	Ability to design and conduct experiments towards research

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	1	-	1	-	1	3	2	1
CO2	3	3	3	3	-	-	1	-	2	-	3	3	3	3
CO3	3	-	-	3	-	-	1	-	1	-	1	3	3	3
CO4	3	3	3	3	-	-	1	-	3	-	3	3	3	3
CO5	3	3	3	3	3	3	1	-	3	-	3	3	3	3
Avg.	3	3	3	3	3	2.5	1	-	2.3	-	2.3	3	2.8	2.6

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2408	DESIGN OF ELECTRICAL APPARATUS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Magnetic circuit parameters and thermal rating of various types of electrical machines. • Armature and field systems for D.C. machines. • Core, yoke, windings and cooling systems of transformers. • Design of stator and rotor of induction machines and synchronous machines. • The importance of computer aided design method.					

Unit-I	DESIGN OF FIELD SYSTEM AND ARMATURE	(9)
Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetising current – Flux leakage – Leakage in Armature. Design of lap winding and wave winding.		
Unit-II	DESIGN OF TRANSFORMERS	(9)
Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. Computer program: Complete Design of single phase core transformer		
Unit-III	DESIGN OF DC MACHINES	(9)
Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – design of field Computer program: Design of Armature main dimensions		
Unit-IV	DESIGN OF INDUCTION MOTORS	(9)
Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current - Computer program: Design of slip-ring rotor		
Unit-V	DESIGN OF SYNCHRONOUS MACHINES	(9)
Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators -Computer program.		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, Fifth Edition, 1984
2	M V Deshpande 'Design and Testing of Electrical Machines' PHI learning Pvt Lt, 2011.
3	Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

REFERENCES:

1	A. Shanmugasundaram, G. Gangadharan, R. Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint 2007.
2	'Electrical Machine Design', Balbir Singh, Vikas Publishing House Private Limited, 1981.
3	V Rajini, V.S Nagarajan, 'Electrical Machine Design', Pearson, 2017

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to understand basics of design considerations for rotating and static electrical machines
CO2:	Ability to design of field system for its application.
CO3:	Ability to design single and three phase transformer.
CO4:	Ability to design armature and field of DC machines.
CO5:	Ability to design stator and rotor of induction motor.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	1	1.5	-	-	-	-	3	-	-
CO2	2	1	3	-	-	-	1.5	-	-	-	-	3	-	-
CO3	3	2	2	-	-	1	1.5	-	-	-	-	3	-	-
CO4	1	2	3	-	-	-	1.5	-	-	-	-	3	-	-
CO5	1	1	3	-	-	1	1.5	-	-	-	-	3	3	2
Avg.	3	3	3	-	-	-	1.5	-	-	-	-	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department		Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2409	ELECTRICAL DRIVES	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand steady state operation and transient dynamics of a motor load system. - To study and analyze the operation of the converter / chopper fed dc drive, both qualitatively and quantitatively. - To study and understand the operation and performance of AC Induction motor drives. - To study and understand the operation and performance of AC Synchronous motor drives. - To analyze and design the current and speed controllers for a closed loop solid state DC motor drives.					

Unit-I	DRIVE CHARACTERISTICS	(9)
Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor		
Unit-II	CONVERTER / CHOPPER FED DC MOTOR DRIVE	(9)
Steady state analysis of the single and three phase converter fed separately excited DC motor drive –continuous and discontinuous conduction – Time ratio and current limit control – 4 quadrant operation of chopper fed drive.		
Unit-III	INDUCTION MOTOR DRIVES	(9)
Stator voltage control – energy efficient drive – v/f control – constant air gap flux – field weakening mode – voltage / current fed inverter – closed loop control.		
Unit-IV	SYNCHRONOUS MOTOR DRIVES	(9)
V/f control and self-control of synchronous motor: Margin angle control and power factor control –permanent magnet synchronous motor.		
Unit-V	DESIGN OF CONTROLLERS FOR DRIVES	(9)
Transfer function for DC motor / load and converter – closed loop control with current and speed feedback – design of controllers; current controller and speed controller-converter selection and characteristics		
Total No of Periods to be Taught		30



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TEXT BOOK:	
1	GopalK.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 2nd Edition January 2010
2	BimalK.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002 1st Edition

REFERENCES:	
1	'Electrical Machine Design', Balbir Singh, Vikas Publishing House Private Limited, 1981.
2	Murphy J.M.D and Turnbull, Thyristor Control of AC Motor, Pergamon Press, Oxford 1988, 1 st Edition
3	GopalK.Dubey, Power semiconductor controlled Drives, Prentice Hall Inc., New Jersey, 1989, 1st Edition
4	R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Prentice hall of India, 2001, 1st Edition

List of Exercises/Experiments	
1.	Simulation of single phase converter
2.	Simulation of three phase converter
3.	Simulation of step down chopper
4.	Simulation of step up chopper
5.	Simulation of closed loop operation of stator voltage control of induction motor drive
6.	Simulation of closed loop operation of rotor voltage control of induction motor drive
7.	Simulation of closed loop operation of v/f control of induction motor drive
8.	Simulation of synchronous motor drive
9.	Simulation of permanent magnet synchronous motor.
10.	Simulation of speed control of dc motor
Total No of Periods to be Taught	
30	

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Understand the basic requirements of motor selection for different load profiles.
CO2:	Analyse the steady state behavior and stability aspects of drive systems.
CO3:	Analyse the dynamic performance of the DC drive using converter and chopper control..
CO4:	Simulate the AC drive.
CO5:	Design the controller for electrical drives

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.N O	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Personal Computers	30 Nos
2	Software: Any Power system simulation software	1



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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	-	1	-	-	-	2	3	3	3
CO2	3	2	2	3	3	-	1	-	-	-	2	3	3	3
CO3	3	2	2	3	3	-	1	-	-	-	2	3	3	3
CO4	3	2	2	3	3	-	1	-	-	-	2	3	3	3
CO5	3	2	2	3	3	-	1	-	-	-	2	3	3	3
Avg.	3	2	2	3	3	-	1	-	-	-	2	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department		Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2410	POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To learn the various types of renewable sources of energy. - To understand the electrical machines to be used for wind energy conversion systems. - To learn the principles of power converters used in solar PV system. - To study the principle of power converters used in Wind system. - To simulate the AC-DC, AC-AC Converters, Matrix Converters and PWM Inverters.					

Unit-I	INTRODUCTION TO RENEWABLE ENERGY SYSTEMS	(9)
Classification of Energy Sources – Importance of Non-conventional energy sources – Advantages and disadvantages of conventional energy sources - Environmental aspects of energy - Qualitative study of renewable energy resources: Ocean energy, Biomass energy, Hydrogen energy, - Solar Photovoltaic (PV), Fuel cells: Operating principles and characteristics, Wind Energy: Nature of wind, Types, control strategy, operating area.		
Unit-II	ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS(WECS)	(9)
Construction, Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) - Permanent Magnet Synchronous Generator (PMSG)		
Unit-III	POWER CONVERTERS AND ANALYSIS OF SOLAR PV SYSTEMS	(9)
Power Converters: Line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing. Analysis: Block diagram of the solar PV systems - Types of Solar PV systems: Stand-alone PV systems, Grid integrated solar PV Systems - Grid Connection Issues.		
Unit-IV	POWER CONVERTERS FOR WIND SYSTEMS	(9)
Power Converters: Three-phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid-Interactive Inverters - Matrix converter.		
Unit-V	HYBRID RENEWABLE ENERGY SYSTEMS	(9)
Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Diesel-PV, Wind-PV, Micro hydel-PV, Biomass-Diesel systems - Maximum Power Point Tracking (MPPT).		
Total No of Periods to be Taught		30



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REFERENCES:	
1	S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford University Press, 2009, 7th impression
2	Rashid .M. H "Power electronics Hand book", Academic press, 2nd Edition, 2006 4th Edition, 2017
3	Rai. G.D, "Non-conventional energy sources", Khanna publishers, 6th Edition, 2017
4	Rai. G.D, "Solar energy utilization", Khanna publishers, 5th Edition, 2008
5	Gray, L. Johnson, "Wind energy system", prentice hall of india, 2nd Edition, 2006
6	H.Khan "Non-conventional Energy sources ", TataMcGraw-hill Publishing Company, NewDelhi, 2017, 3rd Edition

List of Exercises/Experiments	
1.	Simulation on modelling of Solar PV System- V I Characteristics
2.	Simulation on Modelling of fuel cell- V I Characteristics
3.	Simulation of self- excited Induction Generator.
4.	Simulation of PMSG based Wind turbine.
5.	Simulation of DFIG based Wind turbine.
6.	Simulation on Grid integration of RES.
7.	Experiments on "VI-Characteristics and Efficiency of 1kWp Solar PV System".
8.	Experiment on Performance assessment of micro Wind Energy Generator.
9.	Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System.
10.	Simulation study on Wind Energy Generator.
Total No of Periods to be Taught	
30	

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Examine the available renewable energy sources.
CO2:	Demonstrate the working principles of electrical machines and power converters used for wind energy conversion system
CO3:	Demonstrate the principles of power converters used for solar PV systems
CO4:	Examine the available hybrid renewable energy systems
CO5:	Simulate AC-DC converters, buck/boost converters, AC-AC converters and PWM inverters



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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Personal Computers	30 Nos
2	Software: Any Power system simulation software	1

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	-	-	2	-	2	3	3	3
CO2	3	-	2	-	-	-	-	-	2	-	2	3	3	3
CO3	3	-	2	-	-	-	-	-	2	-	2	3	3	3
CO4	3	-	3	-	-	-	-	-	2	-	2	3	3	3
CO5	3	3	2.25	3	3	-	3	-	2	-	3	3	3	3
Avg.	3	3	2	3	3	-	3	-	2	-	2.2	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2411	HYBRID ENERGY TECHNOLOGY	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To provide knowledge about different types of hybrid energy systems. - To analyze the various electrical Generators used for the Wind Energy Conversion Systems. - To design the power converters used in SPV Systems. - To analyze the various power converters used in hybrid energy systems and to understand the importance of standalone and grid-connected operation in Hybrid renewable energy systems.					

Unit-I	INTRODUCTION TO HYBRID ENERGY SYSTEMS	(9)
Hybrid Energy Systems – Need for Hybrid Energy Systems – Solar-Wind-Fuel Cell-Diesel, Wind, Biomass-Diesel, Micro-Hydel-PV, Ocean and geyser energy - Classification of Hybrid Energy systems – Importance of Hybrid Energy systems-Present Indian and international energy scenario of conventional and RE sources - Ocean energy, Hydel Energy - Wind Energy, Biomass energy, Hydrogen energy - Solar Photovoltaic (PV) and Fuel cells: Operating principles and characteristics		
Unit-II	ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS (WECS)	(9)
Review of reference theory fundamentals –Construction, Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) - Permanent Magnet Synchronous Generator (PMSG).		
Unit-III	POWER CONVERTERS AND ANALYSIS OF SOLAR PV SYSTEMS	(9)
Power Converters for SPV Systems - Line commutated converters (inversion-mode) - Boost and buckboost converters- selection of inverter, battery sizing, array sizing - Analysis of SPV Systems - Block diagram of the solar PV systems - Types of Solar PV systems: Stand-alone PV systems.		
Unit-IV	ANALYSIS OF POWER CONVERTERS FOR HYBRID ENERGY SYSTEMS	(9)
Introduction to Power Converters – Stand-alone Converters -AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters - Bi-Directional Converters - Grid-Interactive Inverters - Matrix converter – Merits and Limitations		
Unit-V	CASE STUDIES FOR HYBRID RENEWABLE ENERGY SYSTEMS	(9)
Hybrid Systems- Range and type of Hybrid systems – Performance Analysis – Cost Analysis - Case studies of Diesel-PV, Wind-PV-Fuel-cell, Micro-hydel-PV, Biomass-Diesel-Fuel-cell systems.		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	BahmanZohuri, "Hybrid Energy Systems", Springer, First Edition, 2018
2	S.M. Muyeen, "Wind Energy Conversion Systems", Springer First Edition, 2012
3	Md. Rabiul Islam, Md. Rakibuzzaman Shah, MohdHasan Ali, "Emerging Power Converters for Renewable Energy and Electric Vehicles", CRC Press, First Edition, 2021.

REFERENCES:

1	Ernst Joshua, Wind Energy Technology, PHI, India, 2018, 3rd Edition.
2	S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford University Press, 7th Impression, 2005.
3	Rashid.M. H "Power electronics Hand book", Academic press,4th Edition, 2018.
4	Rai. G.D, "Non-conventional energy sources", Khanna publishers, 6th Edition, 2017.
5	Rai. G.D, "Solar energy utilization", Khanna publishers, 3rd Edition, 1987

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Analyze the impacts of hybrid energy technologies on the environment and demonstrate them to harness electrical power.
CO2:	Select a suitable Electrical machine for Wind Energy Conversion Systems and simulate wind energy conversion system
CO3:	Design the power converters such as AC-DC, DC-DC, and AC-AC converters for SPV systems.
CO4:	Analyze the power converters such as AC-DC, DC-DC, and AC-AC converters for Hybrid energy systems.
CO5:	Interpret the hybrid renewable energy systems.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	3	-	3	3	3	3
CO2	3	3	3	2	3	-	-	-	3	-	3	3	3	3
CO3	3	3	3	2	3	-	-	-	3	-	3	3	3	3
CO4	3	3	3	2	3	-	-	-	3	-	3	3	3	3
CO5	3	3	3	2	-	-	-	-	3	-	3	3	3	3
Avg.	3	3	3	2	3	-	-	-	3	-	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department		Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2412	MULTILEVEL POWER CONVERTERS	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To learn multilevel topology (Symmetry & Asymmetry) with common DC bus link. - To study the working of cascaded H Bridge, Diode Clamped and Flying Capacitor MLI. - To study the working of MLI with reduced switch count. - To simulate three level diode clamped MLI and three level flying capacitor based MLI with resistive and reactive load - To simulate the MLI with reduced switch count.					

Unit-I	MULTILEVEL TOPOLOGIES	(9)
Introduction – Generalized Topology with a Common DC bus – Converters derived from the generalized topology – symmetric topology without a common DC link – Asymmetric topology.		
Unit-II	CASCADED H-BRIDGE MULTILEVEL INVERTERS	(9)
Introduction -H-Bridge Inverter, Bipolar Pulse Width Modulation, Unipolar Pulse Width Modulation.Multilevel Inverter Topologies, CHB Inverter with Equal DC Voltage, H-Bridges with Unequal DC Voltages – PWM, Carrier-Based PWM Schemes, Phase-Shifted Multicarrier Modulation, Level-Shifted Multicarrier Modulation.		
Unit-III	DIODE CLAMPED MULTILEVEL CONVERTER	(9)
Introduction – Converter structure and Functional Description – Modulation of Multilevel converters– Voltage balance Control – Effectiveness Boundary of voltage balancing in DCMC converters –Performance results.		
Unit-IV	FLYING CAPACITOR MULTILEVEL CONVERTER	(9)
Introduction – Flying Capacitor topology – Modulation scheme for the FCMC – Dynamic voltage balance of FCMC		
Unit-V	MULTILEVEL CONVERTER WITH REDUCED SWITCH COUNT	(9)
Multilevel inverter with reduced switch count-structures, working principles and pulse generation methods.		
Total No of Periods to be Taught		30



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TEXT BOOK:

1	Rashid M.H,"Power Electronics Circuits, Devices and Applications", Prentice Hall India,Third Edition, New Delhi, 2014 Pearson 4th edition.
2	Sergio Alberto Gonzalez, Santiago Andres Verne, Maria Ines Valla,"Multilevel Convertersfor Industrial Applications", CRC Press, 22-Jul-2013, 20171st Edition
3	BinWu, Mehdi Narimani,High Power Converters and AC drives by IEEE press 2017, 2ndEdition

REFERENCES:

1	Thomas A. Lipo, Pulse Width Modulation for Power Converters: Principles and Practice,D.Grahame Holmes, John Wiley & Sons, Oct-2003, 1st Edition
2	Fang Lin Luo, Hong Ye,Advanced DC/AC Inverters: Applications in Renewable Energy,CRC Press, 22-Jan-2013, 2017, 1st Edition
3	Hani Vahedi, Mohamed Trabelsi, Single-DC-Source Multilevel Inverters, Springer, 2019, 1 st Edition

List of Exercises/Experiments

1.Simulation of Fixed PWM, for an inverter	
2.Simulation of Sinusoidal PWM for an inverter	
3.Simulation of H bridge inverter with R load	
4.Simulation of H bridge inverter with RL load	
5.Simulation of three level diode clamped MLI with R load.	
6.Simulation of three level diode clamped MLI with RL load.	
7.Simulation of three level capacitor clamped MLI with R load	
8.Simulation of MLI with reduced switch configuration	
9.Simulation study of FCMC	
10.Simulation study of pulse generation methods	
Total No of Periods to be Taught	30

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Examine the different topologies of multilevel inverters (MLIs) with and without DC link capacitor
CO2:	Examine the performance of MLIs with Bipolar Pulse Width Modulation (PWM) Unipolar PWM Carrier-Based PWM Schemes Phase Level Shifted Multicarrier Modulation
CO3:	Demonstrate the working principles of Cascaded H-Bridge MLI, diode clamped MLI, flying capacitor MLI and MLI with reduced switch count
CO4:	Analyze the voltage balancing performance in Diode clamped MLI.
CO5:	Simulate three level, capacitor clamed and diode clamped MLI with R and RL load



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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Personal Computers	30 Nos
2	Software: Any Power system simulation software	1

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	-	2	1	-	3	-	3	3	3	3
CO2	3	2	2	3	-	2	1	-	3	-	3	3	3	3
CO3	3	2	2	3	-	2	1	-	3	-	3	3	3	3
CO4	3	3	3	3	-	2	1	-	3	-	3	3	3	3
CO5	3	3	3	3	3	2	1	-	3	-	3	3	3	3
Avg.	3	3	3	3	3	2	1	-	3	-	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2413	ELECTRIC VEHICLE ARCHITECTURE	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To learn the structure of Electric Vehicle, Hybrid Electric Vehicle • To study about the EV conversion components • To know about the details and specifications for Electric Vehicles • To understand the concepts of Plug-in Hybrid Electric Vehicle • To model and simulate all types of DC motors					

Unit-I	VEHICLE ARCHITECTURE AND SIZING	(9)
Electric Vehicle History, and Evolution of Electric Vehicles. Series, Parallel and Series parallel Architecture, Micro and Mild architectures. Mountain Bike - Motorcycle- Electric Cars and Heavy Duty EVs. -Details and Specifications.		
Unit-II	VEHICLE MECHANICS	(9)
Vehicle mechanics- Roadway fundamentals, Laws of motion, Vehicle Kinetics, Dynamics of vehicle motion, propulsion power, velocity and acceleration, Tire –Road mechanics, Propulsion System Design.		
Unit-III	POWER COMPONENTS AND BRAKES	(9)
Power train Component sizing- Gears, Clutches, Differential, Transmission and Vehicle Brakes. EV power train sizing, HEV Powertrain sizing, Example		
Unit-IV	HYBRID VEHICLE CONTROL STRATEGY	(9)
Vehicle supervisory control, Mode selection strategy, Modal Control strategies.		
Unit-V	PLUG-IN HYBRID ELECTRIC VEHICLE	(9)
Introduction-History-Comparison with electrical and hybrid electrical vehicle-Construction and working of PHEV-Block diagram and components-Charging mechanism-Advantages of PHEVs.		
Total No of Periods to be Taught		45



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REFERENCES:

1	MehrdadEhsani, YiminGao, Sebastian E. Gay, Ali Emadi, 'Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design', CRC Press, 2004.
2	Build Your Own Electric Vehicle, Seth Leitman, Bob Brant, McGraw Hill, Third Edition 2013.
3	Advanced Electric Drive Vehicles, Ali Emadi, CRC Press, First edition 2017
4	The Electric Vehicle Conversion Handbook: How to Convert Cars, Trucks, Motorcycles, and Bicycles -- Includes EV Components, Kits, and Project Vehicles Mark Warner, HP Books, 2011.
5	Heavy-duty Electric Vehicles from Concept to Reality, Shashank Arora, Alireza Tashakori Abkenar, Shantha Gamini Jayasinghe, Kari Tammi, Elsevier Science, 2021
6	Electric Vehicles Modern Technologies and Trends, Nil Patel, Akash Kumar Bhoi, Sanjeevikumar Padmanaban, Jens Bo Holm-Nielsen Springer, 2020

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Summarize the History and Evolution of EVs
CO2:	Describe the vehicle mechanics
CO3:	Analyse the details and Specifications for the various EVs developed. Describe the components of EV concepts related in the Plug-In Hybrid Electric Vehicles
CO4:	Describe the hybrid vehicle control strategy
CO5:	Summarize the History and Evolution of Plug-In hybrid EVs

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	1	-	-	-	2	3	-	-
CO2	3	-	2	-	-	-	1	-	-	-	2	3	3	3
CO3	3	-	2	-	-	-	1	-	-	-	2	3	-	-
CO4	3	-	2	-	-	-	1	-	-	-	2	3	-	-
CO5	3	-	2	3	3	-	1	-	-	-	2	3	3	3
Avg.	3	-	2.2	3	3	-	1	-	-	-	2	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2414	ELECTRIC VEHICLE DESIGN, MECHANICS AND CONTROL	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To learn the basics of EV and vehicle mechanics - To know the EV architecture - To study the energy storage system concepts - To derive model for batteries and to know the different types of batteries and its charging methods - To learn the control preliminaries for DC-DC converters.					

Unit-I	INTERNAL COMBUSTION ENGINES	(9)
IC Engines, BMEP and BSFC, Vehicle Fuel Economy, Emission Control Systems, Treatment of Diesel Exhaust Emissions.		
Unit-II	ELECTRIC VEHICLES AND VEHICLE MECHANICS	(9)
Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings- Comparisons of EV with internal combustion Engine vehicles- Fundamentals of vehicle mechanics.		
Unit-III	BATTERY MODELING, TYPES AND CHARGING	(9)
Batteries in Electric and Hybrid Vehicles - Battery Basics -Battery Parameters. Types- Lead Acid Battery - Nickel-Cadmium Battery - Nickel-Metal-Hydride (NiMH) Battery - Li-Ion Battery - Li-Polymer Battery, Zinc-Air Battery, Sodium-Sulphur Battery, Sodium-Metal-Chloride, Research and Development for Advanced Batteries. Battery Modelling, Electric Circuit Models. Battery Pack Management, Battery Charging.		
Unit-IV	CONTROL PRELIMINARIES	(9)
Control Design Preliminaries - Introduction - Transfer Functions – Bode plot analysis for First order and second order systems - Stability - Transient Performance- Power transfer function for boost converter - Gain margin and Phase margin study-open loop mode.		
Unit-V	CONTROL OF AC MACHINES	(9)
Introduction- Reference frame theory, basics-modelling of induction and synchronous machine in various frames- Vector control- Direct torque control.		
Total No of Periods to be Taught		45



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REFERENCES:

1	Electric and Hybrid Vehicles, Design Fundamentals, Third Edition, Iqbal Husain, CRC Press, 2021.
2	Power Electronic Converters, Dynamics and Control in Conventional and Renewable Energy Applications, Teuvo Suntio, Tuomas Messo, Joonas Puukko, 1st Edition, Wiley - VCH.
3	Ali Emadi, Mehrdad Ehsani, John M. Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel Dekker, Inc 2003, 1st Edition.
4	C.C. Chan and K.T. Chau, 'Modern Electric Vehicle Technology', OXFORD University Press, 2001, 1st Edition.
5	Wie Liu, "Hybrid Electric Vehicle System Modeling and Control", Second Edition, John Wiley & Sons, 2017, 2nd Edition.
6	Dynamic Simulation of Electric Machinery using MATLAB, Chee Mun Ong, Prentice Hall, 1997, 1st Edition.
7	Electrical Machine Fundamentals with Numerical Simulation using MATLAB/ SIMULINK, Atif Iqbal, Shaikh Moinoddin, Bhimireddy Prathap Reddy, Wiley, 2021, 1st Edition.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To describe the concepts related with EV, HEV and to compare the same with internal combustion engine vehicles
CO2:	To find gain margin & phase margin for various types of transfer functions of boost converter
CO3:	To demonstrate the Control of A C Machines
CO4:	To explain the concepts related with batteries and parameters of battery
CO5:	To module the battery and to study the research and development for batteries

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	-	-	1	2	-	2	3	3	3
CO2	3	2	3	2	3	-	-	1	3	-	2	3	3	3
CO3	3	2	3	2	3	3	-	1	2	-	2	3	3	3
CO4	3	2	3	2	3	3	-	1	2	-	2	3	3	3
CO5	3	2	3	2	3	3	-	1	2	-	2	3	3	3
Avg.	3	2	3	2	3	3	-	1	2.3	-	2	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2415	INTELLIGENT CONTROL OF ELECTRIC VEHICLES	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To design and drive the mathematical model of a BLDC motor and its characteristics • To learn the different control schemes for BLDC motor • To study the basics of fuzzy logic • To study the FPGA & VHDL basics • To implement fuzzy logic control of BLDC motor in real time					

Unit-I	MATHEMATICAL MODEL AND CHARACTERISTICS ANALYSIS OF THE BLDC MOTOR	(9)
Structure and Drive Modes - Basic Structure, General Design Method, Drive Modes. Mathematical Model, Differential Equations, Transfer Functions, State-Space Equations. Characteristics Analysis, Starting Characteristics, Steady-State Operation, Dynamic Characteristics, Load Matching Commutation Transients		
Unit-II	SPEED CONTROL FOR ELECTRIC DRIVES	(9)
Introduction -PID Control Principle, Anti windup Controller, Intelligent Controller. Vector Control. Control applied to BLDC motor		
Unit-III	FUZZY LOGIC	(9)
Membership functions: features, fuzzification, methods of membership value assignments Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems, overview of fuzzy expert system-fuzzy decision making.		
Unit-IV	FPGA AND VHDL BASICS	(9)
Introduction – FPGA Architecture-Advantages-Review of FPGA family processors- Spartan 3, Spartan 6 and Spartan 7. VHDL Basics- Fundamentals-Instruction set-data type-conditional statements- programs like arithmetic, sorting, PWM generation, Speed detection.		
Unit-V	REAL TIME IMPLEMENTATION	(9)
Inverter design, identifying rotor position via hall effect sensors, open loop and fuzzy logic control of 48 V BLDC motor using FPGA.		
Total No of Periods to be Taught		45



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REFERENCES:

1	Electric Powertrain Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, John G. Hayes, G. AbasGoodarzi, Wiley 1st Edition 2018
2	VHDL Primer, A (3rd Edition), JayaramBhasker, Prentice Hall, 1st Edition 2015
3	IqbalHussain, "Electric and Hybrid Vehicles: Design Fundamentals, Third Edition" CRC Press, Taylor & Francis Group, 2021, 1stEdition.
4	Chang-liang, Permanent Magnet Brushless DC Motor Drives and Controls, Xia Wiley 2012, 1st Edition.
5	M.N. Cirstea, A. Dinu, J.G. Khor, M. McCormick, Neural and Fuzzy Logic Control of Drives and Power Systems, Newnes publications, 1st Edition, 2002
6	Wei Liu, Hybrid Electric Vehicle System Modelling and Control, Wiley 2017, 2nd Edition
7	Electric and Plug-in Hybrid Vehicle Networks Optimization and Control, EmanueleCrisostomi • Robert Shorten, Sonja Stüdli • Fabian Wirth, CRC Press, 1 st Edition. 2018

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To design the mathematical model of a BLDC motor and to discuss about its characteristics
CO2:	To demonstrate the PID control, ant windup controller, Intelligent Controller and Vector Control. Control applied to BLDC motor.
CO3:	To illustrate the basics of fuzzy logic system.
CO4:	To describe the basics of VHDL & FPGA applied to control of EVs.
CO5:	To design and implement of fuzzy logic control scheme for BLDC motor using FPGA in real time.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	3	-	2	-	3	3	3
CO2	3	3	2	2	-	-	-	3	-	2	-	3	3	3
CO3	3	3	3	3	-	-	-	-	-	2	-	3	3	2
CO4	3	3	3	3	-	-	-	-	-	2	-	3	3	3
CO5	3	3	3	3	3	-	-	3	-	2	-	3	3	3
Avg.	3	3	2.6	2.6	3	-	-	3	-	2	-	3	3	2.8

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2416	GRID INTEGRATION OF ELECTRIC VEHICLES	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To know the basic details of V2G • To study the benefits & challenges of V2G • To learn EV & V2G on the smart grids renewable energy systems • To know the grid integration					

Unit-I	DEFINITION, AND STATUS OF V2G	(9)
Defining Vehicle to Grid (V2G) - History and Development of V2G. Incorporating V2G to the EV, Auditing and Metering, V2G in Practice , V2G - Power Markets and Applications . Electricity Markets and V2G Suitability , Long-Term Storage.		
Unit-II	BENEFITS AND CHALLENGES OF V2G	(9)
Benefits of V2G, Technical Benefits: Storage Superiority and Grid Efficiency, Economic Benefits: EV Owners and Societal Savings, Environment and Health Benefits: Sustainability in Electricity and Transport, Other Benefits.		
Unit-III	CHALLENGES TO V2G	(9)
Technical Challenges-Battery Degradation, Charger Efficiency, Aggregation and Communication, V2G in a Digital Society. The Economic and Business Challenges to V2G - Evaluating V2G Costs and Revenue , EV Costs and Benefits Adding V2G Costs and Benefits, Additional V2G Costs, The Evolving Nature of V2G Costs and Benefits. Regulatory and Political Challenges to V2G , V2G and Regulatory Frameworks , Market Design Challenges. Other V2G Regulatory and Legal Challenges.		
Unit-IV	IMPACT OF EV AND V2G ON THE SMART GRID AND RENEWABLE ENERGY SYSTEMS	(9)
Introduction - Types of Electric Vehicles - Motor Vehicle Ownership and EV Migration - Impact of Estimated EVs on Electrical Network - Impact on Drivers and the Smart Grid - Standardization and Plug-and-Play - IEC 61850 Communication Standard and IEC 61850-7-420 Extension.		
Unit-V	GRID INTEGRATION AND MANAGEMENT OF EVS	(9)
Introduction - Machine to Machine (M2M) in distributed energy management systems - M2M communication for EVs - M2M communication architecture (3GPP) - Electric vehicle data logging - Scalability of electric vehicles - M2M communication with scheduling.		
Total No of Periods to be Taught		45



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REFERENCES:

1	Advanced Electric Drive Vehicles, Ali Emadi, CRC Press 2017, 1st Edition.
2	Plug In Electric Vehicles in Smart Grids, Charging Strategies, Sumedha Rajakaruna, Farhad Shahnian and Arindam Ghosh, Springer, 2015, 1st Edition.
3	ICT for Electric Vehicle Integration with the Smart Grid, Nandkishor 1; Jesus Fraile-Ardanuy, IET 2020, 1st Edition
4	Vehicle-to-Grid: Linking Electric Vehicles to the Smart Grid, Junwei Lu and Jahangir Hossain, IET 2015, 1st Edition
5	Lance Noel · Gerardo Zarazua de Rubens Johannes Kester · Benjamin K. Sovacool, Vehicle-to-Grid A Sociotechnical Transition Beyond Electric Mobility, 2019, 1st Edition.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain the concepts related with V2G
CO2:	Study the grid connection of 3 phase Q inverter
CO3:	Explain the technical, economics. business, regulatory & political challenges related with V2G
CO4:	Demonstrate the impact of EV and V2G on smart grid and renewable energy system
CO5:	Explain the concept of grid integration and management of EVs.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	1	-	2	-	-	3	3	1
CO2	3	3	-	-	3	2	1	-	2	-	-	3	-	-
CO3	3	-	-	-	-	2	1	-	2	-	-	3	-	-
CO4	3	-	-	-	-	2	1	-	2	-	-	3	-	2
CO5	3	-	-	-	-	2	1	-	2	-	-	3	-	3
Avg.	3	3	-	-	3	2	1	-	2	-	-	3	3	1.2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2417	TESTING OF ELECTRIC VEHICLES	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To know various standardization procedures • To learn the testing procedures for EV & HEV components • To know the functional safety and EMC • To realize the effect of EMC in EVs • To study the effect of EMI in motor drives and in DC-DC converter system					

Unit-I	EV STANDARDIZATION	(9)
Introduction - Current status of standardization of electric vehicles, electric Vehicles and Standardization - Standardization Bodies Active in the Field – Standardization activities in countries like Japan. The International Electro Technical Commission - Standardization of Vehicle Components.		
Unit-II	TESTING OF ELECTRIC MOTORS AND CONTROLLERS FOR ELECTRIC AND HYBRID ELECTRIC VEHICLES	(9)
Test Procedure Using M-G Set, electric motor, controller, application of Test Procedure, Analysis of Test Items for the Type Test - Motor Test and Controller Test (Controller Only). - Test Procedure Using Eddy Current Type Engine Dynamometer, Test Strategy, Test Procedure, Discussion on Test Procedure. Test Procedure Using AC Dynamometer.		
Unit-III	FUNDAMENTALS OF FUNCTIONAL SAFETY AND EMC	(9)
Functional safety life cycle - Fault tree analysis - Hazard and risk assessment – software development - Process models - Development assessments - Configuration management - Reliability - Reliability block diagrams and redundancy - Functional safety and EMC - Functional safety and quality - Standards - Functional safety of autonomous vehicles.		
Unit-IV	EMC IN ELECTRIC VEHICLES	(9)
Introduction - EMC Problems of EVs, EMC Problems of Motor Drive, EMC Problems of DC-DC Converter System, EMC Problems of Wireless Charging System, EMC Problem of Vehicle Controller, EMC Problems of Battery Management System, Vehicle EMC Requirements		
Unit-V	EMI IN MOTOR DRIVE AND DC-DC CONVERTER SYSTEM	(9)
Overview -EMI Mechanism of Motor Drive System, Conducted Emission Test of Motor Drive System, IGBT EMI Source, EMI Coupling Path, EMI Modelling of Motor Drive System. EMI in DC-DC Converter, EMI Source, The Conducted Emission High-Frequency, Equivalent Circuit of DC-DC Converter System, EMI Coupling Path		
Total No of Periods to be Taught		45



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REFERENCES:

1	Handbook of Automotive Power Electronics and Motor Drives, Ali Emadi, Taylor & Francis, 2005, 1st Edition
2	Electromagnetic Compatibility of Electric Vehicle, Li Zhai, Springer 2021, 1st Edition
3	EMC and Functional Safety of Automotive Electronics, Kai Borgeest, IET 2018, 1st Edition
4	EMI/EMC Computational Modeling Handbook, Druce Archambeault, Colin Branch, Omar M. Ramachi, Springer 2012, 2nd Edition
5	Automotive EMC, Mark Steffika, Springer 2013, 1st Edition
6	Electric Vehicle Systems Architecture and Standardization Needs, Reports of the PPP European Green Vehicles Initiative, Beate Müller, Gereon Meyer, Springer 2015, 1st Edition.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To describe the status and other details of standardization of EVs
CO2:	To illustrate the testing protocols for EVs and HEV components
CO3:	To analyze the safety cycle and need for functions safety for EVs
CO4:	To analyze the problems related with EMC for EV components.
CO5:	To evaluate the EMI in motor drive and DC-DC converter system.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	2	2	-	3	-	2	3	3	2
CO2	3	1	1	-	-	1	2	-	3	-	2	3	3	2
CO3	3	1	1	-	-	2	2	-	3	-	2	3	3	2
CO4	3	1	1	-	-	1	2	-	3	-	2	3	3	2
CO5	3	1	1	-	-	2	2	-	3	-	2	3	3	3
Avg.	3	1	1	-	-	1.8	2	-	3	-	2	3	3	2.3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2418	DESIGN OF ELECTRIC VEHICLE CHARGING SYSTEM	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To know the charging station and standards - To learn the concepts of power converters in charging - To find the charging scheme in renewable based EV charging - To demonstrate the wireless power transfer technique - To design & simulate power factor correction circuits.					

Unit-I	CHARGING STATIONS AND STANDARDS	(9)
Introduction-Charging technologies- Conductive charging, EV charging infrastructure, International standards and regulations - Inductive charging, need for inductive charging of EV, Modes and operating principle, Static and dynamic charging, Bidirectional power flow		
Unit-II	POWER ELECTRONICS FOR EV CHARGING	(9)
Layouts of EV Battery Charging Systems-AC charging-DC charging systems- Power Electronic Converters for EV Battery Charging- AC-DC converter with boost PFC circuit, with bridge and without bridge circuit - Bidirectional DC-DC Converters- Non-isolated DC-DC bidirectional converter topologies- Half-bridge bidirectional converter.		
Unit-III	EV CHARGING USING RENEWABLE AND STORAGE SYSTEMS	(9)
Introduction- - EV charger topologies , EV charging/discharging strategies - Integration of EV charging-home solar PV system , Operation modes of EVC-HSP system , Control strategy of EVC-HSP system - fast-charging infrastructure with solar PV and energy storage.		
Unit-IV	WIRELESS POWER TRANSFER	(9)
Introduction - Inductive, Magnetic Resonance, Capacitive types. Wireless Chargers for Electric Vehicles - Types of Electric Vehicles - Battery Technology in EVs -Charging Modes in EVs - Benefits of WPT. - WPT Operation Modes - Standards for EV Wireless Chargers, SAE J2954, IEC 61980. ISO 19363		
Unit-V	POWER FACTOR CORRECTION IN CHARGING SYSTEM	(9)
Need for power factor correction- Boost Converter for Power Factor Correction, Sizing the Boost Inductor, Average Currents in the Rectifier and calculation of power losses		
Total No of Periods to be Taught		45



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REFERENCES:

1	Mobile Electric Vehicles Online Charging and Discharging, Miao Wang Ran Zhang Xuemin (Sherman) Shen, Springer 2016, 1st Edition.
2	Alicia Triviño-Cabrera, José M. González-González, José A. Aguado, Wireless Power Transferor Electric Vehicles: Foundations and Design Approach, Springer Publisher 1st Edition. 2020.
3	Nil Patel, Akash Kumar Bhoi, SanjeevikumarPadmanaban, Jens Bo Holm-Nielsen, Electric Vehicles Modern Technologies and Trends. Springer Publisher 1st Edition, 2021.
4	Cable Based and Wireless Charging Systems for Electric Vehicles, Technology and control, management and grid integration, Rajiv Singh, SanjeevikumarPadmanaban, SanjeetDwivedi, Marta Molinas and FredeBlaabjerg, IET 2021, 1st Edition.
5	Electric and Hybrid Electric Vehicles, James D Halderman, Pearson, 2022, 1st Edition
6	Handbook of Automotive Power Electronics and Motor Drives, Ali Emadi, Taylor & Francis, 2005.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To illustrate various charging techniques and to know charging standards and regulations.
CO2:	To demonstrate the working o DC-DC converters used for charging systems and principles
CO3:	To illustrate the advantages of renewable system based charging systems
CO4:	To demonstrate the principles of wireless power transfer.
CO5:	To analyze the standards for wireless charging

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	2	2	-	3	-	3	3	-	-
CO2	3	3	3	3	-	2	2	-	3	-	3	3	3	3
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	-	2	2	-	2	-	1	3	3	3
CO5	3	-	-	-	-	-	-	-	-	-	-	3	3	3
Avg.	3	3	3	3	3	2	2	-	3	-	2	3	3	3

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2419	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To introduce the architecture of PIC microcontroller - To educate on use of interrupts and timers - To educate on the peripheral devices for data communication and transfer - To introduce the functional blocks of ARM processor - To educate on the architecture of ARM processors.					

Unit-I	INTRODUCTION TO PIC MICROCONTROLLER	(9)
Introduction to PIC Microcontroller–PIC 18Fxx Architecture - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – I/O ports - Simple Operations		
Unit-II	TIMER	(9)
Timers-Timer Programming – CCP (Capture, Compare and PWM) Modules – Generating a periodic Waveform using timers – Generating PWM using CCP Module – PWM with variable pulse width by polling method – Timer interrupt to do parallel task.		
Unit-III	INTERRUPTS	(9)
PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine -- Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variable strings.		
Unit-IV	PERIPHERALS AND INTERFACING	(9)
Analog to Digital Converter Data handling circuit–Initialization –Interfacing Input peripherals -Interfacing Push-Button Keys – Interfacing output peripherals - Seven Segment LED interface - LCD and keyboard Interfacing - ADC, DAC, and Sensor Interfacing.		
Unit-V	COMMUNICATION PROTOCOLS	(9)
I2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM—USART-Baud rate selection– Serial Peripheral Interface (SPI).		
Total No of Periods to be Taught		45

TEXT BOOK:	
1	Peatman,J.B., “Design with PIC Micro Controllers”PearsonEducation,3rdEdition, 2004
2	Furber,S., “ARM System on Chip Architecture” Addison Wesley trade Computer Publication, 2000.

REFERENCES:	
1	Mazidi, M.A.“PIC Microcontroller” Rollin Mckinlay, Danny causey Printice Hall of India, 2007.



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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	The hardware functional and software strategies required to develop various Embedded systems
CO2:	The basic differences between various Bus communication standards
CO3:	The incorporation of the interface as Interrupt services
CO4:	The various scheduling algorithms through a Real-time operating system.
CO5:	The various embedded concepts for developing automation applications

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	-	-	-	-	-	-	2	2	3
CO2	3	2	3	2	1	-	-	-	-	-	-	2	1	3
CO3	3	2	2	3	1	-	-	-	-	-	-	2	1	2
CO4	3	2	2	2	1	-	-	-	-	-	-	1	2	3
CO5	3	2	1	2	1	-	-	1	-	-	-	3	1	2
Avg.	3	2.2	2	2.2	1	-	-	1	-	-	-	2	1.4	2.6

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2420	EMBEDDED PROCESSORS	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To introduce the architecture of the ARM processor. - To train students in ARM programming. - To impart the knowledge on Timers and PWM - To involve Discuss the concept of communication interface. - To impart the knowledge on interrupt in ARM processors					

Unit-I	ARM ARCHITECTURE	(9)
Arm processor architecture and pipelining; programmer's model; data paths and instruction decoding; Modes of Operations of ARM; Advanced Microcontroller Bus architecture; ARM instruction set; addressing modes; Simple programming		
Unit-II	PERIPHERALS OF ARM	(9)
General Purpose Input and Output (GPIO); Fast GPIO; Analog to Digital Converter (ADC); Digital to Analog Converter (DAC); Programming.		
Unit-III	TIMERS and PWM	(9)
Different modes of operation of Timers; Match Registers; Generation of PWM using Compare registers; Capture Control; Single and Double Edge Controlled PWM; Programming.		
Unit-IV	ARM COMPONENT & COMMUNICATION INTERFACE	(9)
System Control; Real Time Clock (RTC), Watch Dog Timer (WDT) , USB 2.0 Full-Speed device controller with DMA, UART, I ² C, SPI/SSP.		
Unit-V	EXCEPTION and INTERRUPT HANDLING	(9)
Exception handling overview; Interrupts; Interrupt Handling Schemes; Nested Interrupt Handler; Vectored Interrupt Controller; FIQ and IRQ modes of operation, interrupt programming with External Interrupt, Timer Interrupt, PWM Interrupt, ADC Interrupt, UART interrupt, Watch Dog Timer Interrupt, I2C Interrupt, SPI Interrupt, SSP Interrupt, RTC Interrupt, Brown Out Detect (BOD), USB Interrupt		
Total No of Periods to be Taught		45

TEXT BOOK:	
1	Steve Furber, 'ARM system on chip architecture',Addisonn Wesley,2nd Edition,2015.



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REFERENCES:

1	William Hohl, ' ARMAsebley Language' Fundamentals and Techniques, CRC Press, 2nd Edition 2014
3	Rajkamal," Microcontrollers Architecture, Programming, Interfacing, & System Design,Pearson,2012, 2nd Edition
4	ARM Architecture Reference Manual, LPC214x User Manual www.Nuvoton .com/websites on Advanced ARM Cortex Processors
5	ARM System Developer's Guide: Designing and Optimizing System Software 1st Edition (Designing and Optimizing System Software) Publisher: Morgan Kaufmann Publishers, 2011.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Interpret the basics and functionality of processor functional blocks.
CO2:	Observe the specialty of RISC processor Architecture.
CO3:	Incorporate the I/O hardware interface of processor with peripherals
CO4:	Emphasis the communication features of the processor.
CO5:	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in commercial embedded processors.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	2	2	1	-	-	-	-	-	-	2	1	2
CO2	1	1	2	2	1	-	-	-	-	-	-	1	2	2
CO3	3	2	3	2	3	-	-	-	-	-	-	3	3	3
CO4	3	2	3	2	3	-	-	-	-	-	-	2	2	3
CO5	3	2	1	2	1	-	-	1	-	-	-	1	2	2
Avg.	2.2	1.6	2.2	2	1.8	-	-	1	-	-	-	1.8	2.2	2.4

1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2421	EMBEDDED CONTROL FOR ELECTRIC DRIVES	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To provide the control concept for electrical drives - To emphasize the need of embedded systems for controlling the electrical drives - To provide knowledge about various embedded system-based control strategies for electrical drives - To Impart the knowledge of optimization and machine learning techniques used for electrical drives - To familiarize the high-performance computing for electrical drives.					

Unit-I	INTRODUCTION TO ELECTRIC DRIVES	(9)
Electric drives and its classification-Four-quadrant drive-Solid State Controlled Drives-Machine learning and optimization techniques for electrical drives		
Unit-II	EMBEDDED SYSTEM FOR MOTOR CONTROL	(9)
Embedded Processors choice for motor control- Functional overview of ARM Cortex M; Pinouts and pin description; GPIOs; System configuration controller (SYSCFG); ADC; DAC; Sensors and interface modules for Electric drives-IoT for Electrical drives applications		
Unit-III	INDUCTION MOTOR CONTROL	(9)
Timers in ARM Cortex M - Nested Vectored Interrupt Controller (NVIC) in ARM Cortex M - Speed control methods- PWM techniques- VSI fed three-phase induction motor- Fuzzy logic Based speed control for three-phase induction motor- Embedded processor based three phase induction motor speed control		
Unit-IV	BLDC MOTOR CONTROL	(9)
Overview of BLDC Motor -Speed control methods -PWM techniques- Embedded processor based BDLC motor speed control		
Unit-V	SRM MOTOR CONTROL	(9)
Overview of SRM Motor -Speed control methods -PWM techniques- Embedded processor based SRM motor speed control		
Total No of Periods to be Taught		45

TEXT BOOK:	
1	R.Krishnan, "Electric Motor Drives – Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 2010, 1st Edition.
2	Steve Kilts, "Advanced FPGA Design: Architecture, Implementation, and Optimization" Willey, 2007, 1st Edition.





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REFERENCES:

1	VedamSubramanyam, "Electric Drives – Concepts and Applications", Tata McGraw- Hill publishing company Ltd., New Delhi, 2002, 2nd Edition.
2	K. Venkataratnam ,Special Electrical Machines, Universities Press, 2014, 1st Edition.
3	Steve Furber, 'ARM system on chip architecture',Addison Wesley, 2nd Edition 2015
4	Ron Sass and AnderewG.Schmidt, "Embedded System design with platform FPGAs:Principles and Practices", Elsevier, 2010, 1st Edition.
5	Tim Wescott , Applied Control Theory for Embedded Systems , Elsevier, 2006, 1st Edition

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Interpret the significance of embedded control of electrical drives
CO2:	Deliver insight into various control strategies for electrical drives
CO3:	Developing knowledge of Machine learning and optimization techniques for motor control
CO4:	Develop embedded system solutions for real-time application such as Electric vehicles and UAVs.
CO5:	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded system skills required for motor control strategy

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	2	2	1	-	-	-	-	-	-	2	1	2
CO2	2	1	3	2	1	-	-	-	-	-	-	2	1	2
CO3	3	2	3	3	3	-	-	-	-	-	-	1	3	3
CO4	3	2	3	3	3	-	-	-	-	-	-	3	3	3
CO5	3	2	1	2	1	-	-	1	-	-	-	2	2	3
Avg.	2.4	1.6	2.4	2.4	1.8	-	-	1	-	-	-	2	2	2.6

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2422	PLC AND SCADA SYSTEM	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To know about the basics of PLC and Automation - To understand the importance of Automation - To explore various types and manufactures of PLCs. - To introduce types of programming languages of PLC and some exercise few programs					

Unit-I	INTRODUCTION	(9)
Programmable Logic Controller (PLC)- Block diagram of PLC- Programming languages of PLC Basic instruction sets- Design of alarm and interlocks- Networking of PLC- Overview of safety of PLC with case studies- Process Safety Automation: Levels of process safety through use of PLCs- IEC 61131-3 Standard - Application of international standards in process safety control.		
Unit-II	IEC 61131-3	(9)
Rails- Rungs- Relay Logic- Latch switch- Timers- Counters- Boolean logics- Math Instructions Data manipulation Instructions- Requirement of communication networks for PLC, PLC to PC Communication to computer- FBD equivalent to LL- FBD Programming- IL- SFC-ST.		
Unit-III	SCADA	(9)
Elements of SCADA system- History of SCADA, Remote Terminal Unit- Discrete control- Analog control, Master Terminal Unit- Operator interface.		
Unit-IV	HART AND FIELD BUS	(9)
Introduction- Evolution of signal standards- HART communication protocol- communication modes- HART networks- HART commands- HART and OSI model- Field bus- Architecture Basic requirements of field Bus standard- Field bus Topology- Interoperability- Inter changeability.		
Unit-V	PLC PROGRAMMING	(9)
Exercise in Programming Languages from IEC 61131-3: Traffic Light Control- Two way- Four way – Water Level Control- Automatic Material Sorting System- Automatic Bottle Filling System, Code Converters- DC motor Control- Alarm Circuit.		
Total No of Periods to be Taught	45	

TEXT BOOK:	
1	Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2019.
2	Stuart Boyer A, "SCADA: Supervisory control and data Acquisition", Fourth Edition, ISA- The Instrumentation, Systems, and Automation Society, 2010



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REFERENCES:

1 Bolton. W, "Programmable Logic Controllers", Elsevier Newnes, 6th Edition 2015.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understand the basics and need for Automation in industries .
CO2:	Explain the logic and flow of any particular programming written for a process
CO3:	Apply the knowledge to design or improve an existing program to increase productivity of any process .
CO4:	Breakdown SCADA architecture and communication protocols
CO5:	Build and logic in any of the programming languages from IEC- 61131- 3 standard .

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	1	-	1	-	1	-	-
CO2	2	2	2	2	-	-	-	1	-	1	-	1	-	-
CO3	3	2	2	2	-	-	-	1	-	1	-	1	-	-
CO4	3	2	2	2	-	-	-	1	-	1	-	2	-	-
CO5	3	2	2	2	-	-	-	1	-	1	-	1	-	-
Avg.	2.6	2	2	2	-	-	-	1	-	1	-	1.2	-	-

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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2423	SMPS AND UPS	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To learn the working of isolated & non-isolated DC-DC converters - To design isolated & non-isolated DC-DC converters. - To drive the equations related with converter dynamics. - To design and simulate P, PI & PID controller for buck, boost and buck-boost converters. - To identify and study different configurations of the UPS.					

Unit-I	ANALYSIS OF NON-ISOLATED DC-DC CONVERTERS	(9)
Basic topologies: Buck, Boost and Buck-Boost - Principles of operation – Continuous conduction mode– Concepts of volt-sec balance and charge balance – Analysis and design based on steady-state relationships – Introduction to discontinuous conduction mode		
Unit-II	ANALYSIS OF ISOLATED DC-DC CONVERTERS	(9)
Introduction - classification- forward- flyback- push pull – half bridge – full bridge topologies- Cuck converter as cascade combination of boost followed by buck – isolated version of Cuck converter -design of SMPS – Introduction to design of magnetic components for SMPS, using relevant software- Simulation of bidirectional DC DC converter (both non-isolated and isolated) considering EV as an example application		
Unit-III	CONVERTER DYNAMICS	(9)
AC equivalent circuit analysis – State space averaging – Circuit averaging – Transfer function model for buck, boost and buck-boost converters – Simulation of basic topologies using state space model derived – Comparison with the circuit model based simulation already carried out.		
Unit-IV	CONTROLLER DESIGN	(9)
Review of P, PI, and PID control concepts – gain margin and phase margin – Bode plot based analysis – Design of controller for buck, boost and buck-boost converters.		
Unit-V	POWER CONDITIONERS AND UPS	(9)
Introduction – Power line disturbances – Power conditioners – UPS: Offline and On-line – Need for filters – Filter for PWM VSI – Front-end battery charger – boost charger .		
Total No of Periods to be Taught		45

TEXT BOOK:	
1	Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2019.
2	Stuart Boyer A, "SCADA: Supervisory control and data Acquisition", Fourth Edition, ISA- The Instrumentation, Systems, and Automation Society,2010





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REFERENCES:

1	Robert W. Erickson & Dragon Maksimovic," Fundamentals of Power Electronics", Third Edition, 2020
2	Ned Mohan," Power Electronics: A First Course", John Wiley, 2013
3	Marian K. Kazimierczuk and Agasthya Ayachit," Laboratory Manual for Pulse-Width Modulated DC- DC Power Converters", Wiley 2016
4	Power Electronics handbook, Industrial Electronics series, S.K.Varenina, CRC press, 2002
5	Power Electronic Converters, Teuvo Suntio, Tuomas Messo, Joonas Puukko, First Edition 2017

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Personal Computers	30 Nos
2	Software: Any Power system simulation software	1

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Demonstrate the working of buck boost and buck- boost converters in continuous and discontinuous conduction mode
CO2:	Build buck/boost converters using suitable design method
CO3:	Analyze the behaviors of isolated DC-DC converters and to design SMPS for battery operated vehicle.
CO4:	Compute state space averaged model and transfer function for buck, boost and buck- boost converters.
CO5:	Demonstrate the P, PI and PID controller performance analytically and by simulation for buck boost and buck- boost converters.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	3	3	-	2	-	3	3	3	3
CO2	3	3	3	3	-	3	3	-	2	-	3	3	3	3
CO3	3	3	3	3	-	3	-	-	3	-	3	3	3	3
CO4	3	3	3	3	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	3	-	-	3	-	3	-	3	3	3	3
Avg.	3	3	3	3	-	-	3	-	3	-	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name	105-B.E EEE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEPE2424	SMART GRID	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand the evolution of Smart and Interconnected energy systems. - To understand the various challenges and benefits of smart grid and the national and international initiatives taken - To understand the concepts related with transmission and distribution in smart grid technologies. - To get an insight of the various smart measurement technologies. - To understand the various computing technologies for Smart Operation of the Grid					

Unit-I	INTRODUCTION	(9)
Evolution of Energy Systems, Concept, Definitions and Need, Difference between Conventional & SmartGrid, Drivers, structures, functions, opportunities, challenges and benefits of Smart Grid, Basics of Microgrid, National and International Initiatives in Smart Grid		
Unit-II	SMART METERING	(9)
Introduction to Advanced Metering infrastructure (AMI) - drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Real time management and control, Phasor Measurement Unit (PMU)		
Unit-III	SMART GRID TECHNOLOGIES (TRANSMISSION)	(9)
Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, Wide area Monitoring, Protection and control		
Unit-IV	SMART GRID TECHNOLOGIES (DISTRIBUTION)	(9)
DMS, Volt/VAr control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Electric Vehicle		
Unit-V	HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS	(9)
Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Computing technologies for Smart Grid applications (Web Service to CLOUD Computing), Role of big data and IoT, Cyber Security for Smart Grid		
Total No of Periods to be Taught		45

TEXT BOOK:	
1	Smart Grids Advanced Technologies and Solutions, Second Edition, Edited by Stuart Borlase, CRC, 2018
2	Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley, 2012
3	James Momoh, Smart Grid Fundamentals of Design and Analysis, IEEE press 2012





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REFERENCES:

1	Ahmed F. Zobaa, Trevor J. Bihl, Big data analytics in future power systems, 1st Edition, CRC press 2018.
2	C. Gungor et al., "Smart Grid Technologies: Communication Technologies and Standards," in IEEE Transactions on Industrial Informatics, vol. 7, no. 4, pp. 529-539, Nov. 2011. doi: 10.1109/TII.2011.2166794
3	X. Fang, S. Misra, G. Xue and D. Yang, "Smart Grid — The New and Improved Power Grid: A Survey," in IEEE Communications Surveys & Tutorials, vol. 14, no. 4, pp. 944- 980, Fourth Quarter 2012. doi: 10.1109/SURV.2011.101911.00087
4	Stuart Borlase "Smart Grid : Infrastructure, Technology and Solutions", CRC Press 2012

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To be able to understand the importance and objectives of Power System Grid
CO2:	To be able to know and understand the concept of a smart grid
CO3:	To identify and discuss smart metering devices and associated technologies
CO4:	To be able to get an overview of Microgrid and Electric Vehicle Technology
CO5:	To be able to have an up to date knowledge on the various computing technologies; to understand the role of Big Data and IoT for effective and efficient operation of Smart Grid

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	-	1	-	-	-	2	3	3	-
CO2	3	3	2	3	3	-	1	-	-	-	2	3	3	-
CO3	3	3	2	3	3	-	1	-	-	-	2	3	3	-
CO4	3	3	2	3	3	-	1	-	-	-	2	3	3	-
CO5	3	3	2	3	3	-	1	-	-	-	2	3	3	-
Avg.	3	3	2	3	3	-	1	-	-	-	2	3	3	-

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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2401	ELECTRICAL SAFETY	3	0	0	3	100
Course Objectives	- To provide an overview of electrical safety, shocks and their prevention. - To Understand the electrical safety in residential, commercial and agricultural installations - To familiarise with electrical safety during installation, testing and commissioning, operation and maintenance - To provide an overview of electrical hazardous areas					

Unit-I	INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION	(9)
Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shop.		
Unit-II	ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS	(9)
Wiring and fitting –Domestic appliances –water tap giving shock –shock from wet wall –fan firing shock –multi-storied building –Temporary installations – Agricultural pump installation Do's and Don'ts for safety in the use of domestic electrical appliances.		
Unit-III	ELECTRICAL SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE	(9)
Preliminary preparations –safe sequence –risk of plant and equipment –safety documentation –field quality and safety -personal protective equipment –safety clearance notice –safety precautions –safeguards for operators – safety..		
Unit-IV	ELECTRICAL SAFETY IN HAZARDOUS AREAS	(9)
Hazardous zones –class 0,1 and 2 spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipment's for hazardous locations –Classification of equipment enclosure for various hazardous gases and vapours –classification of equipment/enclosure for hazardous locations		
Unit-V	FIRE EXTINGUISHERS	(9)
Fundamentals of fire-initiation of fires, types; extinguishing techniques, prevention of fire, types of fire extinguishers, fire detection and alarm system;CO2 and Halogen gas schemes; foam schemes.		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Rao, S. and Saluja, H.L., "Electrical Safety, Fire Safety Engineering and Safety Management", Khanna Publishers, 1988
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REFERENCES:

1	Cooper.W.F, "Electrical safety Engineering", Newnes-Butterworth Company, 1978.
2	John Codick, "Electrical safety hand book", McGraw Hill Inc., New Delhi, 2000.
3	Nagrath, I.J. and Kothari, D.P., "Power System Engineering", Tata McGraw Hill, 1998.
4	Wadhwa, C.L., "Electric Power Systems", New Age International, 2004.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understand the Indian power sector organization and Electricity rules, electrical safety in residential, commercial, agriculture, hazardous areas and use of fire extinguishers.
CO2:	Apply various fire extinguishers and the Electrical Safety to prevent the Electric Shocks in residential, commercial, agriculture and hazardous areas;
CO3:	Apply the Electrical Safety to prevent the Electric Shocks during installation, testing, commissioning, Operation and Maintenance
CO4:	Analyse the Electrical Safety, Electric Shocks and Their Prevention.
CO5:	Examine the Electrical Safety in hazardous areas and the use of various fire extinguishers.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3

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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2402	INTRODUCTION TO ELECTRICAL MACHINES	3	0	0	3	100
Course Objectives	- To introduce the principles of operations of DC machines as motor and generator - To introduce the principles of operations of Transformers - To introduce the principles of operations of Induction machines. - To introduce the principles of operations of Synchronous machines. - To introduce other special machines					

Unit-I	D.C. MACHINES	(9)
D.C. Machines – Principle of operation and construction of motor and generator – torque and EMF equation — Characteristics of Motor and Generator – Starting, Speed control and braking of D.C. Motor		
Unit-II	TRANSFORMERS	(9)
Principle , Construction and Types of Transformer - EMF equation - Equivalent circuits - Phasor diagrams - Regulation and efficiency of a transformer-three phase transformer Connection.		
Unit-III	SYNCHRONOUS MACHINES	(9)
Principle of Operation, type - EMF Equation and Phasor diagrams - Synchronous motor-Rotating Magnetic field Starting Methods , Torque V-Curves, inverted – V curves		
Unit-IV	THREE PHASE INDUCTION MOTORS	(9)
Constructional details – Types of rotors — Principle of operation – Slip - Equivalent circuit – Torque-Slip characteristics - Starting, Speed control and induction motor.		
Unit-V	SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES	(9)
Types of single phase induction motors – Capacitor start capacitor run motors – Shaded pole motor – Repulsion type motor – Universal motor – Hysteresis motor - Permanent magnet synchronous motor – Switched reluctance motor – Brushless D.C motor.		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	B.S.Guru and H.R.Hiziroglu, "Electric Machinery and Transformer", Oxford university Press 2007
2	M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009
3	Deshpande M. V., "Electrical Machines" PHI Learning Pvt. Ltd., New Delhi, 2011.

REFERENCES:

1	Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi, 1995.
2	Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., "Electric Machinery", McGraw- Hill, Singapore, 2000.
3	Nagrath I. J and Kothari D. P. 'Electric Machines', Fourth Edition, Tata McGraw Hill. Publishing Company Ltd, 2010
4	M.S. Sarma and M.K.Pathak, "Electric Machines", Cengage Learning, 2012. 5. C.A.Gross, "Electric Machines", CRC Press 2010

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain the construction and working principle of DC machines.
CO2:	Describe the working principle of auto transformer, three phase transformer with different types of connections.
CO3:	Ability to understand the construction and working principle of Synchronous Machines
CO4:	Ability to understand the construction and working principle of Three Phase Induction Motor and knowledge about the starting and speed control of induction motors.
CO5:	To gain knowledge about the basic principles and working of Single phase induction motors and Special Electrical Machines.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2403	ELECTRIC ENERGY GENERATION, UTILIZATION AND CONSERVATION	3	0	0	3	100
Course Objectives	- To study the generation, conservation of electrical power and energy efficient equipments. - To understand the principle, design Of Illumination Systems and energy Efficiency lamps. - To study the methods of industrial heating and welding. - To understand the electric traction systems and their performance.					

Unit-I	GENERATION OF ELECTRIC POWER CONVENTIONAL SOURCES	(9)
Hydro station, Thermal Power Plant, Nuclear Power Plant and Gas Turbine Plant. Non-Conventional Sources (Qualitative): Ocean Energy, Tidal Energy, wind Energy, and Solar Energy.		
Unit-II	ILLUMINATION	(9)
Importance of lighting – properties of good lighting scheme – laws of illumination – photometry types of lamps– lighting calculations–basic design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting – LED lighting and energy efficient lamps.		
Unit-III	TRACTION	(9)
Merits of electric traction–requirements of electric traction system–supply systems - mechanics of train movement – traction motors and control – braking – recent trends in electric traction		
Unit-IV	HEATING AND WELDING	(9)
Role of electric heating for industrial applications–resistance heating–induction heating– dielectric heating - electric arc furnaces. Brief introduction to electric welding–welding generator, welding transformer and the characteristics		
Unit-V	DOMESTIC UTILIZATION OF ELECTRICAL ENERGY	(9)
Domestic utilization of electrical energy – House wiring. Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads – Earthing.		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Wadhwa, C.L. "Generation, Distribution and Utilization of Electrical Energy", New Age International Pvt. Ltd, 2003.
2	Dr.Uppal S.L.and Prof.S. Rao, 'Electrical Power Systems', Khanna Publishers, New Delhi, 15th Edition, 2014.
3	Energy Efficiency in Electric Utilities, BEE Guide Book,2010

REFERENCES:

1	Partab.H, "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co, New Delhi, 2004.
2	OpenshawTaylor.E, "Utilization of Electrical Energy in SI Units", Orient Longman Pvt. Ltd, 2003.
3	Gupta.J.B, "Utilization of Electric Power and Electric Traction", S.K. Kataria and Sons, 2002.
4	Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To understand them a in aspects of generation, utilization and conservation.
CO2:	To understand them a in aspects of illuminations
CO3:	To realize the appropriate type of electric supply system as well as to evaluate the performance of a traction unit.
CO4:	To understand the main aspects of Traction and method of heating
CO5:	To evaluate domestic wiring connection and debug any faults occurred

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3

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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2404	POWER ELECTRONICS AND DRIVES	3	0	0	3	100
Course Objectives	- Comprehensive introduction to various power electronic devices, their structure, operating principle and characteristics - Give exposure to Various topologies, working principle and analysis of controlled rectifiers and ac controllers - Detailed knowledge on Classifications, structure, operating principle of dc choppers. - Introduction to different types of Inverters , their principle of operation and waveform control - Overview on dc and ac drives and their control using power electronic circuits.					

Unit-I	POWER SEMICONDUCTOR DEVICES AND CHARACTERISTICS	(9)
Operating principle and switching Characteristics: Power diodes, Power BJT, Power MOSFET, IGBT, SCR, TRIAC, GTO, MCT, Power integrated circuits (PIC) – Drive and Protection circuits.		
Unit-II	CONTROLLED RECTIFIERS AND AC CONTROLLERS	(9)
Single phase – Three phase – Half controlled – Fully controlled rectifiers – Dual converters -Effect of source and load inductance - AC voltage controllers –Introduction to Cyclo converters, Matrix converters		
Unit-III	DC TO DC CONVERTERS	(9)
Step up and Step down Chopper – Chopper classification - quadrant of operation – Switching mode Regulators – Buck, Boost, Buck-Boost, and Cuk Regulators		
Unit-IV	INVERTERS	(9)
Voltage source Inverters – Half bridge – Full bridge – Three Phase Bridge Inverters – Voltage control– PWM Techniques – Current Source Inverters: Capacitor Commutated Inverter- Resonant inverters: Series, Parallel, ZVS, ZCS – Introduction to multilevel Inverters		
Unit-V	DRIVES AND CONTROL	(9)
Static and Dynamic equations of dc and ac machines – Electrical braking – Rectifier and chopper control of DC drives – Principles of v/f control of AC drives – Open loop and Closed loop schemes for DC and AC drives(Block diagram approach only)– Introduction to vector control of AC drives..		
Total No of Periods to be Taught	45	



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TEXT BOOK:

1	Rashid, M.H., “Power Electronics – Circuits, Devices and Applications”, PHI, 3rd Edition, 2004.
2	Mohan, Udeland and Robbins., “Power Electronics”, John Wiley and Sons, New York, 1995.

REFERENCES:

1	Singh, M.D., and Khanchandani, K.B., “Power Electronics”, 2nd Edition., Tata McGraw-Hill, 2011.
2	2. Bose, B.K., “Modern Power Electronics and AC Drives”, Pearson Education, 2002.
3	Bimbira, P.S., “Power Electronics”, Khanna Publishers, 2006.
4	Moorthi, V.R., “Power Electronics - Devices, Circuits and Industrial Applications”, Oxford University Press, 2005
5	NPTTEL Lecture Series on “Power Electronics” by Dr.B.G.Fernandes, IIT Bombay.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to explain various devices and their structure, operating characteristics in the field of electronics.
CO2:	Ability to classify, analyze and design, Control rectifiers and AC controllers
CO3:	Ability to classify, analyze and design, DC to DC convertors,
CO4:	Ability to classify, analyze and design, inverters
CO5:	Will have ability to apply power electronic circuits for the control of popular applications.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3

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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2405	ELECTRICAL ESTIMATION AND COSTING	3	0	0	3	100
Course Objectives	- Emphasize the estimating and costing aspects of all electrical equipment, installation and designs to analyze the cost availability. - Exposure to design and estimation of wiring, design of overhead and underground distribution lines, substations and illuminations design. - These techniques should help the students to successfully estimate costing of the products/projects that are part of our everyday usage. - A basic knowledge on methods and types of estimation and its merits and demerits. - To prepare the schedule of materials with specifications and estimates for different types of electrical installations.					

Unit-I	DESIGN CONSIDERATIONS OF ELECTRICAL INSTALLATIONS	(9)
Electric Supply System, Three phase four wire distribution system, General requirements of Electrical Installations, testing of installations, Indian Electricity rules, Neutral and Earth wire, Types of loads, Systems of wiring, Service connections, Service Mains, Sub- Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution Board		
Unit-II	ELECTRICAL INSTALLATION OF BUILDINGS AND SMALL INDUSTRIES	(9)
Electrical installations for residential buildings – estimating and costing of material, Electrical installations for commercial buildings, Electrical installations for small industries.		
Unit-III	OVERHEAD AND UNDERGROUND TRANSMISSION AND DISTRIBUTION LINES	(9)
Introduction, Supports for Transmission lines, Distribution lines – Materials used, Underground cables, Mechanical Design of overhead lines, Design of underground cables.		
Unit-IV	SUBSTATIONS:	(9)
Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substation, Floor mounted type.		
Unit-V	DESIGN OF ILLUMINATION SCHEMES:	(9)
Introduction, Terminology in Illumination, laws of illumination, various types of light sources, Practical lighting schemes		
Total No of Periods to be Taught		45



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TEXT BOOK:	
1	Electrical Design Estimating and Costing, K.B. Raina, S.K. Bhattacharya, New Age International Publisher
2	Design of Electrical Installations, Dr. V.K. Jain, Dr. Amitabh Bajaj, University Science Press.
3	Electricity pricing Engineering Principles and Methodologies, Lawrence J. Vogt, P.E., CRC Press.

REFERENCES:	
1	Guide for Electrical Layout in residential buildings, Indian Standard Institution, IS:4648- 1968
2	Electrical Installation buildings Indian Standard Institution, IS:2032

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	The estimating and costing aspects of all electrical equipment, installation and designs to analyze the cost viability.
CO2:	Exposure to design and estimation of wiring,
CO3:	Design of overhead and underground distribution lines, substations and illuminations design.
CO4:	Understand types of substations and their ratings
CO5:	To design illumination systems.

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														



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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UEEOE2406	BASICS OF ELECTRICAL MEASUREMENTS AND INSTRUMENTATION	L	T	P	C	100
		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 • To summarize the overall measurement and instrumentation with the knowledge on digital instrumentation principles.					

Unit-I	CONCEPTS OF MEASUREMENTS	(9)
Instruments: classification, working and applications – Elements of a generalized measurement system - Static and dynamic characteristics - Errors in measurement -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 AND INSTRUMENTATION AMPLIFIERS	(9)
Wheatstone bridge, Kelvin double bridge - Maxwell, Hay, Wien and Schering bridges – Errors and compensation in A.C. bridges - Instrumentation Amplifiers.		
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	OTHER ENERGY SOURCES	(9)
A/D converters: types and characteristics – Sampling, Errors- 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 - Instrument standards		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	A.K. Sawhney, PuneetSawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', DhanpatRai and Co, New Delhi, Edition 2011.
2	H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010
3	Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.

REFERENCES:

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
3	W.Bolton, Programmable Logic Controllers, 6th Edition, Elsevier, 2015.
4	R.B. Northrop, 'Introduction to Instrumentation and Measurements', Taylor & Francis, New Delhi, 3rd Edition 2014.
5	E. O. Doebelin and D. N. Manik, "Measurement Systems – Application and Design", Tata McGraw-Hill, New Delhi, 6th Edition 2017.
6	R. K. Rajput, "Electrical and Electronics Measurements and Instrumentation", Chand Pub, 2016

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Ability to understand the fundamental art of measurement in engineering.
CO2:	Ability to understand the structural elements of various instruments.
CO3:	Ability to understand the importance of bridge circuits.
CO4:	Ability to understand about various transducers and their characteristics by experiments.
CO5:	Ability to understand the concept of digital instrumentation and virtual instrumentation by log/antilog amplifier, analog multiplier /divider, active filters, comparators, waveform generators, A/D and D/A converters

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	-	3	2	-	2	-	-	3	3	3	3
CO2	3	2	3	2	-	-	-	-	-	3	3	3	3	3
CO3	3	2	3	-	3	2	-	-	-	-	3	3	3	3
CO4	3	2	3	-	-	-	-	2	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	-	3	3	3	3	3
Avg.	3	2	3	2	3	2	-	2	-	3	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2407	INTRODUCTION TO CONTROL ENGINEERING	3	0	0	3	100
Course Objectives	To introduce the control system components and transfer function model with their graphical representation To understand the analysis of system in time domain along with steady state error. To introduce frequency response analysis of systems To accord basic knowledge in design of compensators To introduce the state space models.					

Unit-I	MATHEMATICAL MODELLING	(9)
Introduction – transfer function – simple electrical, mechanical, ,pneumatic , hydraulic and thermal systems– analogies		
Unit-II	FEEDBACK CONTROL SYSTEMS	(9)
Control system components - Block diagram representation of control systems, Reduction of block diagrams, Signal flow graphs, Output to input ratios		
Unit-III	STABILITY ANALYSIS	(9)
Response of systems to different inputs viz., Step impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit		
Unit-IV	STATE SPACE TECHNIQUE	(9)
Necessary and sufficient conditions, Routh-Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction frequency response.		
Unit-V	OTHER ENERGY SOURCES	(9)
State vectors–state space models-Digital Controllers–design aspects		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017
2	Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014

REFERENCES:

1	Katsuhiko Ogata, "Modern Control Engineering", Pearson, 2015.
2	Richard C. Dorf and Bishop, R.H., "Modern Control Systems", Pearson Education, 2009
3	John J.D., Azzo Constantine, H. and Houpis Stuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor & Francis Reprint 2009.
4	Ramesh C. Panda and T. Thyagarajan, "An Introduction to Process Modelling Identification and Control of Engineers", Narosa Publishing House, 2017.
5	M. Gopal, "Control System: Principle and design", McGraw Hill Education, 2012.
6	NPTTEL Video Lecture Notes on "Control Engineering" by Prof. S. D. Agashe, IIT Bombay.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To represent and develop systems in different forms using the knowledge gained
CO2:	To analyse the system in time and frequency domain
CO3:	Ability to Derive Transfer function Model of Electrical and Mechanical Systems.
CO4:	Ability to Obtain the transfer Function by the Reduction of Block diagram & Signal flow graph
CO5:	To analyse the stability of physical systems

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	2	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	2.8	3	3	2.8	2	2	1	-	-	-	3	3	3	3

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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2408	FUNDAMENTALS OF ELECTRICAL DRIVES AND CONTROL	3	0	0	3	100
Course Objectives	- To study the conventional and solid-state drives - To study the different methods of starting D.C motors and induction motors. - To understand the basic concepts of different types of electrical machines and their performance					

Unit-I	INTRODUCTION	(9)
Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors		
Unit-II	DRIVE MOTOR CHARACTERISTICS	(9)
Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.		
Unit-III	STARTING METHODS	(9)
Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors		
Unit-IV	CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C DRIVES	(9)
Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.		
Unit-V	CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES	(9)
Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications..		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	VedamSubrahmaniam, "Electric Drives (Concepts and Applications", Tata McGraw-Hill, 2001
2	Nagrath .I.J. & Kothari .D.P, "Electrical Machines", Tata McGraw-Hill, 1998

REFERENCES:

1	Pillai.S.K "A First Course on Electric Drives", Wiley Eastern Limited, 1998
2	Singh. M.D., K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, 1998
3	Partab. H., "Art and Science and Utilisation of Electrical Energy", DhanpatRai and Sons, 1994.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Derive the heating and cooling curve and study the various classes of duty and Selection of power rating
CO2:	Understand the working principle of DC &AC motors and their characteristics and its braking methods
CO3:	Understand the Starting methods of DC &AC motors
CO4:	Understand the Concepts of speed control in DC motors
CO5:	Understand the Concepts of speed control in AC motors

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	-	3	2	2	-	-	-	3	3	3
CO2	3	2	3	2	-	-	-	-	3	-	3	3	3
CO3	3	2	3	-	3	2	-	-	-	-	3	3	3
CO4	3	2	3	-	-	-	2	-	-	-	-	3	3
CO5	3	2	3	2	3	-	-	-	3	-	3	3	3
Avg.	3	2	3	2	3	2	2	-	3	-	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy

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THE KAVERY ENGINEERING COLLEGE

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Mecheri, Salem Dt-636453, Tamilnadu



Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2409	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3	100
Course Objectives	- Understand and analyses the energy data of industries - Carryout energy accounting and balancing - Conduct energy audit and suggest methodologies for energy savings. - Utilize the available resources in optimal ways					

Unit-I	INTRODUCTION	(9)
Energy-Power-Past & Present scenario of World; National Energy consumption Data Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.		
Unit-II	ELECTRICAL SYSTEMS	(9)
Power system structure, Electrical tariff and types- Illumination–Lux, Lumens, law of illumination -Types of lighting, LED Lighting and. Energy Efficient Lighting.		
Unit-III	THERMAL SYSTEMS	(9)
Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters–Efficiency computation and encon measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators& Refractories		
Unit-IV	ENERGYCONSERVATIONINMAJORUTILITIES	(9)
Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems –Cooling Towers – D.G. sets.		
Unit-V	ECONOMICS	(9)
Energy Economics–Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing–ESCO concept		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Energy Manager Training Manual (4 Volumes) available at www.energymanagertraining.com .a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.Power, Government of India, 2004
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REFERENCES:

1	Witte.L.C.,P.S.Schmidt,D.R.Brown,“IndustrialEnergyManagementandUtilisation” Hemisphere Publ, Washington, 1988.
2	Callaghn,P.W.“Design and Management for Energy Conservation”,Pergamon Press, Oxford, 1981.
3	Dryden.I.G.C.,“TheEfficientUseofEnergy”Butterworths,London,1982
4	Turner.W.C.,“EnergyManagementHandbook”,Wiley,NewYork,1982.
5	Murphy. W.R.andG.McKAY,“EnergyManagement”,Butterworths,London1987

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Remember the knowledge for Basic combustion and furnace design and selection of thermal and mechanical energy equipment.
CO2:	Study the Importance of Stoichiometry relations, Theoretical air required for complete combustion.
CO3:	Skills on combustion thermodynamics and kinetics.
CO4:	Apply calculation and design tube still heaters.
CO5:	Studied different heat treatment furnace.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	2	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2	2	2	1	-	-	-	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy														



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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2410	AUTOMOTIVE ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3	100
Course Objectives	The objective of this course is to prepare the students to become familiar with the basic concepts and applications of different sensor and actuators used for electronic control, different communication protocols and networking in vehicles					

Unit-I	INTRODUCTION AND AUTOMOTIVE BATTERIES	(9)
Introduction Overview of vehicle electrical systems Electrical circuits Electrical power supply in conventional vehicle Dimensioning of wires Circuit diagrams and symbols. Batteries – Battery design – Method of operation – Lead acid battery construction – Battery ratings and testing Maintenance free batteries – Battery		
Unit-II	STARTING AND CHARGING SYSTEM	(9)
Starter Motors – Development and Starting requirements in the IC engines starter motor design – Starter motor design variations – starter motor control and power circuits		
Unit-III	IGNITION, LIGHTING AND AUXILLARY SYSTEM	(9)
Ignitions System Ignition fundamentals Electronic ignition Programmed ignition Distributor less ignition Direct ignition Spark plugs. Automotive lighting Technology –Technical demands Development of lighting technology Light sources – physical principles – Front and rear lighting system Interior lighting system – Special purpose lamps – Adaptive Lighting system Instrument clusters Wiper and Washer systems electric horns		
Unit-IV	AUTOMOTIVE ELECTRONICS AND SENSORS AND ACTUATORS	(9)
Automotive Electronics overview and Basic principles of semiconductor technology Electronic Components semiconductor components. Automotive Sensors – Basic Sensors : Position, speed, Force/Torque, Flow meters, Automotive Actuators Electromechanical actuators Fluid mechanical actuators		
Unit-V	VEHICLE NETWORKING	(9)
Data transfer between automotive Electronics systems Basic principles of networking- Network topology- Network organization OSI reference model Control mechanisms communication protocols in embedded systems Vehicle Communication Protocols		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th Edition, 2007, ISBN No: 978- 3- 658- 01783- 5
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REFERENCES:

1	Barry Hole beak, "Automotive Electrical and Electronics" , Delmar Publishers, Clifton Park,USA,2010
2	James D Halderman, "Automotive Electrical and Electronics", Prentice Hall, USA, 2013
3	Tom Denton, "Automotive Electrical and Electronics Systems," Third Edition, 2004, SAE International
4	William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth- Heinemann Publishers, 2012.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Define the glossary related to vehicle electrical and electronic system
CO2:	Explain the need for starter batteries, starter motor and alternator in the vehicle.
CO3:	Differentiate the conventional and modern vehicle architecture and the data transfer among the different electronic control unit using different communication protocols
CO4:	List common types of sensor and actuators used in vehicles
CO5:	Understand networking in vehicles.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	2	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	2.8	3	3	2.8	2	2	1	-	-	-	3	3	3	3

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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2411	INTRODUCTION TO EMBEDDED SYSTEMS	3	0	0	3	100
Course Objectives	To familiarize students with the fundamental concepts of embedded systems, including their architecture, hardware, and software components, and to provide experience in designing and implementing simple embedded systems					

Unit-I	BASICS OF COMPUTER ARCHITECTURE AND THE BINARY NUMBER SYSTEM	(9)
Basics of computer architecture, computer languages, RISC and CISC architectures, number systems, number format conversions, computer arithmetic, units of memory capacity.		
Unit-II	INTRODUCTION TO EMBEDDED SYSTEMS	(9)
Application domain of embedded systems, desirable features and general characteristics of embedded systems, model of an embedded system, microprocessor Vs microcontroller, example of a simple embedded system, merit for an embedded system, classification of MCUs: 4/8/16/32 bits, history of embedded systems		
Unit-III	EMBEDDED SYSTEMS-THE HARDWARE POINT OF VIEW	(9)
Microcontroller unit(MCU), a popular 8-bit MCU, memory for embedded systems, low power design, pull up and pull down resistors		
Unit-IV	SENSORS, ADCs AND ACTUATORS	(9)
Sensors: Temperature Sensor, Light Sensor, Proximity/range Sensor; Analog to digital converters: ADC Interfacing; Actuators Displays, Motors, Opto couplers / Opto isolators, relays.		
Unit-V	EXAMPLES OF EMBEDDED SYSTEMS	(9)
Mobile phone, automotive electronics, radio frequency identification (RFID), wireless sensor networks(WISENET), robotics, biomedical applications, brain machine interface		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Lyla B Das, Embedded systems: An Integrated Approach, 1st Ed., Pearson, 2013
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REFERENCES:

1	Shibu, K.V., Introduction to Embedded Systems, 1st Ed., TMH, 2009
2	KantaRao B, Embedded Systems, 1st Ed., PHI
3	Frank Vahid& Tony Givargis, Embedded System Design, 2nd Edition, John Wiley,

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	learn about the general principles of computer architecture
CO2:	learn about the working of a simple embedded system and embedded system applications
CO3:	learn the hardware aspects of embedded systems
CO4:	Understand the sensors, ADCs and actuators used in embedded systems
CO5:	Understand the real world examples of embedded systems

Mapping of COs with POs and PSOs

COs/POs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	-	3	2	2	-	-	-	3	3	3
CO2	3	2	3	2	-	-	-	-	3	-	3	3	3
CO3	3	2	3	-	3	2	-	-	-	-	3	3	3
CO4	3	2	3	-	-	-	2	-	-	-	-	3	3
CO5	3	2	3	2	3	-	-	-	3	-	3	3	3
Avg.	3	2	3	2	3	2	2	-	3	-	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy

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Department		AGRI		Programme Code & Name				Open to All Departments	
Course Code	Course Name			Hours/Week		Credit	Maximum Marks		
UAIOE2401	INTRODUCTION TO FOOD PROCESSING			L	T	P	C	100	
				3	0	0	3		
Course Objectives									
The course aims to introduce the students to the area of Food Processing. This is necessary for effective understanding of a detailed study of food processing and technology subjects. This course will enable students to appreciate the importance of food processing with respect to the producer, manufacturer and consumer.									
UNIT I		PROCESSING OF FOOD AND ITS IMPORTANCE						9	
Source of food - plant, animal and microbial origin; different foods and groups of foods as raw materials for processing – cereals, pulses, grains, vegetables and fruits, milk and animal foods, sea weeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives; need and significance of processing these foods.									
UNIT II		METHODS OF FOOD HANDLING AND STORAGE						9	
Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods.									
UNIT III		LARGE-SCALE FOOD PROCESSING						9	
Milling of grains and pulses; edible oil extraction; Pasteurization of milk and yoghurt; canning and bottling of foods; drying – Traditional and modern methods of drying, Dehydration of fruits, vegetables, milk, animal products etc; preservation by use of acid, sugar and salt; Pickling and curing with microorganisms, use of salt, and microbial fermentation; frying, baking, extrusion cooking, snack foods.									
UNIT IV		FOOD WASTES IN VARIOUS PROCESSES						9	
Waste disposal-solid and liquid waste; rodent and insect control; use of pesticides; ETP; selecting and installing necessary equipment.									
UNIT V		FOOD HYGIENE						9	
Food related hazards – Biological hazards – physical hazards – microbiological considerations in foods. Food adulteration – definition, common food adulterants, contamination with toxic metals, pesticides and insecticides; Safety in food procurement, storage handling and preparation; Relationship of microbes to sanitation, Public health hazards due to contaminated water and food; Personnel hygiene; Training& Education for safe methods of handling and processing food; sterilization and disinfection of manufacturing plant; use of sanitizers, detergents, heat, chemicals, Cleaning of equipment and premises.									
Total								45 Periods	



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TEXT BOOK:

- 1 Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge, 2003.

REFERENCES:

- 1 VanGarde, S.J. and Woodburn. M “Food Preservation and Safety Principles and Practice”.Surbhi Publications, 2001.
- 2 Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.
- 3 Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005.

COURSE OUTCOMES:

On completion of the course, the students will be able to

- | | |
|------|--|
| CO1: | Be aware of the different methods applied to processing foods. |
| CO2: | Be able to understand the significance of food processing and the role of food and beverage industries in the supply of foods. |
| CO3: | Describe about large-scale food processing methods. |
| CO4: | Distinguish Food Wastes in Various Processes techniques. |
| CO5: | Understand the concepts of Food process methods, Storage techniques, food handling methods, reduces food waste and food hygiene process. |

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy



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Department		AGRI		Programme Code & Name				Open to All Departments	
Course Code	Course Name			Hours/Week		Credit	Maximum Marks		
UAIOE2402	TRADITIONAL INDIAN FOODS			L	T	P	C	100	
				3	0	0	3		
Course Objectives									
To help students acquire a sound knowledge on diversities of foods, food habits and patterns in India with focus on traditional foods.									
UNIT – I		HISTORICAL AND CULTURAL PERSPECTIVES						9	
Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols; importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditionson food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.									
UNIT II		TRADITIONAL METHODS OF FOOD PROCESSING						9	
Traditional methods of milling grains –rice, wheat and corn –equipments and processes as compared to modern methods. Equipments and processes for edible oil extraction, paneer, butter and ghee manufacture – comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation – sun drying, osmotic drying, brining, pickling and smoking.									
UNIT III		TRADITIONAL FOOD PATTERNS						9	
Typical breakfast, meal and snack foods of different regions of India. Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods									
UNIT IV		COMMERCIAL PRODUCTION OF TRADITIONAL FOODS						9	
Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, butter milk, dahi. Commercial production of intermediate foods –ginger and garlic pastes, tamarind pastes, masalas (spicemixes), idli and dosa batters.									
UNIT V		HEALTH ASPECTS OF TRADIONAL FOODS						9	
Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental cost soft raditional foods; traditional foods used for specific ailments /illnesses.									
Total								45 Periods	



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TEXT BOOK:

1	Sen, Colleen Taylor“ Food Culture in India” Green wood Press, 2005.
2	Davidar, Ruth N.“Indian Food Science: A Health and Nutrition Guide to Traditional Recipes: East West Books, 2001

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Provide a comprehensive understanding of the origins, evolution, and regional diversity of Indian cuisine.
CO2:	Highlight the traditional ingredients, cooking methods, and food preparation techniques used across various parts of India.
CO3:	Explore the cultural, religious, and seasonal influences on traditional Indian dietary practices.
CO4:	Analyze the nutritional and therapeutic value of traditional Indian foods and their relevance in modern diets.
CO5:	Introduce traditional food preservation methods like fermentation, pickling, drying, and smoking.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2	PSO 3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3

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Department		AGRI		Programme Code & Name				Open to All Departments	
Course Code	Course Name			Hours/Week			Credit	Maximum Marks	
UAIOE2403	FUNDAMENTALS OF FOOD ENGINEERING			L	T	P	C	100	
				3	0	0	3		
Course Objectives									
- Acquaint and equip the students with different techniques of measurement of engineering properties. - Make the students understand the nature of food constituents in the design of processing equipment									
UNIT – I	ENGINEERING PROPERTIES OF FOOD MATERIALS							9	
Engineering properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties.									
UNIT II	DRYING AND DEHYDRATION IN FOOD PROCESSING							9	
Drying and dehydration: Basic drying theory, heat and mass transfer in drying, drying rate curves, calculation of drying times, dryer efficiencies; classification and selection of dryers; tray, vacuum, osmotic, fluidized bed, pneumatic, rotary, tunnel, trough, bin, belt, microwave, IR, heat pump and freeze dryers; dryers for liquid: Drum or roller dryer, spray dryer and foammat dryers.									
UNIT III	SIZE REDUCTION IN FOOD PROCESSING: PRINCIPLES, BENEFITS, ANALYSIS & EQUIPMENT							9	
Size reduction: Benefits, classification, determination and designation of the fineness of ground material, sieve/screen analysis, principle and mechanisms of comminution of food, Rittinger’s, Kick’s and Bond’s equations, work index, energy utilization; Size reduction equipment: Principal types, crushers (jaw crushers, gyratory, smooth roll), hammer mills and impactors, attrition mills, buhr mill, tumbling mills, tumbling mills, ultra fine grinders, fluid jet pulverizer, colloid mill, cutting machines (slicing, dicing, shredding, pulping).									
UNIT IV	MIXING IN FOOD AND CHEMICAL PROCESSING							9	
Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, theory of liquid mixing, power requirement for liquids mixing; Mixing equipment: Mixers for low- or medium-viscosity liquids (paddle agitators, impeller agitators, powder- liquid contacting devices, other mixers), mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids.									
UNIT V	DOMESTIC UTILIZATION OF ELECTRICAL ENERGY							9	
Mechanical Separations: Theory, centrifugation, liquid-liquid centrifugation, liquid-solid centrifugation, clarifiers, desludging and decanting machine, Filtration: Theory of filtration, rate of filtration, pressure drop during filtration, applications, constant-rate filtration and constant-pressure filtration, derivation of equation; Filtration equipment; plate and frame filter press, rotary filters, centrifugal filters and air filters, filter aids, Membrane separation : General considerations, materials for membrane construction, ultra-filtration, microfiltration, concentration, polarization, processing variables, membrane fouling, applications of ultra-filtration in food processing, reverse osmosis, mode of operation, and applications; Membrane separation methods, demineralization by electro-dialysis, gel filtration, ion exchange, per-evaporation and osmotic dehydration.									
Total								45 Periods	



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TEXT BOOK:

1	R.L. Earle. 2004. Unit Operations in Food Processing. The New Zealand Institute of Food Science & Technology, Nz. Warren L. McCabe, Julian Smith, Peter Harriott. 2004.
2	Unit Operations of Chemical Engineering, 7 th Ed. McGraw-Hill, Inc., NY, USA. Christie John Geankoplis. 2003.
	Transport Processes and Separation Process Principles (Includes Unit Operations), 4th Ed. Prentice-Hall, NY, USA.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	To understand the importance of food polymers
CO2:	To understand the effect of various methods of processing on the structure and texture of food materials
CO3:	To evaluate domestic wiring connection and debug any faults occurred.
CO4:	To understand the interaction of food constituents with respect to thermal, electrical properties to develop new technologies for processing and preservation.
CO5:	Promote awareness of the role of food engineering in ensuring food quality, safety, and sustainability.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3

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Department		AGRI		Programme Code & Name				Open to All Departments	
Course Code	Course Name			Hours/Week		Credit	Maximum Marks		
UAIOE2404	REMOTE SENSING CONCEPTS			L	T	P	C	100	
				3	0	0	3		
Course Objectives									
- To introduce the concepts of remote sensing processes and its components. - To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation									
UNIT – I		REMOTE SENSING AND ELECTROMAGNETIC RADIATION						9	
Definition–components of RS – History of Remote Sensing –Merits and demerits of data collation between conventional and remote sensing methods Electromagnetic Spectrum– Radiation principles - Wave theory, Planck’s law, Wien’s Displacement Law, Stefan’s Boltzmann law, Kirchoff’s law – Radiation sources : active & passive - Radiation Quantities.									
UNIT II		EMRINTERACTION WITH ATMOSPHERE AND EARTH MATERIAL						9	
Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectro radio meter–Spectral Signature concepts –Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.									
UNIT III		ORBITS AND PLATFORMS						9	
Motions of planets and satellites – Newton’s law of gravitation - Gravitational field and potential - Escape velocity - Kepler ‘s law of planetary motion - Orbit elements and types – Orbital per turbations and maneuvers–Types of remote sensing platforms- Ground based, Airborne platforms and Space borne platforms –Classification of satellites –Sun synchronous and Geosynchronous satellites – Lagrange Orbit.									
UNIT IV		SENSING TECHNIQUES						9	
Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV – Orbital and sensor characteristics of live Indian earth observation satellites									
UNIT V		DATA PRODUCTS AND INTERPRETATION						9	
Photographic and digital products –Types, levels and open source satellite data products – selection and procurement of data– Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification									
Total								45 Periods	



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TEXT BOOK:

1	Thomas M. Lilles and, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York,2015.
2	George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Third Edition Universities Press (India) Private limited, Hyderabad, 2018

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understand the concepts and laws related to remote sensing
CO2:	Understand the interaction of electromagnetic radiation with atmosphere and earth material.
CO3:	Acquire knowledge about satellite or bits and different types of satellites.
CO4:	Understand the different types of remote sensors.
CO5:	Gain knowledge about the concepts of interpretation of satellite imagery

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department		AGRI		Programme Code & Name				Open to All Departments	
Course Code	Course Name			Hours/Week			Credit	Maximum Marks	
UAIOE2405	BASICS OF INTEGRATED WATER RESOURCES MANAGEMENT			L	T	P	C	100	
				3	0	0	3		
Course Objectives									
- To introduce the inter disciplinary approach of water management. - To develop knowledge base and capacity building on IWRM.									
UNIT – I		OVER VIEW OF INTEGRATED WATER RESOURCES MANAGEMENT							9
Facts about water – Definition – Key challenges – Paradigm shift – Water management Principles – Social equity – Ecological sustainability – Economic efficiency - SDGs- World Water Forums.									
UNIT II		WATER USE SECTORS : IMPACTS AND SOLUTION							9
Water users : People, Agriculture, ecosystem and others - Impacts of the water use sectors on water resources -Securing water for people, food production, ecosystems and other uses - IWRM relevance in water resources management.									
UNIT III		WATER ECONOMICS							9
Economic characteristics of water good and services –Economic instruments –Private sector involvement in water resources management - PPP experiences through case studies.									
UNIT IV		RECENTTRE AND SIN WATER MANAGEMENT							9
Riverbasin management - Ecosystem Regeneration –5 Rs - WASH – Sustainable livelihood – Water management in the context of climate change.									
UNIT V		IMPLEMENTATION OF IWRM							9
Barriers to implementing IWRM - Policy and legal framework - Bureaucratic reforms and inclusive development - Institutional Transformation - Capacity building - Case studies on conceptual framework of IWRM.									
Total								45 Periods	

TEXT BOOK:

1	Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. 2003.
2	Mollinga P. <i>et al.</i> “Integrated Water Resources Management”, Water in South Asia Volume I, Sage Publications, 2006.

REFERENCES:

1	Technical Advisory Committee, Background Papers No:1, 4 and 7, Stockholm, Sweden.2002.
2	IWRM Guidelines at River Basin Level (UNESCO, 2008).

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.
CO2:	Discuss on the different water uses; how it is impacted and ways to tackle the seimpacts.



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CO3:	Explain the economic aspects of water and choose the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.
CO4:	Illustrate the recent trend in water management.
CO5:	Understand the implementation hitches and the institutional framework.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3

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Department	BME	Programme Code & Name			Open to all Departments		
Semester							
Course Code	Course Name		Hours/Week		Credit	Maximum Marks	
UBMOE2410	BASICS OF MICROBIAL TECHNOLOGY		L	T	P	C	100
			3	0	0	3	
Course Objectives	The student should be made to: The objective is to offer basic concepts of biochemistry to students with diverse background in life sciences including but not limited to the structure and function of various biomolecules and their metabolism.						

Unit-I	BASICS OF MICROBES AND ITS TYPES	(9)
Introduction to microbes, existence of microbes, inventions of great scientist and history, types of microorganisms – Bacteria, Virus, Fungi.		
Unit-II	MICROBIAL TECHNIQUES	(9)
Sterilization – types – physical and chemical sterilization, Decontamination, Preservation methods, fermentation, Cultivation and growth of microbes, Diagnostic methods.		
Unit-III	PATHOGENIC MICROBES	(9)
Infectious Disease – Awareness, Causative agent, Prevention and control - Cholera, Dengu, Malaria, Diarrhea, Tuberculosis, Typhoid, Covid, HIV.		
Unit-IV	BENEFICIAL MICROBES	(9)
Applications of microbes–Clinical microbiology, agricultural microbiology, Food Microbiology, Environmental Microbiology, Animal Microbiology, Marine Microbiology.		
Unit-V	PRODUCTS FROM MICROBES	(9)
Fermented products–Fermented Beverages, Curd, Cheese, Mushroom, Agricultural products– Biopesticide, Biofertilizers, Vermi compost, Pharmaceutical products - Antibiotics, Vaccines		
Total No of Periods to be Taught		45 periods

TEXT BOOK:		
1	TalaronK,TalaronA,Casita,PelczarandReid.FoundationsinMicrobiology,W.C.Brown Publishers, 1993.	
2	PelczarMJ,ChanECSandKreinNR,Microbiology,TataMcGrawHillEdition,NewDelhi, India.	
3	PrescottL.M.,HarleyJ.P.,Kl3einDA,Microbiology,3rdEdition,Wm.C.BrownPublishers, 1996.	


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REFERENCES:

1	Berg, Jeremy M.etal.“Biochemsitry”,6thEdition,W.H.Freeman&Co., 2006.
2	Murray,R.K.,etal“Harper’sllustratedBiochemistry”,31stEdition,McGraw-Hill,2018.
3	Voet,D.andVoet,J.G.,“Biochemistry”,4thEdition,JohnWiley&SonsInc.,2010.

COURSE OUTCOMES:

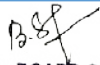
On completion of the course, the students will be able to

CO1:	Students will learn about various kinds of biomolecules and their physiological role.
CO2:	Students will gain knowledge about various metabolic disorders and will help them to know the importance of various biomolecules in terms of disease correlation.
CO3:	Students will learn about various kinds of Infectious Disease – Awareness, Causative agent, Prevention and control
CO4:	Students will gain knowledge beneficial microbes
CO5:	Students will learn about various kinds of products from microorganisms

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO3
CO1	3	3	1	1	1	-	-	-	-	-	1		-	-
CO2	3	3	1	1	1	-	-	-	-	-	1		-	-
CO3	3	3	1	1	1	-	-	-	-	-	1		-	-
CO4	3	3	1	1	1	-	-	-	-	-	1		-	-
CO5	3	3	1	1	1	-	-	-	-	-	1		-	-
Avg.	3	3	1	1	1	-	-	-	-	-	1		-	-

1 – Slight, 2 – Moderate, 3 –Substantial, BT – Bloom’s Taxonomy


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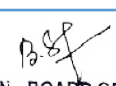


Department	BME	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UBMOE2402	RADIOLOGICAL EQUIPMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	The student should be made to: • Understand generation of x-rays and its uses in imaging. • Learn different types of radio diagnostic techniques. • Know techniques used for visualizing different sections of the body. • Learn radiation therapy methodologies and the radiation safety.					

Unit-I	MEDICAL X-RAY EQUIPMENT	(9)
Nature of X-rays- X-Ray absorption – Tissue contrast. X- Ray Equipment (Block Diagram) – X-Ray Tube, the collimator, Bucky Grid, power supply, Digital Radiography- discrete digital detectors, storage phosphor and film scanning, X-ray Image Intensifier tubes – Fluoroscopy – Digital Fluoroscopy. Angiography, cine Angiography. Digital subtraction Angiography. Mammography.		
Unit-II	COMPUTED TOMOGRAPHY	(9)
Principles of tomography, CT Generations, X- Ray sources- collimation- X- Ray detectors-Viewing systems- spiral CT scanning – Ultra fast CT scanners. Image reconstruction techniques- back projection and iterative method.		
Unit-III	MAGNETIC RESONANCE IMAGING	(9)
Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system- system magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, MRI.		
Unit-IV	NUCLEAR MEDICINE SYSTEM	(9)
Applications of microbes–Clinical microbiology, agricultural microbiology, Food Microbiology, Environmental Microbiology, Animal Microbiology, Marine Microbiology.		
Unit-V	RADIATION THERAPY AND RADIATION SAFETY	(9)
Radiation therapy – linear accelerator, Telegamma Machine. SRS –SRT,-Recent Techniques in radiation therapy - 3DCRT – IMRT – IGRT and Cyber knife- radiation measuring instruments- Dosimeter, film badges, Thermo Luminescent dosimeters- electronic dosimeter- Radiation protection in medicine- radiation protection principles.		
Total No of Periods to be Taught		45 periods


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TEXT BOOK:

1	Steve Webb, The Physics of Medical Imaging, Adam Hilger, Philadelphia, 1988 (Units I, II, III & IV).
2	R.Hendee and Russell Ritenour "Medical Imaging Physics", Fourth Edition William, Wiley-Liss, 2002.

REFERENCES:

1	Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine"- Third edition Springer, 2006.
2	B.H.Brown, PV Lawford, R H Small wood , D R Hose, D C Barber, "Medical physics and biomedical Engineering", - CRC Press, 1999
3	Myer Kutz, "Standard handbook of Biomedical Engineering and design", McGraw Hill, 2003.
4	P.Ragunathan, "Magnetic Resonance Imaging and Spectroscopy in Medicine

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Describe the working principle of X-ray machine and its applications.
CO2:	Illustrate the principle of Computed Tomography (CT).
CO3:	Interpret the techniques used for visualizing various sections of the body using Magnetic Resonance Imaging (MRI).
CO4:	Demonstrate the applications of radionuclide imaging / nuclear medicine imaging.
CO5:	Outline the methods of radiation safety and protection.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	-	-	1	-	-	-
CO2	3	3	1	1	-	-	-	-	-	-	1	-	-	-
CO3	3	3	1	1	-	-	-	-	-	-	1	-	-	-
CO4	3	3	1	1	-	-	-	-	-	-	1	-	-	-
CO5	3	3	1	1	1	-	-	-	-	-	1	-	-	-
Avg.	3	3	1	1	1	-	-	-	-	-	1	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department	BME	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UBMOE2403	FUNDAMENTALS OF CELL AND MOLECULAR BIOLOGY	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To provide knowledge on the fundamentals of cell biology. • To understand the signalling mechanisms. • To Understand basic principles of molecular biology at intracellular level to regulate growth, division and development					

Unit-I	INTRODUCTION TO CELL	(9)
Cell, cell wall and Extracellular Matrix (ECM), composition, cellular dimensions, Evolution, Organization, differentiation of prokaryotic and Eukaryotic cells, Virus, bacteria, cyanobacteria, mycoplasma and prions		
Unit-II	CELL ORGANELLES	(9)
Molecular organization, biogenesis and function Mitochondria, endoplasmic reticulum, Golgi apparatus, plastids, chloroplast, leucoplast, centrosome, lysosome, ribosome, peroxisome, Nucleus and nucleolus. Endo membrane system, concept of compartmentalization		
Unit-III	BIO-MEMBRANE TRANSPORT	(9)
Physiochemical properties of cell membranes. Molecular constitute of membranes, asymmetrical organization of lipids and proteins. Solute transport across membrane's-fick's law, simple diffusion, passive-facilitated diffusion, active transport- primary and secondary, group translocation, transport ATP ases, membrane transport in bacteria and animals. Transport mechanism- mobile carriers and pores mechanisms. Transport by vesicle formation, endocytosis, exocytosis, cell respiration		
Unit-IV	CELL CYCLE	(9)
Cell cycle- Cell division by mitosis and meiosis, Comparison of meiosis and mitosis, regulation of cell cycle, cell lysis, Cytokinesis, Cell signaling, Cell communication, Cell adhesion and Cell junction, cell cycle checkpoints.		
Unit-V	CENTRAL DOGMA	(9)
Overview of Central dogma DNA replication: Meselson & Stahl experiment, bi-directional DNA replication, Okazaki fragments. Structure and function of mRNA, rRNA and tRNA. RNA synthesis: Initiation, elongation and termination of RNA synthesis Introduction to Genetic code- Steps in translation: Initiation, Elongation and termination of protein synthesis.		
Total No of Periods to be Taught		45 periods


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TEXT BOOK:

1	Cooper, G.M. and R.E. Hansman “The Cell: A Molecular Approach”, 8th Edition, Oxford University Press, 2018
2	Friefelder, David. “Molecular Biology.” Narosa Publications, 1999

REFERENCES:

1	Lodish H, Berk A, Matsudaira P, Kaiser CA, Krieger M, Schot MP, Zipursky L, Darnell J. Molecular Cell Biology, 6th Edition, 2007
2	Becker, W.M. etal., “The World of the Cell”, 9 th Edition, Pearson Education, 2003.
3	Campbell, N.A., J.B. Reece and E.J. Simon “Essential Biology”, VIIrd Edition, Pearson International, 2007

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understanding of cell at structural and functional level.
CO2:	Understand the central dogma of life and its significance.
CO3:	Comprehend the basic mechanisms of cell division.
CO4:	Study on the Cell cycle
CO5:	Students will learn about Central dogma

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO2	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO3	3	2	3	1	-	-	1	1	-	-	1	-	-	-
CO4	3	2	3	1	-	-	1	1	-	-	1	-	-	-
CO5	3	2	3	1	-	-	-	-	-	-	1	-	-	-
Avg.	3	2	3	1	-	-	-	-	-	-	1	-	-	-

1 – Slight, 2 – Moderate, 3 –Substantial, BT – Bloom’s Taxonomy


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Department	BME	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UBMOE2404	HUMAN PHYSIOLOGY	L	T	P	C	100
		3	0	0	3	
Course Objectives	The student should be made to: The objective is to offer basic concepts of biochemistry to students with diverse background in life sciences including but not limited to the structure and function of various biomolecules and their metabolism.					

Unit-I	BASIC ELEMENTS OF HUMAN BODY	(9)
Cell: Structure and organelles - Functions of each component in the cell. Cell membrane –transport across membrane – origin of cell membrane potential – Action potential. Tissue: Types – Specialized tissues – functions.		
Unit-II	SKELETAL AND RESPIRATORY SYSTEM	(9)
Skeletal system: Bone types and functions – Joint - Types of Joint - Cartilage and functions. Respiratory System: Components of respiratory system – Respiratory Mechanism. Types of respiration - Oxygen and carbon dioxide transport and acid base regulation		
Unit-III	CIRCULATORY SYSTEM	(9)
Blood composition - functions of blood – functions of RBC. WBC types and their functions. Blood groups – importance of blood groups – identification of blood groups. Blood vessels- Structure of heart – Properties of Cardiac muscle – Conducting system of heart – Cardiac cycle – ECG - Heart sound		
Unit-IV	URINARY AND SPECIAL SENSORY SYSTEM	(9)
Urinary system: Structure of Kidney and Nephron. Mechanism of Urine formation and acid base regulation – Urinary reflex – Homeostasis and blood pressure regulation by urinary system. Special senses: Eye and Ear.		
Unit-V	NERVOUS SYSTEM	(9)
Structure of a Neuron – Types of Neuron. Synapses and types. Conduction of action potential in neuron. Brain – Divisions of brain lobes - Cortical localizations and functions - EEG. Spinal cord – Tracts of spinal cord - Reflex mechanism – Types of reflex. Autonomic nervous system and its functions.		
Total No of Periods to be Taught		45 periods


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TEXT BOOK:

1	Elaine.N. Marieb, “Essential of Human Anatomy and Physiology”, Eight Edition, Pearson Education, New Delhi ,2007.
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REFERENCES:

1	Gillian Pocock, Christopher D. Richards, The human Body – An introduction for Biomedical and Health Sciences, Oxford University Press, USA, 2009
2	William F.Ganong, “Review of Medical Physiology”, 22 nd Edition, Mc Graw Hill, New Delhi, 2005

COURSE OUTCOMES:

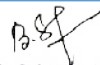
On completion of the course, the students will be able to

CO1:	Describe basic structural and functional elements of human body.
CO2:	Explain organs and structures involving in system formation and functions.
CO3:	Identify all systems in the human body.
CO4:	Study on the Urinary system and sensory system
CO5:	Students will learn about nervous system

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO2	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO3	3	2	3	1	-	-	1	1	-	-	1	-	-	-
CO4	3	2	3	1	-	-	1	1	-	-	1	-	-	-
CO5	3	2	3	1	-	-	-	-	-	-	1	-	-	-
Avg.	3	2	3	1	-	-	-	-	-	-	1	-	-	-

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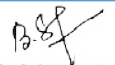
Department	BME	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UBMOE2405	LIFESTYLE DISEASES	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To study the cell types and differentiation. • To study basics about stem cells and its applications • To understand the methods and design involved in tissue engineering					

Unit-I	INTRODUCTION	(9)
Lifestyle diseases – Definition ; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise		
Unit-II	CANCER	(9)
Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment		
Unit-III	CARDIOVASCULAR DISEASES	(9)
Coronary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse -- Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation		
Unit-IV	DIABETES AND OBESITY	(9)
Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI		
Unit-V	RESPIRATORY DISEASES	(9)
Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing		
Total No of Periods to be Taught		45 periods

TEXT BOOK:	
1	R. Kumar & Meenal Kumar, “Guide to Prevention of Lifestyle Diseases”, Deep & Deep Publications, 2003
2	Gary Eggar et al, “Lifestyle Medicine”, 3rd Edition, Academic Press, 2017


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REFERENCES:

1	James M.R, “Lifestyle Medicine”, 2nd Edition, CRC Press, 2013
2	Akira Miyazaki et al, “New Frontiers in Lifestyle-Related Disease”, Springer, 2008

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain the concept of lifestyle diseases, their causes, risk factors, and preventive measures.
CO2:	Describe different types of cancer, their causes, diagnosis methods, and treatment approaches.
CO3:	Analyze cardiovascular diseases, their risk factors, diagnostic techniques, treatment, and rehabilitation.
CO4:	Illustrate the types of diabetes mellitus, obesity, complications, and methods for weight control using BMI.
CO5:	Discuss respiratory diseases such as asthma and COPD, their causes, diagnosis, and prevention.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO2	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO3	3	2	3	1	-	-	1	1	-	-	1	-	-	-
CO4	3	2	3	1	-	-	1	1	-	-	1	-	-	-
CO5	3	2	3	1	-	-	-	-	-	-	1	-	-	-
Avg.	3	2	3	1	-	-	-	-	-	-	1	-	-	-

1 – Slight, 2 – Moderate, 3 –Substantial, BT – Bloom’s Taxonomy


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Department	BME	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UBMOE2406	PATHOLOGY AND MICROBIOLOGY	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Gain a knowledge on the structural and functional aspects of living organisms. • Know the etiology and remedy in treating the pathological diseases. • Empower the importance of public health.					

Unit-I	CELL DEGENERATION, REPAIR AND NEOPLASIA	(9)
Cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification, cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours. Autopsy and biopsy.		
Unit-II	FLUID AND HEMODYNAMIC DERRANGEMENTS	(9)
Edema, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock. Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas		
Unit-III	MICROSCOPES	(9)
Light microscope – bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM & SEM). Preparation of samples for electron microscope. Staining methods – simple, gram staining and AFB staining.		
Unit-IV	MICROBIAL CULTURES	(9)
Morphological features and structural organization of bacteria, growth curve, identification of bacteria , culture media and its types , culture techniques and observation of culture.		
Unit-V	IMMUNOLOGY	(9)
Natural and artificial immunity, opsonization, phagocytosis, inflammation, Immune deficiency syndrome, antibodies and its types, antigen and antibody reactions, immunological techniques: immune diffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies. Disease caused by bacteria, fungi, protozoal, virus and helminthes		
Total No of Periods to be Taught		45 periods


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TEXT BOOK:

1	Old RW, Primrose SB, “Principles of Gene Manipulation, An Introduction to Genetic Engineering”, Blackwell Science Publications, 1993.
2	Principles of Genome Analysis and Genomics by S.B.Primrose and R.M.Twyman, 3rd Ed. (Blackwell Publishing).

REFERENCES:

1	Isil Aksan Kurnaz, “Techniques in Genetic Engineering”, CRC Press, 2015.
2	Oksana Ableitner, “Introduction to Molecular Biology: Working with DNA and RNA (essentials)”, Springer International, 2022.
3	Arun K. Shukla, “Proteomics in Biology”, Academic Press, 2017.o

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Analyze structural and functional aspects of living organisms.
CO2:	Explain the function of microscope
CO3:	Discuss the importance of public health.
CO4:	Describe methods involved in treating the pathological diseases
CO5:	Study about the immunology and immune system

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO2	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO3	3	2	3	1	-	-	1	1	-	-	1	-	-	-
CO4	3	2	3	1	-	-	1	1	-	-	1	-	-	-
CO5	3	2	3	1	-	-	-	-	-	-	1	-	-	-
Avg.	3	2	3	1	-	-	-	-	-	-	1	-	-	-

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Department	BME	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UBMOE2407	MEDICAL ELECTRONICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	The students will be exposed to electrical and non-electrical physiological measurements and bioamplifiers					

Unit-I	BIO POTENTIAL ELECTRODES	(9)
Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode-skin interface, half cell potential, impedance, polarization effects of electrode – nonpolarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits		
Unit-II	ELECTRODE CONFIGURATIONS	(9)
Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven’s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode.		
Unit-III	BIO AMPLIFIER	(9)
Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECG amplifier. Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference		
Unit-IV	MEASUREMENT OF NON-ELECTRICAL PARAMETERS	(9)
Blood Pressure: indirect methods - auscultatory method, oscillometric method, direct methods. Blood flow measurement Electromagnetic and ultrasound blood flow measurement. Cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method,		
Unit-V	BIO-CHEMICAL MEASUREMENT	(9)
Biochemical sensors - pH, pO ₂ and pCO ₂ , Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors - Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).		
Total No of Periods to be Taught		45 periods


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TEXT BOOK:

1	John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 2004. (Units I, II & V)
2	Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003. (Units II & IV)

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Perform electrical and non-electrical physiological measurements
CO2:	Explain the function of bio amplifiers.
CO3:	Students will learnt about bio amplifier AC and DC
CO4:	Measurement of non-electrical parameters blood pressure
CO5:	Students will learnt about biochemical measurements

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	POS1	PSO2	PSO3
CO1	3	2	1	-	-	1	1	-	-	-	-	-	-	-
CO2	3	2	1	-	-	1	1	-	-	-	-	-	-	-
CO3	3	2	1	-	-	1	1	-	-	-	-	-	-	-
CO4	3	2	1	-	-	1	1	-	-	-	-	-	-	-
CO5	3	2	1	-	-	1	1	-	-	-	-	-	-	-
Avg.	3	2	1	-	-	1	1	-	-	-	-	-	-	-

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Department	BME	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UBMOE2408	ASSIST DEVICES	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Study various mechanical techniques that will help failing heart. • Learn the functioning of the unit which does the clearance of urea from the blood • Understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss. • Know the various orthotic devices and prosthetic devices to overcome orthopedic problems. • Understand electrical stimulation techniques used in clinical applications.					

Unit-I	CARDIAC ASSIST DEVICES	(9)
Principle of External counter pulsation techniques, intra-aortic balloon pump, Auxillary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.		
Unit-II	HEMODIALYSERS	(9)
Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters.		
Unit-III	HEARING AIDS	(9)
Common tests – audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.		
Unit-IV	PROSTHETIC AND ORTHODIC DEVICES	(9)
Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthodic system, functional electrical stimulation, and sensory assist devices.		
Unit-V	RECENT TRENDS	(9)
Transcutaneous electrical nerve stimulator, bio-feedback.		
Total No of Periods to be Taught	45 periods	


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TEXT BOOK:

1	Levine S.N. (ed), "Advances in Bio-medical Engineering and Medical physics", Vol. I, II, IV, inter university publications, New York, 1968 (Unit I, IV, V).
2	Kolff W.J, "Artificial Organs", John Wiley and sons, New York, 1976. (Unit II).

REFERENCES:

1	D.S. Sunder, "Rehabilitation Medicine", 3 rd Edition, Jaypee Medical Publication, 2010.
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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain the functioning and usage of electromechanical units which will restore normal functional ability of particular organ that is defective temporarily or permanently
CO2:	Explain the functioning and usage of hemodialysers and its functional parameters
CO3:	To study about the Common tests – audiograms, air conduction, bone conduction
CO4:	Knowledge on prosthetic and orthodic devices
CO5:	To know about the knowledge on recent trends

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	1	-	1	-	1	-	-	-	-
CO2	3	2	1	-	-	1	-	1	-	1	-	-	-	-
CO3	3	2	1	-	-	1	-	1	-	1	-	-	-	-
CO4	3	2	1	-	-	1	-	1	-	1	1	-	-	-
CO5	3	2	1	-	-	1	-	1	-	1	1	-	-	-
Avg.	3	2	1	-	-	1	-	1	-	1	1	-	-	-

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Department	Chemical Engineering	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCHOE2401	NANOMATERIALS AND APPLICATIONS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Understanding the classification and types of polymers. understand different types of nanomaterials for the future engineering applications - Gaining knowledge on polymer analysis and solution properties - Having knowledge on the structure and properties of bulk polymers - Having knowledge on the commercial polymers - Acquiring knowledge on polymer processing techniques					

Unit-I	NANOMATERIALS	(9)
Introduction, Classification: 0D, 1D, 2D, 3D nanomaterials and nano-composites, their mechanical, electrical, optical, magnetic properties; Nanomaterials versus bulk materials.		
Unit-II	THERMODYNAMICS & KINETICS OF NANOSTRUCTURED MATERIALS	(9)
Size and interface/interphase effects, interfacial thermodynamics, phase diagrams, diffusivity, grain growth, and thermal stability of nanomaterials.		
Unit-III	PROCESSING	(9)
Bottom-up and top-down approaches for the synthesis of nanomaterials, mechanical alloying, chemical routes, severe plastic deformation, and electrical wire explosion technique.		
Unit-IV	STRUCTURAL CHARACTERISTICS	(9)
Principles of emerging nanoscale X-ray techniques such as small angle X-ray scattering and X-ray absorption fine structure (XAFS), electron and neutron diffraction techniques and their application to nanomaterials; SPM, Nanoindentation, Grain size, phase formation, texture, stress analysis		
Unit-V	APPLICATIONS	(9)
Applications of nanoparticles, quantum dots, nanotubes, nanowires, nanocoatings; applications in electronic, electrical and medical industries.		
Total No of Periods to be Taught		45

TEXT BOOK:

1	Bhusan, Bharat (Ed), "Springer Handbook of Nanotechnology", 2nd edition, 2007.
2	Carl C. Koch (ed.), Nanostructured Materials, Processing, Properties and Potential Applications, NOYES PUBLICATIONS, Norwich, New York, U.S.A.

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REFERENCES:

1	Poole C.P, and Owens F.J., Introduction to Nanotechnology, John Wiley 2003.
2	Nalwa H.S., Encyclopedia of Nanoscience and Nanotechnology, American Scientific Publishers 2004.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Evaluate nanomaterials and understand the different types of nanomaterials
CO2:	Recognise the effects of dimensionality of materials on the properties
CO3:	Process different nanomaterials and use them in engineering applications
CO4:	Use appropriate techniques for characterizing nanomaterials
CO5:	Identify and use different nanomaterials for applications in different engineering fields.

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	3	-	-	-	-	-	-	-	2	1	2
CO2	3	1	2	2	-	-	-	-	-	-	-	2	2	2
CO3	3	2	1	2	-	-	-	-	-	-	-	2	2	2
CO4	3	1	-	3	-	-	-	-	-	-	-	2	2	2
CO5	3	2	2	2	-	-	-	-	-	-	-	2	2	2
Avg.	2.8	1.6	1.7	2.2	-	-	-	-	-	-	-	2	1.8	2

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Department	Chemical Engineering	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCHOE2402	POLYMER TECHNOLOGY	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Understanding the classification and types of polymers. understand different types of nanomaterials for the future engineering applications - Gaining knowledge on polymer analysis and solution properties - Having knowledge on the structure and properties of bulk polymers - Having knowledge on the commercial polymers - Acquiring knowledge on polymer processing techniques					

Unit-I	INTRODUCTION TO POLYMERS AND POLYMERIZATIONS	(9)
Polymers - Basic concepts - Classification - Natural and synthetic polymers, thermoplasts and thermosets. Polymerization - Addition, condensation, ring opening, copolymerization, ionic and coordination polymerization - Kinetics of polymerization.		
Unit-II	POLYMER ANALYSIS AND SOLUTION PROPERTIES	(9)
Molecular weight and distribution- Number average, weight average, viscosity average and Z-average molecular weight - Determination by light scattering, solution viscosity and gel permeation chromatography. Degree of polymerization. Glass transition temperature - Theory and measurements. Polymer solutions- Solubility and swelling, Thermodynamics of polymer solutions, Phase separation in polymer solutions.		
Unit-III	STRUCTURE AND PROPERTIES OF BULK POLYMERS	(9)
Morphology and order in crystalline polymers -crystal structure of polymers, morphology of polymer single crystals. Rheology and the mechanical properties of polymers - Viscous flow, kinetic theory of rubber elasticity and viscoelasticity, stress-strain behavior, compression vs tensile tests, deformation of solid polymers. Thermal analysis of polymers using TGA and DSC.		
Unit-IV	MANUFACTURE AND PROPERTIES OF COMMERCIAL POLYMERS	(9)
Hydrocarbon plastics and elastomers - low density (branched) polyethylene, high density (linear) polyethylene, polypropylene, natural rubber, rubbers derived from butadiene. Other carbon chain polymers polystyrene, acrylic polymers, poly(vinyl esters) and derived polymers. Heterochain thermoplastics - Polyamides. Thermosetting resins - Phenolic resins and amino resins.		
Unit-V	POLYMER PROCESSING TECHNIQUES	(9)
Plastic molding techniques - Injection, blow, extrusion and compression. Processing agents - Fillers, plasticizers, and other additives. Fiber Technology - Textile and fabric properties, spinning - wet and dry methods - fiber treatments. Elastomer technology - Compounding and elastomer properties, vulcanization and reinforcement.		
Total No of Periods to be Taught		45

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TEXT BOOK:

1	Billmeyer F.W., Textbook of Polymer Science, Third Edition, Wiley Interscience, 1984.
2	Charles E., Carraher Jr., Seymour/carraher's polymer chemistry, Seventh Edition, CRC Press, 2012.

REFERENCES:

1	Fried J.R., Polymer Science and Technology, Second Edition, Prentice Hall of India Pvt Ltd., 2003.
2	Bhatnagar M.S., A Textbook of Polymers, Vol. 2, S.Chand and Company Ltd., 2012s.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understand the basic concepts of polymer science and identify the polymerization techniques and its kinetics.
CO2:	Assess the molecular weight distribution techniques, glass transition, and solution properties like thermodynamics, phase separations.
CO3:	Explain the morphology, rheology, mechanical and thermal properties of bulk polymers.
CO4:	Compare and analyze the manufacture and properties of commercial polymers.
CO5:	Apply the knowledge in assessing the polymeric, fiber and elastomer processing techniques.

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	-	3	-	-	-	2	3	1	-	2	-
CO2	2	3	3	-	3	-	-	-	2	3	1	-	2	-
CO3	2	3	3	-	3	1	-	-	-	3	1	-	2	-
CO4	2	3	3	-	3	1	-	-	2	3	1	-	2	-
CO5	2	3	3	-	3	1	-	-	2	3	1	-	2	-
Avg.	2	3	3	-	3	1	-	-	2	3	1	-	2	-

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy

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Department	Chemical Engineering	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCHOE2403	ENZYME ENGINEERING	L	T	P	C	100
		3	0	0	3	
Course Objectives	Focuses on the introduction to enzymes and gives an overview of kinetics, production, immobilization, fermentation process and its industrial applications.					

Unit-I	ENZYMES AND KINETICS	(9)
Classification of enzymes; Principle of enzymatic catalysis; Enzyme kinetics-Factors affecting the enzyme activity- Concentration, pH and temperature. Kinetics of a single-substrate enzyme catalysed reaction, Michealis-Menten Equation, Km, Vmax, L.B Plot, Turnover number, Kcat. Kinetics of Enzyme Inhibition.		
Unit-II	ENZYME PRODUCTION	(9)
Extraction of crude enzyme from plant, animal and microbial source; Purification of enzymes by the help of different methods. Methods of characterization of enzymes; criteria of purity. Unit of enzyme activity - definition and importance. Development of enzyme assays.		
Unit-III	ENZYME IMMOBILIZATION	(9)
Immobilization Type: Adsorption, Matrix entrapment, Encapsulation, Cross linking, Covalent binding and their examples; Advantages and disadvantages of different immobilization techniques. Structure & stability of immobilized enzymes, kinetic properties of immobilized enzymes- partition effect, diffusion effect.		
Unit-IV	LARGE SCALE PRODUCTION	(9)
Fermentation using continuously stirred aerated tank bioreactors. Mixing power correlation. Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power.		
Unit-V	INDUSTRIAL APPLICATIONS OF ENZYMES	(9)
Industrial Enzymes in:Dairy, Bread making, Starch processing, Brewing; Bioethanol production and other fermentation processes; Thermophilic enzymes, amylases, lipases, proteolytic enzymes in Meat and Leather industry, Cellulose degrading enzymes in Paper and Pulp industry; Metal degrading and pollutant degradation. Biosensors		
Total No of Periods to be Taught		45

TEXT BOOK:

1	Nicolas C. Price and Lewis Stevens, "Fundamentals of enzymology: Cell and Molecular Biology of Catalytic Proteins", 3rd Edition, Oxford University Press, United States of America, 2000 for Unit I.
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2	Young JeYoo, Yan Feng, Yong Hwan Kim Camila Flor J. Yagonia, "Fundamentals of Enzyme Engineering", 1st Edition, Springer Inc, United Kingdom, 2017 for Units II, III, IV & V.
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REFERENCES:

1	Trevor Palmer and Philip Bonner, "Enzymes: Biochemistry, Biotechnology and Clinical Chemistry", 2nd Edition, Woodhead Publishing, United Kingdom, 2001.
2	Nalwa H.S., Encyclopedia of Nanoscience and Nanotechnology, American Scientific Publishers 2004

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Classify enzymes and elaborate the principles of catalysis and enzyme kinetics
CO2:	Describe the enzyme production, purification, characterisation and assay
CO3:	Outline the immobilization of enzymes
CO4:	Elaborate the large scale fermentation process using bioreactors
CO5:	Apply enzyme science in its industrial applications

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	1	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	1	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-	-	-	-
Avg.	3	3	3	3	-	-	-	-	-	-	-	-	-	-

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy

8.6.11
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Department	Chemical Engineering	Programme Code & Name			Open to all Departments	
Semester						
Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCHOE2404	Bio Energy Resources	L	T	P	C	100
		3	0	0	3	
Course Objectives	Focuses on the introduction to bioenergy and gives an overview of resources, gasification and combustion processes.					

Unit-I	(9)
Energy perspective: Current methods, Biomass possibilities. Fundamental concepts in understanding biofuel and bioenergy production: Mass Balances, Energy Balances, Thermodynamics, Organic compounds, Chemistry of plant materials resources.	
Unit-II	(9)
Biogas technology: Feedstock for producing biogas; Microbial and biochemical aspects and operating parameters for biogas production, Kinetics and mechanism. Dry and wet fermentation, Digestors for rural application-High rate digesters for industrial waste water treatment.	
Unit-III	(9)
Pyrolysis and thermo-chemical conversion: Thermo-chemical conversion of lignocellulosic biomass. Incineration for safe disposal of hazardous waste, Biomass processing for liquid fuel production, Pyrolysis of biomass-pyrolysis regime, effect of particle size, temperature, and products obtained.	
Unit-IV	(9)
Comparison of Bio-energy Sources, Biorefinery, Biofuels for Transportation, Vegetable Oils as Engine Fuels. Biodiesel as Engine Fuel: Engine Emissions from Biodiesel, Biodiesel production by using various microorganisms, algae and Transesterification process, methods of biodiesel production.	
Unit-V	(9)
Combustion of biomass and cogeneration systems: Combustion of woody biomass-theory, calculations and design of equipment, Cogeneration in biomass processing industries. Case studies: Combustion of rice husk, Use of bagasse for cogeneration	
Total No of Periods to be Taught	45

TEXT BOOK:	
1	Anju Dahiya, Bioenergy: Biomass to biofuels First Edition, Academic Press, 2014.
2	Li, Yebo, and Samir Kumar Khanal. Bioenergy: principles and applications. John Wiley & Sons, 2016.





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REFERENCES:

1	Vaughn C Nelson, Kenneth L. Starcher. Introduction to bioenergy. CRC Press, 2017.
2	Wall, Judy D., Caroline S. Harwood, and Arnold Demain. "Bioenergy." Bioenergy.. ASM Press, 2008.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understand the fundamental knowledge on energy perspective
CO2:	Learn the production of biogas
CO3:	Gather knowledge on the operations of incineration, pyrolysis.
CO4:	Understand the comparison of bioenergy sources
CO5:	Knowledge on the types of combustion of biomass.

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	1	2	2	2	1	1	1	1	2	1	2
CO2	2	-	2	1	2	2	2	1	1	1	2	2	2	2
CO3	2	1	2	1	2	2	2	2	1	1	2	2	1	2
CO4	2	1	2	1	2	2	2	1	1	1	2	2	2	2
CO5	2	2	2	2	2	2	2	1	1	1	2	2	1	2
Avg.	2	1	2	1	2	2	2	1	1	1	1	2	1	2

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy

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Department	Chemical Engineering	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCHOE2405	CHEMICAL PROCESS SAFETY	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Teach the principles of safety applicable to the design, and operation of chemical process plants. - Ensure that potential hazards are identified and mitigation measures are in place to prevent unwanted release of energy. - Learn about the hazardous chemicals into locations that could expose employees and others to serious harm. - Focuses on preventing incidents and accidents during large scale manufacturing of chemicals and pharmaceuticals. - Ensure that the general design of the plant is capable of complying with the dose limits in force and with the radioactive releases.					

Unit-I	SAFETY IN THE STORAGE AND HANDLING OF CHEMICALS AND GASES	(9)
Types of storage-general considerations for storage layouts- atmospheric venting, pressure and temperature relief - relief valve sizing calculations - storage and handling of hazardous chemicals and industrial gases, safe disposal methods, reaction with other chemicals, hazards during transportation - pipe line transport - safety in chemical laboratories.		
Unit-II	CHEMICAL REACTION HAZARDS	(9)
Hazardous inorganic and organic reactions and processes, Reactivity as a process hazard, Detonations, Deflagrations, and Runaways, Assessment and Testing strategies, Self - heating hazards of solids, Explosive potential of chemicals, Structural groups and instability of chemicals, Thermochemical screening.		
Unit-III	SAFETY IN THE DESIGN OF CHEMICAL PROCESS PLANTS	(9)
Design principles -Process design development -types of designs, feasibility survey, preliminary design, Flow diagrams, piping and instrumentation diagram, batch versus continuous operation, factors in equipment scale up and design, equipment specifications - reliability and safety in designing - inherent safety - engineered safety - safety during startup and shutdown - non destructive testing methods - pressure and leak testing - emergency safety devices - scrubbers and flares- new concepts in safety design and operation- Pressure vessel testing standards- Inspection techniques for boilers and reaction vessels.		
Unit-IV	SAFETY IN THE OPERATION OF CHEMICAL PROCESS PLANTS	(9)
Properties of chemicals - Material Safety Data Sheets - the various properties and formats used - methods available for property determination. Operational activities and hazards -standards operating procedures - safe operation of pumps, compressors, heaters, column, reactors, pressure vessels, storage vessels, piping systems - effects of pressure, temperature, Flow rate and humidity on operations - corrosion and control measures- condition monitoring - control valves - safety valves - pressure reducing valves, drains, bypass valves, inert gases. Chemical splashes, eye irrigation and automatic showers.		



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Unit-V	SAFETY AND ANALYSIS	(9)
Safety vs reliability- quantification of basic events, system safety quantification, Human error analysis, Accident investigation and analysis, OSHAS 18001 and OSHMS.		
Total No of Periods to be Taught		45

TEXT BOOK:	
1	George Kanwaty, "Introduction to Work Study ", ILO, Geneva, 1996, ISBN: 9221071081 ISBN-13: 9789221071082
2	Enrick N. L., "Time study manual for Textile industry", Wiley Eastern (P) Ltd., 1989, ISBN: 0898740444 ISBN-13: 9780898740448
REFERENCES:	
1	Norberd Lloyd Enrick., "Industrial Engineering Manual for Textile Industry", Wiley Eastern (P) Ltd., New Delhi, 1988, ISBN: 0882756311 ISBN-13: 9780882756318
2	Chuter A. J., "Introduction to Clothing Production Management", Wiley-Black well Science, U.S. A., 1995, ISBN: 0632039396 ISBN-13: 9780632039395

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Differentiate between inherent safety and engineered safety and recognize the importance of safety in the design of chemical process plants.
CO2:	Develop thorough knowledge about safety in the operation of chemical plants.
CO3:	Apply the principles of safety in the storage and handling of gases.
CO4:	Identify the conditions that lead to reaction hazards and adopt measures to prevent them.
CO5:	Develop thorough knowledge about safety and analysis.

Mapping of COs with POs and PSOs														
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	1	1	2	2	1	1	1
CO2	1	2	2	2	2	1	2	1	2	2	2	2	1	1
CO3	1	2	2	1	1	2	2	1	2	1	2	2	1	3
CO4	1	2	2	1	1	1	2	1	1	1	1	2	2	1
CO5	2	2	3	2	2	1	2	1	1	2	2	1	1	3
Avg.	2	1	1	1	2	1	2	2	2	2	2	2	1	2
1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy														


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Department	CIVIL	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCEOE2401	ARCHITECTURAL HERITAGE OF INDIA	L	T	P	C	100
		3	0	0	3	
Course Objectives	● To help students understand the history and styles of Indian architecture. ● To create awareness about preserving India’s architectural heritage.					

Unit-I	INDUS VALLEY CIVILIZATION	(9)
Indus valley civilization – Chronological introduction – Construction style – Materials used – The cities Harappa, lothal and Mohenjo-Daro, The great bath – The granary at Harappa – The assembly hall – Ajanta-Ellora Cave temples – Mahabodhi temple complex		
Unit-II	SOUTH INDIAN ARCHITECTURE	(9)
Chera-Chola-Pandya architecture – Chronological introduction – Construction style – Materials used – Brihadeeswarar Temple – Meenakshi Temple – Kalinga – Chalukya – Pallava architecture – Mahabalipuram stone temples – Khajuraho – Muskin Bhanvi – Konark Sun Temple – Hoysala – Vijayanagara architecture – twin temples Mosale – Virupaksha temple Raya Gopura at Hampi		
Unit-III	MUGHAL ARCHITECTURE	(9)
Mughal architecture – Chronological introduction – Construction style – Materials used – Qutub Minar – Taj Mahal – Humayun's Tomb – Redfort – Fatehpur Sikri – Agra fort – Jama Masjid – Rajput civil architecture – Chronological introduction – Construction style – Materials used – All hill forts of Rajasthan		
Unit-IV	BRITISH ARCHITECTURE	(9)
British colonial architecture – Chronological introduction – Construction style – Materials used – Buildings in Chennai, Mumbai, Shimla – Churches – Mountain railways of India-bridges.		
Unit-V	COLONIAL ARCHITECTURE	(9)
Other colonial architecture – Portuguese-Dutch-French-Danish – Chronological introduction – Construction style – Materials used – Churches – Churches and Convents of Goa and Cochi – French town of Puducherry – Tranquebar fort – Bungalow on the beach		
Total No of Periods to be Taught		45 periods

TEXT BOOK:	
1	Bindia Thapar, Surat Kumar Manto, and Suparna Bhalla., Introduction to Indian Architecture: Arts of Asia, Periplus Editions (HK) Ltd, Hong Kong, First Edition, 2005
2	Sandhya Ketkar., The History of Indian Art, Jyotsna Prakashan Publisher, Maharashtra, E – Edition, 2020



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REFERENCES:

1	Christopher Tadgell., The History of Architecture in India, Phaidon Press Ltd, New York, First Edition, 1990
2	Mark M. Jarzombek, Vikramaditya Prakash, Francis D. K. Ching., A Global History of Architecture, John Wiley & Sons, Hoboken, Second Edition, 2010
3	https://nptel.ac.in/courses/124106009
4	https://ncert.nic.in/textbook/pdf/kefa106.pdf

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Illustrate various materials used and construction style of Indus Valley Civilization
CO2:	Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture
CO3:	Describe the materials used and construction style of Mughal architecture
CO4:	Explain the various materials and construction style of British architecture
CO5:	Describe various materials and construction style of Portuguese, Dutch, French and Danish

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	2	-	-	-	-	3	-	-	-
CO2	3	3	-	2	-	2	-	-	-	-	3	-	-	-
CO3	3	3	-	1	-	2	-	-	-	-	3	-	-	-
CO4	3	3	-	2	-	2	-	-	-	-	3	-	-	-
CO5	3	3	-	1	-	2	-	-	-	-	3	-	-	-
Avg.	3	3	-	2	-	2	-	-	-	-	3	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	CIVIL	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCEOE2402	BUILDING PLANNING AND CONSTRUCTION	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To teach the basic principles of building planning and design. • To provide knowledge about construction methods and materials.					

Unit-I	FUNCTIONAL PLANNING OF BUILDINGS	(9)
Types of Buildings, Aspects and Principles of Building Planning, Building By - laws and Regulations, Site Selection criteria, Orientation of Building and its relation to surrounding environment, Sustainability and Green Buildings - Building Bye - laws and Building code of India 2016.		
Unit-II	BUILDING COMPONENTS AND FOUNDATIONS	(9)
Lintels, arches, different types of floors-concrete, mosaic, terrazzo floors, pitched, flat and curved roofs, lean-to roof, coupled roofs, trussed roofs, king and queen post trusses; RCC roofs, madras terrace/shell roofs. Foundations: Shallow foundations, spread, combined, strap and mat footings.		
Unit-III	ALTERNATIVE MATERIALS AND MASONRY	(9)
Structure, properties, seasoning of timber; Classification of various types of woods used in buildings, defects in timber; Alternative materials for wood, galvanized iron, fibre-reinforced plastics, steel, aluminium and glass; Types of masonry, English and Flemish bonds, rubble and ashlar masonry, cavity and partition walls - Light weight concrete blocks – merits and demerits.		
Unit-IV	FLOORS, ROOFS AND STAIRCASES	(9)
Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings. Functional requirements of a good stair, type of stairs, planning a stair case.		
Unit-V	DAMP PROOFING AND FIRE PROTECTION	(9)
Damp proofing and Fire protection: Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Grading of buildings according to fire resistance, Fire resisting properties of common building materials, Fire resistant construction.		
Total No of Periods to be Taught		45 periods

TEXT BOOK:	
1	Varghese P. C., Building construction, PHI Learning Pvt. Ltd, New Delhi ,Second Edition, 2016.
2	B. C. Punmia , Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications, New Delhi, Eleventh Edition,2019.



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REFERENCES:

1	S. K. Duggal, Building Materials , New Age International (P) Limited, New Delhi ,Fourth Edition, 2016,
2	Bulding Bye-laws 2019
3	National Building Code of India, 2016.
4	www.nptel.ac.in/courses/105101088/2 home.htm

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Outline the factors to be considered in planning and construction of buildings
CO2:	Infer the different components and Foundations of building in their construction practices.
CO3:	Interpret masonry and alternative materials of wood, aluminum and glass.
CO4:	Discuss different types of floors, roofs and the materials which are commonly used for construction.
CO5:	Explain about dampness and fire resistance in buildings

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	3	-	-	-	-	2	-	-	-
CO2	3	2	-	2	-	3	-	-	-	-	2	-	-	-
CO3	2	-	-	2	-	3	-	-	-	-	2	-	-	-
CO4	3	2	-	2	-	3	-	-	-	-	2	-	-	-
CO5	3	2	-	2	-	3	-	-	-	-	2	-	-	-
Avg.	3	2	1	2	-	3	-	-	-	-	2	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy



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Department	CIVIL	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCEOE2403	ELEMENTARY CIVIL ENGINEERING	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To introduce the fundamental concepts and branches of civil engineering. • To create awareness about basic materials, tools, and construction practices.					

Unit-I	OVERVIEW OF CIVIL ENGINEERING	(9)
History of Civil Engineering - Role and Functions of Civil Engineer - Fields of Civil Engineering - Importance of Civil Engineering		
Unit-II	BASICS OF SURVEYING	(9)
Introduction - Basic Definitions (Surveying, leveling, Plans, Maps, Scales) - Introduction to divisions of surveying - Classification of surveying - Fundamental principles of surveying - Measurement in Surveying - Phases of Surveying MODERN TOOLS OF SURVEYING AND MAPPING: Introduction to Global Positioning System - Remote Sensing and Geographic Information System		
Unit-III	FUNDAMENTALS OF BUILDING MATERIALS	(9)
Bricks – stones – sand – M-sand - cement – fly ash - silica fume - mortar- concrete – steel – glass - wood plastics – ceramics		
Unit-IV	COMPONENTS OF BUILDING	(9)
Foundations – stone masonry – brick masonry – beams – columns – lintels – roofing – flooring – plastering- damp proofing weathering course		
Unit-V	STRUCTURES	(9)
Introduction to dams, weirs, barrages and check dams - Role of transportation in national development - Modes of transportation - Introduction to road traffic and traffic control - Introduction to mass transportation system		
Total No of Periods to be Taught		45 periods

TEXT BOOK:	
1	Anurag Kandya, Elements of Civil Engineering, Charotar Publishing House Pvt. Ltd, Gujarat, Third Edition, 2017.
2	Palanichamy M.S., Basic Civil Engineering, Tata McGraw-Hill, New Delhi, Fourth Edition, 2011.



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REFERENCES:

1	Poonam Sharma & Swati Rajput, Sustainable Smart Cities in India – Challenges and Future Perspectives, Springer, First Edition, 2017.
2	Dr.B.C.Punamia, Surveying, Laxmi Publication, New Delhi, Seventh Edition, 2016.
3	https://nptel.ac.in/courses/105102088
4	https://byjusexamprep.com/civil-engineering-exams/building-materials

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Provide an overview of civil engineering
CO2:	Explain the basics of surveying , modern tools of surveying and mapping
CO3:	Summarize the fundamentals of building materials in civil engineering
CO4:	Explain the components of building structures.
CO5:	Interpret various infrastructures of civil engineering in construction

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	1	-	-	-	-	1	-	-	-
CO2	2	1	-	-	-	2	-	-	-	-	1	-	-	-
CO3	2	1	-	-	-	2	-	-	-	-	1	-	-	-
CO4	2	1	-	-	-	2	-	-	-	-	1	-	-	-
CO5	3	2	1	-	-	3	-	-	-	-	1	-	-	-
Avg.	3	2	1	-	-	3	-	-	-	-	1	-	-	-

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Department	CIVIL	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCEOE2404	ENERGY AND ENVIRONMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	● To provide basic knowledge about different energy sources and their uses. ● To create awareness about environmental issues and sustainable practices.					

Unit-I	INTRODUCTION	(9)
Overview on the Earth's energy requirements-Climate Change-Origins of the terrestrial atmosphere-Earth's early atmosphere- Introduction to Climate-Layers of the atmosphere.		
Unit-II	GLOBAL ATMOSPHERIC ISSUES	(9)
Composition of the present day atmosphere-Introduction to Atmospheric chemistry-Green House Gases, and the O3 - depletion problem-Post Industrial Revolution Scenario		
Unit-III	ENERGY BALANCE	(9)
Earth Atmosphere System- Solar and Terrestrial Radiation- Absorption of Radiation by gases.-Energy balance- Solar variability and the Earth's Energy Balance.		
Unit-IV	ATMOSPHERIC CHEMISTRY AND CLIMATE	(9)
The Global Temperature Record.-Possible effects of Global Warming. – Indian Context. Atmospheric Chemistry and Climate Change- Atmospheric Aerosol and Cloud Effects on Climate.		
Unit-V	ENVIRONMENTAL VARIABILITY	(9)
Natural (volcanoes, forest fires) and Anthropogenic (Antarctic Ozone Hole, Global Warming).-Green House Gas theory.- Effects of urbanization- Landscape changes-Influence of Irrigation-Desertification and Deforestation		
Total No of Periods to be Taught		45 periods

TEXT BOOK:	
1	Peter E Hodgson, Energy the Environment and Climate Change, Imperial College Press, London, First Edition, 2010
2	Ahluwalia V K, Energy and Environment, The Energy and Resources Institute, New Delhi, First Edition, 2019



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REFERENCES:

1	Richard Wolfson, Energy, Environment, and Climate, Publisher: W. W. Norton & Company, New York, Second Edition, 2011
2	Saeed Moaveni, Energy, Environment, and Sustainability with Mind Tap, Cengage India Private Limited, New Delhi, First Edition, 2017
3	Wilbanks, T., Bilello D, Schmalzer D, Scott, Climate Change and Energy Supply and Use: Technical Report for the U.S. Department of Energy in Support of the National Climate Assessment., Island Press, Washington, 2013
4	Frank T. Princiotta, Global Climate Change - The Technology Challenge, Springer Publisher, New York, First Edition, 2011

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Outline the earth's energy, environment and the processes leading to climate change
CO2:	Infer the atmospheric issues related to the chemistry, green house gases
CO3:	Summarize the role of the terrestrial energy-environment-climate system
CO4:	Interpret the Possible effects of Global Warming and climate change.
CO5:	Outline the Natural and Anthropogenic and Green House Gas theory

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	2	-	-	-	-	2	-	-	-
CO2	3	3	-	-	-	2	-	-	-	-	2	-	-	-
CO3	3	3	-	-	-	2	-	-	-	-	2	-	-	-
CO4	3	3	-	-	-	2	-	-	-	-	2	-	-	-
CO5	3	3	1	-	-	2	-	-	-	-	2	-	-	-
Avg.	3	3	1	-	-	2	-	-	-	-	2	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Mecheri, Salem Dt-636453, Tamilnadu



Department	CIVIL	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCEOE2405	GLOBAL WARMING AND CLIMATE CHANGE	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To explain the causes and effects of global warming and climate change. • To promote awareness of mitigation strategies and sustainable solutions.					

Unit-I	EARTH'S CLIMATE SYSTEM	(9)
Role of ozone in environment – Ozone layer – Ozone depleting gases – Greenhouse gases and its sources – Green House Effect, Radiative Effects of Greenhouse Gases -The Hydrological Cycle – Green House Gases and Global Warming – Effects and causes of Global Warming, Carbon Cycle.		
Unit-II	ATMOSPHERE AND ITS COMPONENTS	(9)
Importance of Atmosphere – Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere - Composition of the atmosphere - Atmospheric stability -Temperature profile of the atmosphere - Lapse rates- Temperature inversion - effects of inversion on pollution dispersion.		
Unit-III	OBSERVED CHANGES AND ITS CAUSES	(9)
Causes of Climate change – Change of Temperature in the environment - Melting of ice Pole-sea level rise - Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.		
Unit-IV	OBSERVED CHANGES AND ITS CAUSES	(9)
Climate change and Carbon credits – CDM- Initiatives in India - Kyoto Protocol - Intergovernmental Panel on Climate change - Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India		
Unit-V	CLIMATE CHANGE AND MITIGATION MEASURES	(9)
Clean Development Mechanism – Carbon Trading – Examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding - Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste(MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.		
Total No of Periods to be Taught		45 periods



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TEXT BOOK:

1	Kandarp Tarkeshprasad Vaishnav., Climate Change Solutions, Global Warming Solutions & Innovative Ideas For Construction of World Development, Notion Press, Chennai, First Edition, 2018
2	Vivian Moritz., Climate Change and Global Warming, Syrawood Publishing House, New York, First Edition, 2017

REFERENCES:

1	Marie Antonette and Chloe Marechal., Climate Change Past, Present & Future, Wiley-Blackwell, New Jersey, First Edition, 2015.
2	Empereur Raymond., Global Warming and Climate Change, Litfire Publishing, Atlanta, First Edition, 2017.
3	Agarwal S.K., Global Warming and Climate Change Past, Present & Future, Ashish Publishing House, New Delhi, First Edition, 2004.
4	https://onlinecourses.swayam2.ac.in/arp19_ap55/preview

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Outline the concept of the causes and effects of global warming
CO2:	Summarize about physical and chemical characteristics of atmosphere
CO3:	Identify the causes and effects of climate change
CO4:	Infer the agreements took place among the countries regarding climate change
CO5:	Summarize about the concept of mitigation measures against climate change

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	3	-	-	-	-	2	-	-	-
CO2	3	2	-	-	-	3	-	-	-	2	2	-	-	-
CO3	3	-	-	2	-	3	-	-	-	2	3	-	-	-
CO4	3	2	-	2	-	3	-	2	-	-	2	-	-	-
CO5	3	2	-	-	-	3	-	3	-	2	3	-	-	-
Avg.	3	2	2	2	-	3	-	3	-	2	3	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department	CIVIL	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCEOE2406	INTRODUCTION TO DISASTER MANAGEMENT AND MITIGATION	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Provide adequate knowledge about disaster mitigation, preparedness, response, and recovery to face disaster among government bodies, institutions, N O's, etc. • Obtain the knowledge different disaster and its preparedness and mitigation methods. • Provide adequate knowledge about applications of space technology in disaster monitoring and information dissemination					

Unit-I	INTRODUCTION TO DISASTER	(9)
Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change		
Unit-II	NATURAL DISASTER AND MANMADE DISASTERS	(9)
Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion. Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.		
Unit-III	DISASTER MANAGEMENT CYCLE AND FRAMEWORK	(9)
Disaster Management Cycle, Paradigm Shift in Disaster Management Pre-Disaster Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development, Awareness During Disaster Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment, IDNDR, Yokohama Strategy, Hyogo Framework of Action.		
Unit-IV	DISASTER MANAGEMENT IN INDIA DISASTER PROFILE OF INDIA	(9)
Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies.		
Unit-V	APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT & MITIGATION	(9)
Geo-informatics in Disaster Management, Disaster Communication System, Land Use Planning and Development Regulations, Structural and Non Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India.		
Total No of Periods to be Taught		45 periods



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TEXT BOOK:

1	R B Singh., Disaster Management and Mitigation, World focus Publisher, New Delhi, First Edition, 2016.
2	Satish Modh, Introduction to disaster management, Macmillan publishers India Ltd, New Delhi, Second Edition, 2019.

REFERENCES:

1	R B Singh., Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi, Reprint Edition, 2006.
2	Pardeep Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, Fourth Edition, 2018.
3	M. Saravanakumar, Disaster Management, Himalaya Publishing House, Bangalore, First Edition, 2017
4	Singh, Disaster Management: Future Challenges, IK International, New Delhi, First Edition, 2017.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain the concepts of disaster and its effect in Indian scenario.
CO2:	Elaborate the difference between natural and manmade disasters.
CO3:	Outline the disaster management cycle and its operation.
CO4:	Outline the disaster management in India and its profile
CO5:	Propose the application of geo-informatics for disaster management and mitigation.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	2	-	-	-	-	3	-	-	-
CO2	3	3	1	-	-	3	-	-	-	-	3	-	-	-
CO3	3	3	-	-	-	2	-	-	-	-	3	-	-	-
CO4	3	3	1	-	-	3	-	-	-	-	3	-	-	-
CO5	3	3	3	-	2	3	-	-	-	-	3	-	-	-
Avg.	3	3	1	-	2	3	-	-	-	-	3	-	-	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy



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Department		CSE		Programme Code & Name			OPEN TO ALL DEPARTMENTS	
Course Code	Course Name			Hours/Week		Credit	Maximum Marks	
UCSOE2401	Introduction to C Programming			L	T	P	C	100
				2	0	2	3	
Course Objectives	- Understand the basic structure and syntax of C programming language. - Develop logical thinking and problem-solving skills. - Apply control structures, functions, and arrays. - Understand pointers, structures, and file handling. - Gain practical experience through lab exercises.							

Unit-I	INTRODUCTION TO C PROGRAMMING	(6)
History and Features of C-Structure of C Program-Character Set, Tokens, Keywords, -Identifiers- Constants and Variables-Data Types (int, float, char, double)-Operators: Arithmetic, Relational, Logical, Assignment-Expressions and Precedence-Input and Output Functions (printf, scanf).		
Unit-II	CONTROL STATEMENTS	(6)
Decision Making: if, if-else, nested if, switch-case -Looping: for, while, do-while-Nested loops Jump Statements: break, continue, goto-Applications of loops.		
Unit-III	FUNCTIONS	(6)
Function Definition and Declaration-Types of Functions-Recursion-Storage Classes: auto, static, extern, register-Parameter Passing: Call by Value, Call by Reference.		
Unit-IV	ARRAYS AND STRINGS	(6)
One Dimensional Arrays - Two Dimensional Arrays - Matrix Operations-String Declaration and Initialization-String Functions: strlen, strcpy, strcat, strcmp-Applications of Arrays and Strings.		
Unit-V	POINTERS, STRUCTURES AND FILE HANDLING	(6)
Pointers and Pointer Arithmetic-Pointers with Arrays and Functions-Structures and Unions-File Handling: fopen, fclose, fprintf, fscanf, fgets, fputs-File Modes and Applications.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

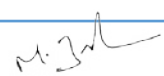
1	E. Balagurusamy, Programming in ANSI C, McGraw Hill, 9th Edition, 2024.
2	Kernighan & Ritchie, The C Programming Language, 2nd Edition, 1988.

REFERENCES:

1	Yashavant Kanetkar, Let Us C, BPB, 20th Edition, 2024.
2	Herbert Schildt, C: The Complete Reference, McGraw Hill, 4th Edition, 2000.
3	Byron Gottfried, Programming with C, McGraw Hill, 1996.

List of Exercises/Experiments

1. Implement a C program to display Hello World.	
2. Implement programs using input and output operations.	
3. Implement programs using arithmetic and logical operators.	
4. Implement decision making programs (if, switch).	
5. Implement looping programs (for, while, do-while).	
6. Implement functions and recursive programs.	
7. Implement array operations (1D and 2D arrays).	
8. Implement string handling programs.	
9. Implement pointer-based programs.	
10. Implement structure and file handling programs.	
Total No of Periods to be Taught	30 Periods


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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain C fundamentals.
CO2:	Apply control structures.
CO3:	Develop programs using arrays and functions.
CO4:	Implement pointers and structures.
CO5:	Design file-based applications neural networks for various tasks.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 4 GB RAM, 64 GB+ storage)	30
2.	Turbo C Compiler	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	0	0	1	0	0	0	0	0	1	3	2	1
CO2	3	3	2	0	1	0	0	0	0	0	1	3	3	2
CO3	3	3	3	2	2	0	0	0	0	0	1	3	3	2
CO4	3	3	3	2	2	0	0	0	0	0	1	3	3	2
CO5	3	3	3	2	3	0	0	0	0	0	2	3	3	3
Avg.	3	2.8	2.2	1.2	1.8	0	0	0	0	0	1.2	3	2.8	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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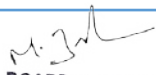
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Department		CSE	Programme Code & Name				OPEN TO ALL DEPARTMENTS
Course Code	Course Name		Hours/Week			Credit	Maximum Marks
UCSOE2402	Introduction to Data Structures		L	T	P	C	100
			2	0	2	3	
Course Objectives	- To understand fundamental data structures. - To analyze and design algorithms. - To implement linear and non-linear data structures. - To evaluate performance of algorithms. - To apply data structures in problem solving.						

Unit-I	Introduction to Data Structures	(6)
Definition and Classification of Data Structures-Abstract Data Types (ADT)-Algorithm -Analysis: Time and Space Complexity-Asymptotic Notations: Big-O, Theta, Omega-Recursion and its applications.		
Unit-II	Linear Data Structures	(6)
Arrays and their operations-Linked Lists: Singly, Doubly, Circular-Stack ADT: Operations and Applications-Queue ADT: Linear Queue, Circular Queue, Deque-Applications of Stacks and Queues.		
Unit-III	Searching and Sorting	(6)
Linear Search and Binary Search-Sorting Techniques: Bubble, Selection, Insertion-Divide and Conquer: Merge Sort, Quick Sort-Hashing: Hash Functions, Collision Handling-Performance Analysis of Searching and Sorting.		
Unit-IV	Trees	(6)
Tree ADT and Terminologies-Binary Trees and Traversals (Inorder, Preorder, Postorder)-Binary Search Trees-AVL Trees-Heaps and Priority Queues.		
Unit-V	Graphs	(6)
Graph ADT and Representations-Graph Traversals: BFS and DFS-Directed Acyclic Graphs (DAG)-Shortest Path Algorithms-Minimum Spanning Trees.		
Total No of Periods to be Taught		30 Periods


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TEXT BOOK:

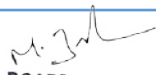
1	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson, 2nd Edition, 1997.
2	Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures, Galgotia, 1976.

REFERENCES:

1	Seymour Lipschutz, Data Structures, Schaum's Outline, McGraw Hill, 2011.
2	Reema Thareja, Data Structures Using C, Oxford University Press, 2014.
3	YedidyahLangsam, Moshe Augenstein, Data Structures Using C and C++, Pearson.

List of Exercises/Experiments

1. Implement array operations.	
2. Implement singly linked list operations.	
3. Implement doubly and circular linked lists.	
4. Implement stack operations using array/linked list.	
5. Implement queue operations (linear and circular)	
6. Implement searching algorithms (linear, binary).	
7. Implement sorting algorithms (bubble, selection, insertion).	
8. Implement divide and conquer sorting (merge, quick sort).	
9. Implement tree traversals.	
10.Implement graph traversals (BFS, DFS).	
Total No of Periods to be Taught	30 Periods


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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain basic data structures concepts.
CO2:	Apply linear data structures.
CO3:	Implement searching and sorting techniques.
CO4:	Analyze trees and graphs.
CO5:	Design efficient algorithms using data structures.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 4 GB RAM, 64 GB+ storage)	30
2.	Turbo C Compiler	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	0	0	1	0	0	0	0	0	1	3	2	1
CO2	3	3	2	0	2	0	0	0	0	0	1	3	3	2
CO3	3	3	3	2	2	0	0	0	0	0	1	3	3	2
CO4	3	3	3	3	2	0	0	0	0	0	1	3	3	3
CO5	3	3	3	3	3	0	0	0	0	0	2	3	3	3
Avg.	3	2.8	2.2	1.6	2	0	0	0	0	0	1.2	3	2.8	2.2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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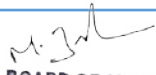
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Department		CSE	Programme Code & Name				OPEN TO ALL DEPARTMENTS	
Course Code	Course Name		Hours/Week			Credit	Maximum Marks	
UCSOE2403	Data Science Fundamentals		L	T	P	C	100	
			2	0	2	3		
Course Objectives		• Familiarize students with the data science process. • Understand the data manipulation functions in Numpy and Pandas. • Explore different types of machine learning approaches. • Understand and practice visualization techniques using tools. • Learn to handle large volumes of data with case studies.						

Unit-I	INTRODUCTION	(6)
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data.		
Unit-II	DATA MANIPULATION	(9)
Python Shell - Jupyter Notebook - IPython Magic Commands - NumPy Arrays-Universal Functions – Aggregations – Computation on Arrays – Fancy Indexing – Sorting arrays – Structured data – Data manipulation with Pandas – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – String operations – Working with time series – High performance.		
Unit-III	MACHINE LEARNING	(5)
The modeling process - Types of machine learning - Supervised learning - Unsupervised learning - Semi-supervised learning- Classification, regression - Clustering – Outliers and Outlier Analysis.		
Unit-IV	DATA VISUALIZATION	(5)
Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.		
Unit-V	HANDLING LARGE DATA	(5)
Problems - techniques for handling large volumes of data - programming tips for dealing with large data sets- Case studies: Predicting malicious URLs, Building a recommender system - Tools and techniques needed - Research question - Data preparation - Model building – Presentation and automation.		


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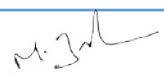


Total No of Periods to be Taught	30 Periods
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TEXT BOOK:	
1	David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2	Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

REFERENCES:	
1	Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
2	Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.

List of Exercises/Experiments	
1.	Download, install and explore the features of Python for data analytics
2.	Working with Numpy arrays.
3.	Working with Pandas data frames.
4.	Basic plots using Matplotlib.
5.	Statistical and Probability measures a) Frequency distributions b) Mean, Mode, Standard Deviation c) Variability d) Normal curves e) Correlation and scatter plots f) Correlation coefficient g) Regression.
6.	Use the standard benchmark data set for performing the following: a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis. b) Bivariate Analysis: Linear and logistic regression modelling.
7.	Apply supervised learning algorithms and unsupervised learning algorithms on any data set.
8.	Apply and explore various plotting functions on any data set.
Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.	
Total No of Periods to be Taught	30 Periods


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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Gain knowledge on data science process.
CO2:	Perform data manipulation functions using Numpy and Pandas.
CO3:	Understand different types of machine learning approaches.
CO4:	Perform data visualization using tools.
CO5:	Handle large volumes of data in practical scenarios.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 4 GB RAM, 64 GB+ storage)	30
2.	Idle Python (latest version)	
3.	Jupyter Notebook	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	1	0	0	0	0	0	1	3	2	1
CO2	3	3	2	1	3	0	0	0	0	0	1	3	3	2
CO3	3	3	3	2	2	0	0	0	0	0	1	3	3	2
CO4	3	2	2	1	3	0	0	0	0	0	1	3	3	2
CO5	3	3	3	3	3	0	0	0	0	0	2	3	3	3
Avg.	3	2.6	2.2	1.4	2.4	0	0	0	0	0	1.2	3	2.8	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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Accredited by NAAC with A+ grade & Recognised by UGC under section 2f & 12B

Mecheri, Salem Dt-636453, Tamilnadu



Department		CSE	Programme Code & Name				OPEN TO ALL DEPARTMENTS	
Course Code	Course Name		Hours/Week			Credit	Maximum Marks	
UCSOE2404	Introduction of Data Analytics		L	T	P	C	100	
			2	0	2	3		
Course Objectives	- Understand the fundamental concepts of Data analytics. - Learn about various types of data formats and its manipulations. - It helps students to learn exploratory data analysis and visualization techniques in addition to R/Python/Tableau programming language.							

Unit-I	INTRODUCTION TO DATA SCIENCE	(5)
Introduction to Data Science, Need for Data Science, the 5 V's, Evolution of Data Science, Data Science Lifecycle, types of Data Analysis, Data Science Tools and technologies, Applications of Data Science in various fields.		
Unit-II	DATA HANDLING	(7)
Types of Data: structured, semi-structured, unstructured data, Numeric, Categorical, Graphical, High Dimensional Data, Transactional Data, Spatial Data, Social Network Data, standard datasets, Data Classification, Sources of Data, Data manipulation in various formats, import and export data in R/Python.		
Unit-III	DATA PRE-PROCESSING	(6)
Data Cleaning: - missing values, noisy data; Data Transformation: -Normalization, Attribute Selection, Discretization, Hierarchy Generation; Data Reduction: - Attribute Subset Selection, Numerosity and Dimensional Reduction, Exploratory Data Analysis techniques, Concept of data munging and data wrangling, Feature generation and Feature selection algorithms.		
Unit-IV	DATA VISUALIZATION	(6)
Introduction and importance of Data Visualization, Benefits, Idea and tools; Types of Data visualization, Libraries for Data visualization, Data visualization using Python/R, Creating Dashboards & Stories Tableau: Getting started with Tableau Software, Using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps).		
Unit-V	APPLICATION	(5)
Application of Data Science, Data Science and Ethical Issues-Discussion on privacy, security, Ethics-A look back at data science-next generation data scientists. Case Study of Data science-Facebook, uber and Amazon.		

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Total No of Periods to be Taught	30 Periods
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TEXT BOOK:

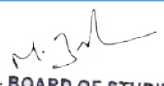
1	Glenn J. Myatt, Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, John Wiley Publishers, 2007.
2	Data Analysis and Data Mining, 2nd Edition, John Wiley & Sons Publication, 2014.

REFERENCES:

1	Open Data for Sustainable Community: Glocalised Sustainable Development Goals, Neha Sharma, Santanu Ghosh, MonodeepSaha, Springer, 2021.
2	The Data Science Handbook, Field Cady, John Wiley & Sons, Inc, 2017.
3	Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, 2012.

List of Exercises/Experiments

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.	
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files.	
3. Implement of Matrix Multiplication with Hadoop Map Reduce.	
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.	
5. Installation of Hive along with practice examples.	
6. Installation of HBase, Installing thrift along with Practice examples.	
7. Practice importing and exporting data from various databases.	
Total No of Periods to be Taught	30 Periods


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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understand the fundamental concepts of data analytics in the areas that plays major role within the realm of data science.
CO2:	Explain and exemplify the most common forms of data and its representations.
CO3:	Understand and apply data pre-processing techniques.
CO4:	Illustrate various visualization methods for different types of data sets and application scenarios.
CO5:	Understand application and ethics of Data Science.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 4 GB RAM, 64 GB+ storage)	30
2.	Idle Python (latest version)	
3.	Jupyter Notebook	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	1	0	0	0	0	0	1	3	2	1
CO2	3	3	2	1	2	0	0	0	0	0	1	3	3	2
CO3	3	3	3	2	2	0	0	0	0	0	1	3	3	2
CO4	3	2	2	1	3	0	0	0	0	0	1	3	3	2
CO5	3	3	2	2	2	1	1	1	0	0	2	3	3	3
Avg.	3	2.6	2	1.2	2	0.2	0.2	0.2	0	0	1.2	3	2.8	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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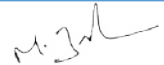
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Department		CSE	Programme Code & Name				OPEN TO ALL DEPARTMENTS
Course Code	Course Name		Hours/Week			Credit	Maximum Marks
UCSOE2405	Artificial Intelligence and Machine Learning Fundamentals		L	T	P	C	100
			2	0	2	3	
Course Objectives	- Understand the importance, principles, and search methods of AI - Provide knowledge on predicate logic and Prolog. - Introduce machine learning fundamentals. - Study of supervised learning algorithms. - Study about unsupervised learning algorithms.						

Unit-I	INTELLIGENT AGENT AND UNINFORMED SEARCH	(6)
Introduction - Foundations of AI - History of AI - The state of the art - Risks and Benefits of AI - Intelligent Agents - Nature of Environment - Structure of Agent - Problem Solving Agents - Formulating Problems - Uninformed Search - Breadth First Search - Dijkstra's algorithm or uniformcost search - Depth First Search - Depth Limited Search.		
Unit-II	PROBLEM SOLVING WITH SEARCH TECHNIQUES	(7)
Informed Search - Greedy Best First - A* algorithm - Adversarial Game and Search - Game theory - Optimal decisions in game - Min Max Search algorithm - Alpha-beta pruning - Constraint Satisfaction Problems (CSP) - Examples - Map Coloring - Job Scheduling - Backtracking Search for CSP.		
Unit-III	LEARNING	(6)
Machine Learning: Definitions – Classification - Regression - approaches of machine learning models - Types of learning - Probability - Basics - Linear Algebra – Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance - Regression: Linear Regression - Logistic Regression.		
Unit-IV	SUPERVISED LEARNING	(6)
Neural Network: Introduction, Perceptron Networks – Adaline - Back propagation networks - Decision Tree: Entropy – Information gain - Gini Impurity - classification algorithm - Rule based Classification - Naïve Bayesian classification - Support Vector Machines (SVM).		
Unit-V	UNSUPERVISED LEARNING	(6)


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Unsupervised Learning – Principle Component Analysis - Neural Network: Fixed Weight Competitive Nets
- Kohonen Self-Organizing Feature Maps – Clustering: Definition - Types of Clustering – Hierarchical clustering algorithms – k-means algorithm.

Total No of Periods to be Taught

30 Periods

TEXT BOOK:

- | | |
|---|--|
| 1 | S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach”, Prentice Hall, Fourth Edition, 2021. |
| 2 | S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India.3 rd ed. |

REFERENCES:

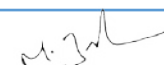
- | | |
|---|---|
| 1 | Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997. |
| 2 | I. Bratko, “Prolog: Programming for Artificial Intelligence”, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011. |
| 3 | C. Muller & Sarah Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020. |

List of Exercises/Experiments

1. Implement breadth first search.
2. Implement depth first search.
3. Analysis of breadth first and depth first search in terms of time and space.
4. Implement and compare Greedy and A* algorithms.

Supervised learning

5. Implement the non-parametric locally weighted regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
6. Write a program to demonstrate the working of the decision tree based algorithm.
7. Build an artificial neural network by implementing the back propagation algorithm and test the same using appropriate data sets.


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8. Write a program to implement the naïve Bayesian classifier.	
Unsupervised learning	
9. Implementing neural network using self-organizing maps.	
10. Implementing k-Means algorithm to cluster a set of data.	
11. Implementing hierarchical clustering algorithm.	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understand the foundations of AI and the structure of Intelligent Agents.
CO2:	Use appropriate search algorithms for any AI problem.
CO3:	Study of learning methods.
CO4:	Solving problem using Supervised Learning.
CO5:	Solving problem using Unsupervised Learning.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	1	0	0	0	0	0	1	3	2	1
CO2	3	3	2	1	2	0	0	0	0	0	1	3	3	2
CO3	3	3	2	2	2	0	0	0	0	0	1	3	3	2
CO4	3	3	3	2	3	0	0	0	0	0	1	3	3	3
CO5	3	3	3	3	3	0	0	0	0	0	2	3	3	3
Avg.	3	2.8	2.2	1.6	2.2	0	0	0	0	0	1.2	3	2.8	2.2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 4 GB RAM, 64 GB+ storage)	30
2.	Idle Python (latest version)	
3.	Anaconda	

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Department		CSE		Programme Code & Name			OPEN TO ALL DEPARTMENTS	
Course Code	Course Name			Hours/Week			Credit	Maximum Marks
UCSOE2406	IOT CONCEPTS AND APPLICATIONS			L	T	P	C	100
				2	0	2	3	
Course Objectives	- To apprise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IOT. - To teach a student how to analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms. - To introduce the technologies behind Internet of Things(IoT). - To explain the students how to code for an IoT application using Arduino/Raspberry Pi open platform. - To apply the concept of Internet of Things in real world scenario.							

Unit-I	INTRODUCTION TO INTERNET OF THINGS	(5)
Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT .		
Unit-II	COMPONENTS IN INTERNET OF THINGS	(5)
Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules).		
Unit-III	PROTOCOLS AND TECHNOLOGIES BEHIND IOT	(6)
IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData Analytics, Cloud Computing, Embedded Systems.		
Unit-IV	OPEN PLATFORMS AND PROGRAMMING	(7)
IOT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.		
Unit-V	IOT APPLICATIONS	(7)
Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

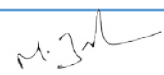
1	Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.
2	Samuel Greengard, The Internet of Things, The MIT Press, 2015.

REFERENCES:

1	Perry Lea, “Internet of things for architects”, Packt, 2018.
2	. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
3	IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
4.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.

List of Exercises/Experiments

1. Introduction to Arduino platform and programming.	
2. Interfacing Arduino to Zigbee module.	
3. Interfacing Arduino to GSM module.	
4. Interfacing Arduino to Bluetooth Module.	
5. Introduction to Raspberry PI platform and python programming.	
6. Interfacing sensors to Raspberry PI.	
7. Communicate between Arduino and Raspberry PI using any wireless medium.	
8. Setup a cloud platform to log the data.	
9. Log Data using Raspberry PI and upload to the cloud platform.	
10. Design an IOT based system.	
Total No of Periods to be Taught	30 Periods


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COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Explain the concept of IoT.
CO2:	Understand the communication models and various protocols for IoT.
CO3:	Design portable IoT using Arduino/Raspberry Pi /open platform.
CO4:	Apply data analytics and use cloud offerings related to IoT.
CO5:	Analyze applications of IoT in real time scenario..

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	1	0	0	0	0	0	1	3	2	1
CO2	3	3	2	1	2	0	0	0	0	0	1	3	3	2
CO3	3	3	3	2	3	0	0	0	0	0	1	3	3	3
CO4	3	3	2	2	3	0	0	0	0	0	1	3	3	3
CO5	3	3	3	3	3	1	1	1	0	0	2	3	3	3
Avg.	3	2.8	2.2	1.6	2.4	0.2	0.2	0.2	0	0	1.2	3	2.8	2.4

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 4 GB RAM, 64 GB+ storage)	30
2.	https://www.arduino.cc/en/software/	
3.	https://www.raspberrypi.com/software/operating-systems/	

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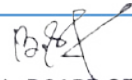
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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2401	INDUSTRIAL ELECTRONICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Study the overview of different types of power semi-conductor devices and their switching characteristics. • Acquire the knowledge of characteristics and performance parameters of controlled converters. • Measure and analyze the characteristics of DC Amplifiers. • Study about the different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction methods. • Expose the practical application for power electronics converters in conditioning the power supply.					

Unit-I	POWER DEVICES	(9)
Power diode --Power transistor -- Power MOSFET - SCR -- TRIAC - GTO - IGBT - MCT -- Protection of power devices		
Unit-II	CONVERTERS	(9)
Introduction to half wave, full wave and bridge rectifiers - Single phase and three phase -Half controlled and fully controlled converters -- Dual converters -- Introduction to cycle converters and ac controllers		
Unit-III	AMPLIFIERS	(9)
Need for DC amplifiers, DC amplifiers - Drift, Causes, Darlington Emitter Follower, Cascade amplifier, Stabilization, Differential amplifiers -- Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers		
Unit-IV	MOTORS	(9)
Steady state characteristic of dc motors - Control of DC motor using converters and choppers Regenerative and dynamic braking -- Closed loop control scheme - Speed-torque characteristic of induction motor -- Static stator voltage control -- V/f control -- Static rotor resistance control -- Slip power recovery scheme -- Self control of synchronous motor.		
Unit-V	INDUSTRIAL APPLICATIONS	(9)
Electronic timers -- Digital counters -- Voltage regulators - Online and offline ups -- Switched modepower supply -- Principle and application of induction and dielectric heating.		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Bogdan M Wilamowski and J David Irwin, "Fundamentals of Industrial Electronics" Second Edition, 2011
---	--

REFERENCES:

1	M. H. Rashid, "power Electronics Circuits, Devices and Application", PHI, third edition, 2004.
2	G. M. Chute and R. D. Chute, "Electronics in Industry", McGraw Hill Ltd, Tokyo, Second Edition 1995.
3	F. D. Petruzulla, "Industrial Electronics", McGraw Hill, Singapore, Second Edition 1996.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Enumerate the functions of various power devices.
CO2:	Explain the various types of converters.
CO3:	Illustrate the various types of amplifiers and analyze the function.
CO4:	Construct the characteristics of DC motors and AC drives.
CO5:	Construct the application of timers and counters.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	2	-	-	-	-	-	-	-	3	2	-
CO2	3	2	3	3	-	-	-	-	-	-	-	3	2	-
CO3	3	2	2	2	-	-	-	-	-	-	-	3	3	-
CO4	3	3	2	2	-	-	-	-	-	-	-	3	3	-
CO5	3	2	2	3	-	-	-	-	-	-	-	3	2	-
Avg.	3	2	3	3	-	-	-	-	-	-	-	3	3	-

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

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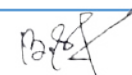
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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2402	IMAGE PROCESSING AND COMPUTER VISION	L	T	P	C	100
		3	0	0	3	
Course Objectives	• This subject emphasis on fundamentals of Image processing and Computer vision. • Students will gain the knowledge of Image Formation, Image Enhancement and Segmentation. • Students will also learn various feature extraction techniques. • This subject has more emphasis on core vision tasks through Motion estimation and Object as well as pattern recognition. • Students shall explore the areas where automation can be possible through Image processing and Computer Vision.					

Unit-I	INTRODUCTION	(9)
Digital Image fundamentals, Image Sensing and acquisition, Sampling and Quantization, Image formation models, Overview of Computer Vision, Applications of Image processing and Computer Vision		
Unit-II	IMAGE ENHANCEMENT	(9)
Image enhancement in spatial domain, Basic grey level Transformations, Histogram Processing Techniques, Spatial Filtering, Image smoothing and Image Sharpening, Image enhancement process in frequency domain, Low pass filtering, High pass Filtering		
Unit-III	IMAGE SEGMENTATION	(9)
Point, line and edge detection, Thresholding, Regions Based segmentation, Edge linking and boundary detection		
Unit-IV	FEATURE EXTRACTION	(9)
Importance of Features, Feature extraction techniques, Histogram of Oriented Gradient (HOG), Scale Invariant Feature Transform (SIFT), Background subtraction techniques, Image Matching, Principal Component Analysis (PCA)		
Unit-V	OBJECT RECOGNITION AND MOTION ESTIMATION & APPLICATIONS OF IMAGE PROCESSING AND COMPUTER VISION	(9)
Object Recognition techniques: Viola-Jones, Yolo, Deep learning algorithms for Object Recognition. Optical Flow, Gaussian Mixture Model (GMM), Structure of Motion, Motion Estimation.& Face Recognition, Facial Expression Recognition, Optical Character Recognition, Automated Video Surveillance		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	NPTEL Courses: https://onlinecourses.nptel.ac.in/noc19_cs58/preview https://onlinecourses.nptel.ac.in/noc19_ee55/preview
2	Course era Courses on Image Processing, Computer Vision

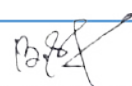
REFERENCES:

1	Digital Image Processing- Refael C. Gonzalez and Richard E. Woods, Wesley
2	Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
3	Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
4	Computer Vision, D. H. Ballard, C. M. Brown, Prentice-Hall, Englewood Cliffs, 1982.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Understand fundamentals of image processing and computer vision.
CO2:	Understand and apply concepts of Image formation and Image Enhancement.
CO3:	Understand and apply image segmentation and feature extraction methods.
CO4:	Acquire knowledge about various Object Detection, Object Recognition, Motion estimation techniques and their applications.
CO5:	Ability to apply various Image processing and Computer vision algorithms to solve real time problems.


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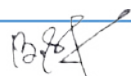
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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	1	-	-	-	-	-	1	-	3	3	1
CO2	3	3	3	1	-	-	-	-	-	1	-	3	3	2
CO3	3	2	2	1	-	-	-	-	-	1	-	3	2	2
CO4	3	3	3	2	-	-	-	-	-	1	-	3	3	1
CO5	3	3	3	1	-	-	-	-	-	1	-	3	3	1
Avg.	3	3	3	1	-	-	-	-	-	1	-	3	3	1

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy


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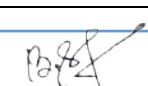
Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2403	4G / 5G COMMUNICATION NETWORKS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To learn the evolution of wireless networks. • To get acquainted with the fundamentals of 5G networks. • To study the processes associated with 5G architecture. • To study spectrum sharing and spectrum trading. • To learn the security features in 5G networks.					

Unit-I	EVOLUTION OF WIRELESS NETWORKS	(9)
Networks evolution: 2G,3G,4G, evolution of radio access networks, need for 5G. 4G versus 5G, Next Generation core(NG-core), visualized Evolved Packet core(vEPC)		
Unit-II	5G CONCEPTS AND CHALLENGES	(9)
Fundamentals of 5G technologies, overview of 5G core network architecture,5G new radio and cloud technologies, Radio Access Technologies (RATs), EPC for 5G		
Unit-III	NETWORK ARCHITECTURE AND THE PROCESSES	(9)
5G architecture and core, network slicing, multi access edge computing(MEC)visualization of 5G components, end-to-end system architecture, service continuity, relation to EPC, and edge computing. 5G protocols: 5G NAS,NGAP, GTP-U, IPSec and GRE		
Unit-IV	DYNAMIC SPECTRUM MANAGEMENT AND MM-WAVES	(9)
Mobility management, Command and control, spectrum sharing and spectrum trading, cognitive radio based on 5G, millimeter waves		
Unit-V	SECURITY IN 5G NETWORKS	(9)
Security features in 5G networks, network domain security, user domain security, flow based QoS frame work, mitigating the threats in 5G		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	5G Core networks: Powering Digitalization , Stephen Rommer, Academic Press,2019
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2	An Introduction to 5G Wireless Networks : Technology, Concepts and Use cases, Saro Velrajan, First Edition, 2020.
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REFERENCES:

1	5G Simplified: ABCs of Advanced Mobile Communications Jyrki. T.J.Penttinen, Copyrighted Material.
2	5G system Design: An end to end Perspective , Wan Lee Anthony, Springer Publications, 2019.

COURSE OUTCOMES:

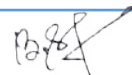
On completion of the course, the students will be able to

CO1:	To understand the evolution of wireless networks.
CO2:	To learn the concepts of 5G networks.
CO3:	To comprehend the 5G architecture and protocols
CO4:	To understand the dynamic spectrum management
CO5:	To learn the security aspects in 5G networks.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	-	-	-	-	3	3	3	2
CO2	3	3	3	2	2	2	-	-	-	-	3	3	2	2
CO3	3	3	3	3	1	2	-	-	-	-	3	2	3	2
CO4	2	3	3	2	2	1	-	-	-	-	2	2	1	2
CO5	3	3	3	2	2	1	-	-	-	-	2	2	2	2
Avg.	3	3	3	2	2	2	-	-	-	-	2	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2404	WIRELESS COMMUNICATION	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Know the characteristic of wireless channel • Learn the various cellular architectures • Understand the concepts behind various digital signaling schemes for fading channels • Be familiar the various multipath mitigation techniques • Understand the various multiple antenna systems					

Unit-I	WIRELESS CHANNELS	(9)
Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters Coherence bandwidth – Doppler spread & Coherence time, Fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading		
Unit-II	CELLULAR ARCHITECTURE	(9)
Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept Frequency reuse - channel assignment- hand off- interference & system capacity- trunking & grade of service – Coverage and capacity improvement		
Unit-III	DIGITAL SIGNALING FOR FADING CHANNELS	(9)
Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR		
Unit-IV	MULTIPATH MITIGATION TECHNIQUES	(9)
Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver		
Unit-V	MULTIPLE ANTENNA TECHNIQUES	(9)
MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	Rappaport,T.S., —Wireless communications , Pearson Education, Second Edition, 2010.(UNIT I, II, IV)

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2	Andreas.F. Molisch, —Wireless Communications , John Wiley – India, 2006. (UNIT III,V)
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REFERENCES:

1	Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2	Van Nee, R. and Ramji Prasad, —OFDM for wireless multimedia communications, Artech House, 2000
3	David Tse and Pramod Viswanath, —Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4	AUpena Dalal, —Wireless Communication , Oxford University Press, 2009.

COURSE OUTCOMES:

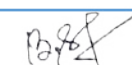
On completion of the course, the students will be able to

CO1:	Gain information on the various types of wireless channels and its parameters associated with it.
CO2:	Design cellular networks.
CO3:	Analyze probability of error of different digital modulation schemes.
CO4:	Understand receiver processing schemes for wireless communication systems for improved transceiver
CO5:	Update latest topics in wireless communication systems and its capacity analysis

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	1	-	-	-	-	-	3	1	1
CO2	3	3	2	1	3	2	-	-	-	-	1	3	1	2
CO3	3	3	3	3	2	2	-	-	-	-	1	3	1	2
CO4	2	3	2	2	2	2	-	-	-	-	1	2	1	1
CO5	2	-	3	3	2	1	-	-	-	-	1	2	2	2
Avg.	3	3	2	2	2	2	-	-	-	-	1	3	1	2

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy


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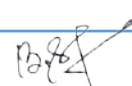
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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2405	EMBEDDED AND REAL TIME SYSTEMS	L 3	T 0	P 0	C 3	100
Course Objectives	- Study the basic of Real time systems - Learn the various uni processor and Multiprocessor scheduling mechanisms - Familiarize the real time memory and design considerations - Introduce the fault tolerant architectures - Understand the Integration of Hardware and software in real time applications					

Unit-I	INTRODUCTION	(9)
Introduction to real time computing - Concepts-Example of real-time applications -- Structure of a real time system - Characterization of real time systems and tasks - Performance metrics • Prediction of Execution Time-Source code analysis, Micro-architecture level analysis, Cache and pipeline issues- Programming Languages for Real-Time Systems		
Unit-II	DESIGN TECHNIQUES	(9)
Real time Kernels- Process Scheduling- Round Robin Scheduling-Cyclic Executives-Fixed Priority Scheduling-Rate Monotonic Approach- Dynamic Priority Scheduling-Earliest Deadline First Approach- Inter task Communication and Synchronization		
Unit-III	MEMORY MANAGEMENT	(9)
Process Stack Management - Runtime Ring Buffer - Maximum Stack Size - Multiple Stack Arrangements- Memory Management in the Task-Control - Block Model - Swapping- Overlays- Block or Page Management- Replacement Algorithms- Memory Locking- Working Sets- Real-Time Garbage Collection- Contiguous File Systems- Building versus Buying Real-Time Operating Systems- Selecting Real Time Kernels		
Unit-IV	FAULT TOLERANT ARCHITECTURES	(9)
Faults- The Role of Testing- Testing Techniques- System-Level Testing- Design of Testing Plans- Fault-Tolerance		
Unit-V	SYSTEM INTEGRATION	(9)
Goals of System Integration- System Unification- System Verification- System Integration Tools- A Simple Integration Strategy- Patching- The Probe Effect- Case Study : Fault Tolerant Design		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Laplante Philip. A, "Real-time systems design and analysis: An engineer's handbook", PHI Publication, Second Edition, 1994.
2	C.M. Krishna, Kang G. Shin, "Real Time Systems", International Edition, McGraw Hill Companies, Inc, New York, Third Edition, 2010.

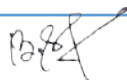
REFERENCES:

1	Jane W.S. Liu, "Real-Time Systems", Pearson Education India, First Edition, 2000.
2	Raymond J.A. Buhr, Donald L. Bailey, "An Introduction to Real Time Systems from Design to Networking with C/C++", Prentice Hall, First Edition, 1999.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Describe issues related to the design and analysis of system time constraints.
CO2:	Illustrate about various Scheduling Techniques
CO3:	Explain the various types of memory concepts Real time management
CO4:	Determine the concepts of testing and fault tolerance
CO5:	Discover the real time systems by Integration


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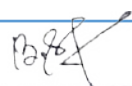
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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	1	-	3	3	1	-	-	-	1	-	3
CO2	-	-	-	1	-	3	3	2	-	-	-	1	-	3
CO3	-	-	-	1	-	3	2	2	-	-	-	1	-	3
CO4	-	-	-	1	-	3	3	1	-	-	-	1	-	3
CO5	-	-	-	1	-	3	3	1	-	-	-	1	-	3
Avg.	-	-	-	1	-	3	3	1	-	-	-	1	-	3

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy


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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week				Credit	Maximum Marks
UECOE2406	ROBOTICS AND ITS INDUSTRIAL APPLICATIONS	L	T	P	C		100
		3	0	0	3		
Course Objectives	- Explain 3D translation and orientation representation & illustrate the robot arm kinematics and use of robot operating system usage. - Classify the robot which meets kinematic requirements. - Apply localization and mapping aspects of mobile robotics. - Illustrate ROS applications. - Test robot programming.						

Unit-I	INTRODUCTION & MATERIAL HANDLING	(9)
Automation In Production System - Manual Labor in production systems -Principles and Strategies of Automation - Basic Elements of An Automated System - Levels of Automation - production concepts and mathematical models - Material Handling: Introduction to Material Handling- Material Handling Equipment's - Principles and Design Consideration in material handling Material Transport Equipment - Automated Storage systems		
Unit-II	FLUID POWER AND PNEUMATIC SYSTEMS	(9)
Introduction to Fluid power - Pascal's Law, Hydraulic Circuit Design and Analysis- Introduction - Control of A Single - Acting Hydraulic Cylinder Circuit - Control of a Double Acting Hydraulic Cylinder Circuit - Regenerative Cylinder Circuit. Basic Pneumatic systems: Types of Cylinders - Single acting Cylinder - Double acting Cylinder - Direction Control Valves- Valve position - Shuttle Valve		
Unit-III	MANUFACTURING SYSTEMS	(9)
Introduction to Manufacturing systems - Components of Manufacturing systems - Classification scheme for Manufacturing systems - Simple problems using Mathematic models of production performance - single station manufacturing cells - fundamentals of manual assembly lines		
Unit-IV	AUTOMATED PRODUCTION LINES AND ASSEMBLY SYSTEMS	(9)
Fundamentals of Automated Production Lines - Applications Of Automated production lines - System configurations - Work Part Transfer Mechanisms - Storage Buffers - Power Transmission Systems - Gears - Power Screws (Linear Guide ways)		
Unit-V	CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEMS	(9)
Introduction - Part Families - Manufacturing Cells - Cellular Manufacturing - Part classification and coding - Production Flow Analysis - Group Technology and its applications. Introduction to FMS - FMS Industrial Applications and its benefits - FMS components		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	Automation, Production Systems and Computer Integrated Manufacturing- M. P. Groover, Pearson Education. Third edition/Fifth edition, 2009*.
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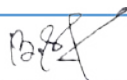
REFERENCES:

1	Fluid Power with Applications-Anthony Esposito, Peason, Sixth Addition.Edition
2	Pneumatic Systems, Principles and Maintenance- SR Majumdar, 2011 Edition.
3	Industrial Robotics, Technology, Programming, and applications- MikellP.Groover
4	Computer Based Industrial Control- Krishna Kant, EEE-PHI,2nd edition,2010
5	Engineering Metrology and Measurements -- N.V. Raghavendra, L.Krishnamurthy, 2018

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Select & identify suitable automation hardware for the given understand application.
CO2:	Describe & explain potential areas of automation, material handling, Understand and Fluid power systems.
CO3:	Estimate of Manufacturing systems & Mathematical models of apply production lines
CO4:	Identify Industrial Automated production lines, work part transfer analyze mechanism and buffer storage analysis. Analyze Cellular Manufacturing, Flexible manufacturing Systems.
CO5:	planning implementation issues and implementation of quality Analyze programs in production systems.


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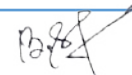
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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3	2	3	-	-	-	-	-	-	3	1	-
CO2	3	3	3	1	3	-	-	-	-	-	-	3	3	-
CO3	3	3	1	3	3	-	-	-	-	-	-	3	1	-
CO4	3	3	1	3	3	-	-	-	-	-	-	3	1	-
CO5	3	1	3	1	3	-	-	-	-	-	-	3	1	-
Avg.	3	1	3	2	3	-	-	-	-	-	-	3	1	-

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy


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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2407	INDUSTRIAL IOT	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To understand the fundamentals of Internet of Things. • To learn about the basics of IOT protocols. • To build a small low cost embedded system using IoT. • To apply the concept of IOT in the real world scenario.					

Unit-I	INTRODUCTION AND ARCHITECTURE OF IoT	(9)
Introduction – Definition and characteristics of IoT – Physical and Logical Design of IoT - Communication models and APIs – Challenges in IoT - Evolution of IoT- Components of IoT - A Simplified IoT Architecture – Core IoT Functional Stack.		
Unit-II	INDUSTRIAL IoT	(9)
IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking		
Unit-III	IIOT ANALYTICS	(9)
Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop		
Unit-IV	IOT SECURITY	(9)
Industrial IoT: Security and Fog Computing - Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT		
Unit-V	CASE STUDY	(9)
Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	Industry 4.0: The Industrial Internet of Things”, by Alasdair Gilchrist (Apress), 2017

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REFERENCES:

1	Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Cap
2	"Industrial Internet of Things: Cyber manufacturing Systems" by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer), 2017

COURSE OUTCOMES:

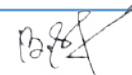
On completion of the course, the students will be able to

CO1:	Understand the basic concepts and Architectures of Internet of Things.
CO2:	Understand various IoT Layers and their relative importance.
CO3:	Realize the importance of Data Analytics in IoT.
CO4:	Study various IoT platforms and Security
CO5:	Understand the concepts of Design Thinking.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	2	-	-	-	-	2	3	2	2
CO2	3	2	2	2	1	2	-	-	-	-	2	3	3	2
CO3	3	2	2	2	2	2	-	-	-	-	2	3	3	2
CO4	3	2	3	2	3	2	-	-	-	-	2	3	3	2
CO5	3	3	3	3	3	3	-	-	-	-	1	3	2	3
Avg.	3	2.3	2.4	2.3	2	2.3	-	-	-	-	1.8	3	2.6	2.3

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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2408	SENSORS AND TRANSDUCERS	L 3	T 0	P 0	C 3	100
Course Objectives	The objective of this course is to make the students to list common types of sensor and actuators used in automotive vehicles.					

Unit-I	INTRODUCTION	(9)
Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types		
Unit-II	MOTION, PROXIMITY AND RANGING SENSORS	(9)
Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR)		
Unit-III	FORCE, MAGNETIC AND HEADING SENSORS	(9)
Strain Gauge, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclometers		
Unit-IV	OPTICAL, PRESSURE AND TEMPERATURE SENSORS	(9)
Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure –Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors		
Unit-V	SIGNAL CONDITIONING AND DAQ SYSTEMS	(9)
Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multichannel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	Ernest O Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw-Hill, 2009.

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2	Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi, 2013.
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REFERENCES:

1	Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2010.
2	John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	List common types of sensor and actuators used in vehicles.
CO2:	Design measuring equipment's for the measurement of pressure force, temperature and flow
CO3:	Generate new ideas in designing the sensors and actuators for automotive application
CO4:	Understand the operation of the sensors, actuators and electronic control
CO5:	Design temperature control actuators for vehicles

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	2	-	-	-	-	2	3	3	2
CO2	3	2	2	2	1	2	-	-	-	-	2	3	3	2
CO3	3	2	2	2	2	2	-	-	-	-	2	3	3	2
CO4	3	2	2	2	3	2	-	-	-	-	2	3	3	2
CO5	3	2	3	3	3	3	-	-	-	-	2	3	2	3
Avg.	3	2	2.3	2.3	2	2.3	-	-	-	-	2	3	2.8	2.3

1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy

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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2409	SPACE SCIENCE	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To outline the space environment and their effects. • To extend the origin of universe and development. • To classify the galaxies and their evolution. • To interpret the variable stars in the galaxies. • To explain theory of formation of our solar system.					

Unit-I	INTRODUCTION	(9)
Introduction to space science and applications – historical development – Space Environment-Vacuum and its Effects, Plasma & Radiation Environments and their Effects, Debris Environment and its Effects - Newton's Law of gravitation – Fundamental Physical Principles		
Unit-II	ORIGIN OF UNIVERSE	(9)
Early history of the universe – Big-Bang and Hubble expansion model of the universe – cosmic microwave background radiation – dark matter and dark energy		
Unit-III	GALAXIES	(9)
Galaxies, their evolution and origin – active galaxies and quasars – Galactic rotation – Stellar populations – galactic magnetic field and cosmic rays		
Unit-IV	STARS	(9)
Stellar spectra and structure – stellar evolution – Nucleo-synthesis and formation of elements – Classification of stars – Harvard classification system – Hertsprung-Russel diagram – Luminosity of star – variable stars – composite stars (white dwarfs, Neutron stars, black hole, star clusters, supernova and binary stars) – Chandrasekhar limit		
Unit-V	SOLAR SYSTEM	(9)
Nebular theory of formation of our Solar System – Solar wind and nuclear reaction as the source of energy – Sun and Planets: Brief description about shape size – period of rotation about axis and period of revolution – distance of planets from sun – Bode's law – Kepler's Laws of planetary motion – Newton's deductions from Kepler's Laws – correction of Kepler's third law – determination of mass of earth – determination of mass of planets with respect to earth – Brief description of Asteroids – Satellites and Comets		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Hess W., "Introduction to Space Science", Gordon & Breach Science Pub; Revised Ed., 1968
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2	Krishnaswami K. S., “Astrophysics: A modern Perspective”, New Age International, 2006.
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REFERENCES:

1	Arnab Rai Choudhuri, “Astrophysics for Physicists”, Cambridge University Press, New York, 2010.
2	Krishnaswami K. S., “Understanding cosmic Panorama”, New Age International, 2008.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1:	Obtain a broad, basic knowledge of the space sciences.
CO2:	Explain the scientific concepts such as evolution by means of natural selection, age of the Earth and solar system and the Big-Bang.
CO3:	Describe the main features and formation theories of the various types of observed galaxies, in particular the Milky Way.
CO4:	Explain stellar evolution, including red giants, supernovas, neutron stars, pulsars, white dwarfs and black holes, using evidence and presently accepted theories;
CO5:	Describe the presently accepted formation theories of the solar system based upon observational and physical constraints.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	1	-	1	-	1	3	3	3
CO2	3	2	2	3	2	3	-	-	-	-	1	3	3	3
CO3	3	3	3	2	1	3	-	-	-	-	1	3	3	3
CO4	3	3	2	3	2	3	-	-	-	-	1	3	3	3
CO5	3	2	3	2	2	1	-	-	-	-	1	3	3	3
Avg.	3	2.3	2.3	2.3	2	2.3	1	-	1	-	1	3	3	3

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