



THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

Mecheri, Salem – 636 453.



Approved by AICTE, New Delhi
Affiliated to Anna University

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING



AUTONOMOUS
CURRICULUM AND

UG
REGULATIONS
2024

Academic Year 2024-25 onwards

SYLLABUS
I-VIII
SEMESTERS



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. ELECTRONICS AND COMMUNICATION 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 be a centre of excellence in education, training and research in Electronics and Communication Engineering to cultivate technically competent professionals for Industry and Society.

MISSION

- To impart knowledge and skills to face challenges in Electronics and Communication Engineering.
- To provide ethical value based education to address the social needs.
- To provide innovative environment to learning global atonements.

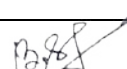
PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- ❖ To provide the students with a strong foundation in the required sciences in order to pursue studies in Electronics and Communication Engineering.
- ❖ To gain adequate knowledge to become good professional in electronic and communication engineering associated industries, higher education and research.
- ❖ To develop attitude in lifelong learning, applying and adapting new ideas and technologies as their field evolves.
- ❖ To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.
- ❖ To inculcate in the students a professional and ethical attitude and an ability to visualize the engineering issues in a broader social context.

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 math, science, and engineering fundamentals to complex problems
2.	Problem analysis	Identify and analyze complex problems using research and sustainability principles
3.	Design/development of solutions	Design systems and processes considering health, safety, cost, culture, and environment.


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4.	Conduct Investigations of Complex Problems	Use experiments, modelling, and data analysis to reach valid conclusions.
5.	Modern Tool Usage	Apply modern tools for modelling and problem-solving, recognizing their limits
6.	Society & Environment	Assess societal, legal, and environmental impacts of engineering solutions.
7.	Ethics	Commit to ethics, human values, diversity, and legal compliance.
8.	Individual and team work	Work effectively as an individual and in multidisciplinary teams
9.	Communication	Communicate clearly in reports, presentations, and documentation across diverse groups.
10.	Project management and finance	Apply management and economic principles in projects and teamwork.
11.	Life-long learning	Engage in continuous learning, adapt to new technologies, and think critically

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

- ❖ Design, develop and analyze electronic systems through application of relevant electronics, mathematics and engineering principles.
- ❖ Design, develop and analyze communication systems through application of fundamentals from communication principles, signal processing, and RF System Design & Electromagnetics.
- ❖ Adapt to emerging Electronics and Communication Technologies and develop innovative solutions for existing and newer problems.


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REGULATIONS - 2024

CHOICE BASED CREDIT SYSTEM

B.E- DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM & SYLLABI FOR I TO VIII SEMESTERS

SEMESTER – I									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory Course(s)									
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 / தமிழர் மரபு	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	HSMC
Total Credits to be earned					22				
\$ Skill Based Course									
SEMESTER – II									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory Course(s)									
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
UPHT24204	Physics for Electronics Engineering	3	0	0	3	40	60	100	BSC
UBET24204	Electrical and Instrumentation Engineering	3	0	0	3	40	60	100	ESC
UGET24201	Engineering Graphics	2	0	4	4	50	50	100	ESC
UECT24201	Circuit Analysis	3	1	0	4	40	60	100	PCC
UTAT24201	Tamils and Technology/ தமிழரும் தொழில்நுட்பமும்	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
UECL24201	Circuits Analysis Laboratory	0	0	2	1	60	40	100	PCC
UGEL24202	Communication Laboratory /Foreign Language ^{\$}	0	0	4	2	60	40	100	EEC
Total Credits to be earned					26				

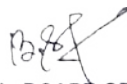
SEMESTER – III									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory Course(s)									
UMAT24305	Random Processes and Linear Algebra	3	1	0	4	40	60	100	BSC
UCST24304	C Programming and Data Structures	3	0	0	3	40	60	100	ESC
UECT24301	Signals and Systems	3	1	0	4	40	60	100	PCC
UECT24302	Electronic Devices and Circuits	3	0	0	3	40	60	100	PCC
UECT24303	Control Systems	3	0	0	3	40	60	100	PCC
Theory with Practical Course(s)									
UECTL24301	Digital Systems Design	3	0	2	4	50	50	100	PCC
Practical / Employability Enhancement									
UECL24301	Electronic Devices and Circuits Laboratory	0	0	3	1.5	60	40	100	PCC
UCSL24304	C Programming and Data Structures Laboratory	0	0	3	1.5	60	40	100	ESC
Mandatory Courses									
USD24301	Soft Skill 1	2	0	0	0	100	-	100	MC
Total Credits to be earned					24				

SEMESTER – IV									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory Course(s)									
UECT24401	Electromagnetic Fields	3	0	0	3	40	60	100	PCC
UECT24402	Linear integrated Circuits	3	0	0	3	40	60	100	PCC
UECT24403	Image processing	3	0	0	3	40	60	100	PCC
UESST24401	Environmental Sciences and Sustainability	2	0	0	2	40	60	100	BSC
Theory with Practical Course(s)									
UECTL24401	Networks and Security	3	0	2	4	50	50	100	PCC
UECTL24402	Digital Signal Processing	3	0	2	4	50	50	100	PCC
Practical / Employability Enhancement									
UECL24401	Linear Integrated Circuits Laboratory	0	0	2	1	60	40	100	PCC
UECL24402	Image processing Laboratory	0	0	2	1	60	40	100	PCC
Mandatory Courses									
USD24401	Soft Skill 2	2	0	0	-	100	-	100	MC
Total Credits to be earned					21				

SEMESTER – V									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory Course(s)									
UECT24501	VLSI and Chip Design	3	0	0	3	40	60	100	PCC
UECT24502	Transmission lines and RF Systems	3	0	0	3	40	60	100	PCC
	Open Elective–I*	3	0	0	3	40	60	100	OEC
Theory with Practical Course(s)									
UCSTL24503	Java Programming	3	0	2	4	50	50	100	ESC
UECTL24501	Analog & Digital Communication	3	0	2	4	50	50	100	PCC
Practical / Employability Enhancement									
UECL24501	VLSI Laboratory	0	0	2	1	60	40	100	PCC
UIDL24001	Idea lab	0	0	2	1	100	-	100	EEC
USI24501	Summer Internship - I *	0	0	0	1	-	-	100	EEC
Mandatory Courses									
USD24501	Soft Skill 3	2	0	0	-	100	-	-	MC
	Mandatory Course I	2	0	0	0	40	60	100	MC
Total Credits to be earned					20				

* 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.

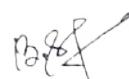
SEMESTER – VI									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory Course(s)									
UECT24601	Microwave and Optical Communication	3	0	0	3	40	60	100	PCC
	Professional Elective – I	3	0	0	3	40	60	100	PEC
	Open Elective–II*	3	0	0	3	40	60	100	OEC
Theory with Practical Course(s)									
UECTL24601	Embedded Systems and IOT Design	3	0	2	4	50	50	100	PCC
UCSTL24401	Artificial Intelligence and Machine Learning	3	0	2	4	50	50	100	ESC
Practical / Employability Enhancement									
UECL24601	Microwave and Optical Communication Laboratory	0	0	2	1	60	40	100	PCC
UECL24602	Mini Project with Technical Seminar	0	0	4	2	60	40	100	EEC
Mandatory Courses									
USD24601	Soft Skill 4	2	0	0	-	100	-	100	MC
	Mandatory Course II	2	0	0	-	-	-	-	MC
Total Credits to be earned					20				


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SEMESTER – VII										
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category	
		L	T	P		CA	ESE	Total		
Theory Course(s)										
UGET24707	Human Values and Ethics	2	0	0	2	40	60	100	HSMC	
	Professional Elective – II	3	0	0	3	40	60	100	PEC	
	Professional Elective – III	3	0	0	3	40	60	100	PEC	
	Professional Elective -IV	-	-	-	3	-	-	100	PEC	
Theory with Practical Course(s)										
UECTL24701	Wireless and Mobile Communication	3	0	2	4	50	50	100	PCC	
Practical / Employability Enhancement										
USI24701	Summer Internship - II [#]	0	0	0	1	0	0	100	EEC	
Total Credits to be earned					16					

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 -V	-	-	-	3	-	-	100	PEC	
	Open Elective–III*	3	0	0	3	40	60	100	OEC	
Practical / Employability Enhancement										
UECL24801	Project Work / Internship	0	0	20	10	60	40	100	EEC	
Total Credits to be earned					16					


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MANDATORY COURSES

S.No	Course Code	Course Title	Hours / Week			Total Contact periods	Credits
			L	T	P		
1	UMC24001	Disaster Risk Reduction and Management	2	0	0	2	0
2	UMC24002	Elements of Literature	2	0	0	2	0
3	UMC24003	Film Appreciation	2	0	0	2	0
4	UMC24004	Introduction to Gender Studies	2	0	0	2	0
5	UMC24005	Industrial Safety	2	0	0	2	0
6	UMC24006	Interpersonal Skills	2	0	0	2	0
7	UMC24007	Personality and Character Development	2	0	0	2	0
8	UMC24008	Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	2	0	0	2	0

PROFESSIONAL ELECTIVES (PEC)

Course Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
STREAM-I NETWORKS AND COMMUNICATION									
UECPE2401	Next Generation Networks	PEC	3	0	0	3	40	60	100
UECPE2402	High speed Networks	PEC	3	0	0	3	40	60	100
UECPE2403	Fundamentals of MEMS	PEC	2	0	2	3	50	50	100
UECPE2404	Wireless Broad Band Networks	PEC	3	0	0	3	40	60	100
UECPE2405	Software Defined Radio	PEC	2	0	2	3	50	50	100
UECPE2406	Massive MIMO Networks	PEC	2	0	2	3	50	50	100
UECPE2407	Satellite Communication	PEC	3	0	0	3	40	60	100
UECPE2408	Optical Communication & Networks	PEC	3	0	0	3	40	60	100
UECPE2409	Positioning and Navigation Systems	PEC	3	0	0	3	40	60	100
UECPE2410	Advanced Wireless Communication Techniques	PEC	3	0	0	3	40	60	100
STREAM-II SIGNAL PROCESSING									
UECPE2411	Advanced Digital Signal Processing	PEC	2	0	2	3	50	50	100
UECPE2412	Speech Processing	PEC	2	0	2	3	50	50	100
UECPE2413	Deep learning Architectures	PEC	3	0	0	3	40	60	100
UECPE2414	Pattern Recognition	PEC	3	0	0	3	40	60	100

UECPE2415	Multimedia Compression Techniques	PEC	3	0	0	3	40	60	100
UECPE2416	Digital Video Processing	PEC	3	0	0	3	40	60	100
UECPE2417	DSP Architecture and Programming	PEC	2	0	2	3	50	50	100
STREAM-III VLSI DESIGN									
UECPE2418	ASIC Design	PEC	3	0	0	3	40	60	100
UECPE2419	Low Power IC Design	PEC	2	0	2	3	50	50	100
UECPE2420	VLSI Testing and Verification	PEC	3	0	0	3	40	60	100
UECPE2421	System-on-Chip	PEC	3	0	0	3	40	60	100
UECPE2422	Computer Aided Design for VLSI	PEC	3	0	0	3	40	60	100
UECPE2423	Digital System Design using FPGAs	PEC	3	0	0	3	40	60	100
UECPE2424	VLSI Signal processing	PEC	3	0	0	3	40	60	100
UECPE2425	Mixed Signal IC Design Testing	PEC	2	0	2	3	50	50	100
UECPE2426	Analog IC Design	PEC	2	0	2	3	50	50	100
STREAM- IV EMBEDDED SYSTEMS & IoT									
UECPE2427	Embedded Sensing Technologies	PEC	3	0	0	3	40	60	100
UECPE2428	IoT for Industrial Applications	PEC	3	0	0	3	40	60	100
UECPE2429	Robotics and Automation	PEC	3	0	0	3	40	60	100
UECPE2430	IoT Based Systems Design	PEC	3	0	0	3	40	60	100
UECPE2431	ARM Based Embedded System	PEC	3	0	0	3	40	60	100
UECPE2432	Industry 5.0	PEC	3	0	0	3	40	60	100
UECPE2433	Real Time operating System	PEC	3	0	0	3	40	60	100
UECPE2434	IoT Sensor Technologies	PEC	3	0	0	3	40	60	100
UECPE2435	Wireless Sensor Networks and IoT	PEC	3	0	0	3	40	60	100
UECPE2436	Design of Embedded Systems	PEC	3	0	0	3	40	60	100

OPEN ELECTIVES (OEC)

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories).

**List of Open Elective courses offered by Other Engineering Branches for ECE 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	Nanomaterials 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
Electrical and Electronics Engineering									
UEEOE2401	Electrical safety	3	0	0	3	40	60	100	OEC
UEEOE2402	Introduction to Electrical Machines	3	0	0	3	40	60	100	OEC
UEEOE2403	Electric Energy Generation, Utilization and Conservation.	3	0	0	3	40	60	100	OEC
UEEOE2404	Power Electronics and Drives	3	0	0	3	40	60	100	OEC
UEEOE2405	Electrical Estimation and Costing	3	0	0	3	40	60	100	OEC
UEEOE2406	Basics of Electrical Measurements and Instrumentation	3	0	0	3	40	60	100	OEC
UEEOE2407	Introduction to Control Engineering	3	0	0	3	40	60	100	OEC
UEEOE2408	Fundamentals of Electrical Drives and Control	3	0	0	3	40	60	100	OEC
UEEOE2409	Energy Conservation and Management	3	0	0	3	40	60	100	OEC
UEEOE2410	Automotive Electrical and Electronics Engineering	3	0	0	3	40	60	100	OEC
UEEOE2411	Introduction to Embedded Systems	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


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OPEN ELECTIVE COURSES (For Other Branches)										
S. NO.	Course Code	Course	Category	Periods/Week			C	Maximum Marks		
				L	T	P		CA	FE	Total
Theory Course(s)										
1.	UECOE2401	Industrial Electronics	OEC	3	0	0	3	40	60	100
2.	UECOE2402	Image Processing and Computer Vision	OEC	3	0	0	3	40	60	100
3.	UECOE2403	4G/5G Communication Networks	OEC	3	0	0	3	40	60	100
4.	UECOE2404	Wireless Communication	OEC	3	0	0	3	40	60	100
5.	UECOE2405	Embedded and Real Time Systems	OEC	3	0	0	3	40	60	100
6.	UECOE2406	Robotics and its Industrial Application	OEC	3	0	0	3	40	60	100
7.	UECOE2407	Industrial IoT	OEC	3	0	0	3	40	60	100
8.	UECOE2408	Sensors and Transducers	OEC	3	0	0	3	40	60	100
9.	UECOE2409	Space Science	OEC	3	0	0	3	40	60	100


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CREDITS SUMMARY

S.NO	CATEGORY	CREDITS SUMMARY								TOTAL CREDITS	CREDITS in %
		I	II	III	IV	V	VI	VII	VIII		
1.	HSMC	5	5					2		12	7.27%
2.	BSC	12	7	4	2					25	15.15%
3.	ESC	5	9	4.5		4	4			26.5	16.06%
4.	PCC		5	15.5	19	11	8	4		62.5	37.88%
5.	PEC						3	9	3	15	9.09%
6.	OEC					3	3		3	9	5.45%
7.	EEC				√	2	2	1	10	15	9.09%
8.	MC					√	√				0%
TOTAL		22	26	24	21	20	20	16	16	165	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


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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						

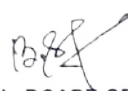
VERTICAL 4: BUSINESS DATA ANALYTICS

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, CO₂ 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
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 - சிறிலக்கியங்கள் -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 கல்வியியல்பணிகள்கழகம்).
2	கணினித்தமிழ் – முனைவர் இல, சுந்தரம். (விகடன்பிரசுரம்).
3	கீழடி –வைகை நதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4	பொருநை -ஆற்றங்கரைநாகரிகம், (தொல்லியல்துறைவெளியீடு)
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& 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) (Publishedby: 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: DepartmentofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)


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Mecheri, Salem Dt-636453, Tamilnadu



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 ₂ CO 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 (TiO ₂ /ZnO/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	-	-

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


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Department	ECE	Programme Code & Name	106 - ECE
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECL24201	CIRCUIT ANALYSIS LABORATORY	L	T	P	C	100
		0	0	2	1	
Course Objectives	- To gain hands- on experience in Thevenin & Norton theorem, KVL& KCL, and Superposition Theorems. - To understand the working of RL, RC and RLC circuits.					

List of Exercises/Experiments

1. Verifications of KVL&KCL.

2. Verifications of Thevenin & Norton theorem.

3 .Verification of Superposition Theorem.

4. Verification of maximum power transfer Theorem.

5. Determination of Resonance Frequency of Series & Parallel RLC Circuits.

6. Transient analysis of RL and RC circuits.

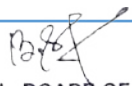
Total No of Periods to be Taught

30 Periods

COURSE OUTCOMES:

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

CO1:	Apply Voltage and current laws in circuits
CO2:	Understand the various theorems and its uses.
CO3:	Analyze the frequency response of circuits.
CO4:	Analyze the transient property of circuits.


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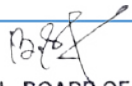
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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Resistors, Capacitors, Inductors – sufficient quantities. Bread Boards	15
2.	CRO (30MHz)	10
3.	Function Generators (3MHz)	10
4.	Dual Regulated Power Supplies (0 – 30V)	10
5.	Decade Resistance Box	10
6.	Voltmeter(0-30v	15
7.	Ammeter(0-30mA	15

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	1	-	-	-	-	1	2	1	2
CO2	2	2	3	3	2	1	-	-	-	-	1	2	1	2
CO3	2		2		1	1	-	-	-	-	1	2	1	2
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	2	2	3	3	2	1	-	-	-	-	1	2	1	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														


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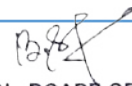


Department	ECE	Programme Code & Name	106 - ECE
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECT24201	CIRCUITANALYSIS	L	T	P	C	100
		3	1	0	4	
Course Objectives	• To learn the basic concepts and behaviour of DC and AC circuits. • To understand various methods of circuit/network analysis using network theorems. • To understand the transient and steady state response of the circuits subjected to DC excitations and AC with sinusoidal excitations. • To learn the concept of coupling in circuits and topologies					

Unit-I	DC CIRCUIT ANALYSIS	(12)
Basic Components of electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohms Law, Kirchoff's Current Law, Kirchoff's voltage law, The single Node – Pair Circuit, series and Parallel Connected Independent Sources, Resistors in Series and Parallel, voltage and current division, Nodal analysis, Mesh analysis.		
Unit-II	NETWORK THEOREM AND DUALITY	(12)
Useful Circuit Analysis techniques - Linearity and superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion, Duals, Dual circuits. Analysis using dependent current sources and voltage sources		
Unit-III	SINUSOIDAL STEADY STATE ANALYSIS	(12)
Sinusoidal Steady – State analysis, Characteristics of Sinusoids, The Complex Forcing Function, The Phasor, Phasor relationship for R, L, and C, impedance and Admittance, Nodal and Mesh Analysis, Phasor Diagrams, AC Circuit Power Analysis, Instantaneous Power, Average Power, apparent Power and Power Factor, Complex Power.		
Unit-IV	TRANSIENTS AND RESONANCE IN RLC CIRCUITS	(12)
Basic RL and RC Circuits, The Source- Free RL Circuit, The Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits, RLC Circuits, Frequency Response, Parallel Resonance, Series Resonance, Quality Factor.		
Unit-V	COUPLED CIRCUITS AND TOPOLOGY	(12)
Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the Ideal Transformer, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis SUGGESTED ACTIVITIES: Practice solving variety of problems		
Total No of Periods to be Taught		60 Periods


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TEXT BOOK:

1	HaytJackKemmerly,StevenDurbin,"EngineeringCircuitAnalysis",McGrawHilleducation,9th Edition,2018
2	CharlesK.Alexander&MathewN.O.Sadiku,"Fundamentals of Electric Circuits",Mc Graw Hill,2nd Edition,2003.
3	Joseph Edminister and Mahmood Nahvi, —Electric Circuits, Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCES:

1	Robert.L.Boylestead, "Introductory Circuit Analysis", Pearson Education India, 12th Edition, 2014. David Bell, "Fundamentals of Electric Circuits", Oxford University press, 7th Edition, 2009.
2	John O Mallay, Schaum's Outlines "Basic Circuit Analysis", The Mc Graw Hill companies, 2nd Edition, 2011
3	Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning, Fifth Edition, 1st Indian Reprint 2013

COURSE OUTCOMES:

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

CO1:	Apply the basic concepts of circuit analysis such as Kirchoff's laws, mesh current and node voltage method for analysis of DC and AC circuits.
CO2:	Apply suitable network theorems and analyze AC and DC circuits
CO3:	Analyze steady state response of any R,L and C circuits
CO4:	Analyze the transient response for any RC, RL and RLC circuits and frequency response of parallel and series resonance circuits.
CO5:	Analyze the coupled circuits and network topologies

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	-	1	-	-	-	-	-
CO2	3	3	2	2	-	-	1	-	1	-	-	-	-	-
CO3	3	3	3	3	-	-	1	-	1	-	-	-	-	-
CO4	3	3	3	3	-	-	1	-	1	-	-	-	-	-
CO5	3	3	3	2	-	-	1	-	1	-	-	-	-	-
Avg.	3	3	3	2	-	-	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 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	-	-	-

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	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	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	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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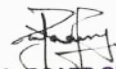


Department	S&H	Programme Code & Name	106 - ECE
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPHT24204	PHYSICS FOR ELECTRONICS ENGINEERING	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To make the students to understand the basics of crystallography and its importance in studying materials properties. • 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	CRYSTALLOGRAPHY	(9)
Crystal structures: Crystal lattice – basis - unit cell and lattice parameters – crystal systems and Bravais lattices – Structure and packing fractions of SC, BCC, FCC, diamond cubic, NaCl, ZnS structures – crystal planes, directions and Miller indices – distance between successive planes – linear and planar densities – crystalline and noncrystalline materials –Example use of Miller indices: wafer surface orientation – wafer flats and notches – pattern alignment - imperfections in 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.		


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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 nano materials – Tunneling – Single electron phenomena – Single electron Transistor. Conductivity of metallic nano wires – 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		45 Periods

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
4	Mark Fox, Optical Properties of Solids, Oxford Univ.Press, 2001.
5	N.Gershenfeld. The Physics of Information Technology. Cambridge University Press, 2011.

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Know basics of crystallography and its importance for varied materials properties
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


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CO5: Appreciate the importance of nanotechnology and nano devices.

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	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	-	-	-
CO4	3	-	1	-	3	2	-	-	-	-	-	1	-	-
CO5	3	-	2	1	-	2	-	-	-	-	-	1	-	-
Avg.	3	2	1.4	1.5	2.5	2	-	-	-	-	-	1	-	-

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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	-	-

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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).
2	கணித்தமிழ் – 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)

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Mecheri, Salem Dt-636453, Tamilnadu



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	ECE	Programme Code & Name	106 – B.E ECE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMAT24305	RANDOM PROCESSES AND LINEAR ALGEBRA	L	T	P	C	100
		3	1	0	4	
Course Objectives	- To introduce the basic notions of vector spaces which will then be used to solve related problems. - To understand the concepts of vector space, linear transformations, inner product spaces and orthogonalization. - To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering. - To provide necessary basics in probability that are relevant in applications such as random signals, linear systems in communication engineering. - To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.					

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	TWO - DIMENSIONAL RANDOM VARIABLES	(9+3)
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).		
Unit-III	RANDOM PROCESSES	(9+3)
Classification – Stationary process – Markov process - Poisson process - Discrete parameter Markov chain – Chapman Kolmogorov equations (Statement only) - Limiting distributions		
Unit-IV	VECTOR SPACES	(9+3)
Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.		
Unit-V	LINEAR TRANSFORMATION AND INNER PRODUCT SPACES	(9+3)
Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Inner product - Norms - Gram Schmidt orthogonalization process – Adjoint of linear operations - Least square approximation.		
Total No of Periods to be Taught		60 Periods


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TEXT BOOK:

1	Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student 4th Edition, 2014.
2	Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.
3	Friedberg. A.H., Insel. A.J. and Spence. L., "Linear Algebra", Prentice Hall of India, New Delhi, 4th Edition, 2004.

REFERENCES:

1	Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
2	Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
3	Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.

COURSE OUTCOMES:

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

CO1:	Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
CO2:	Demonstrate accurate and efficient use of advanced algebraic techniques.
CO3:	Apply the concept of random processes in engineering disciplines.
CO4:	Understand the fundamental concepts of probability with a thorough knowledge of standard distributions that can describe certain real-life phenomenon.
CO5:	Understand the basic concepts of one and two dimensional random variables and apply them to model engineering 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	0	0	0	0	0	3	0	0	2	-	-	-
CO2	3	3	0	0	0	0	0	3	0	0	2	-	-	-
CO3	3	3	0	0	0	0	0	3	0	0	2	-	-	-
CO4	3	3	0	0	0	0	0	3	0	0	2	-	-	-
CO5	3	3	0	0	0	0	0	3	0	0	2	-	-	-
Avg.	3	3	0	0	0	0	0	3	0	0	2	-	-	-

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



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Department	ECE	Programme Code & Name	106 - B.E ECE
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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:

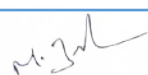
On completion of the course, the students will be able to

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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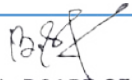


Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECT24301	SIGNALS AND SYSTEMS	L	T	P	C	100
		3	1	0	4	
Course Objectives	• To understand the basic properties of signal & systems. • To know the methods of characterization of LTI systems in time domain. • To analyze continuous time signals and system in the Fourier and Laplace domain. • To analyze discrete time signals and system in the Fourier and Z transform domain.					

Unit-I	CLASSIFICATION OF SIGNALS AND SYSTEMS	(9+3)
Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids- Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.		
Unit-II	ANALYSIS OF CONTINUOUS TIME SIGNALS	(9+3)
Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and Properties		
Unit-III	LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS	(9+3)
Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.		
Unit-IV	ANALYSIS OF DISCRETE TIME SIGNALS	(9+3)
Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT - Z Transform & Properties		
Unit-V	LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS	(9+3)
Impulse response–Difference equations-Convolution sum - Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.		
Total No of Periods to be Taught		60 Periods


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TEXT BOOK:

1	Oppenheim, Willsky and Hamid, "Signals and Systems", 2nd Edition, Pearson Education, New Delhi, 2015.(Units I - V)
2	Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2002

REFERENCES:

1	B. P. Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford, 2009.
2	M. J. Roberts, "Signals and Systems Analysis using Transform methods and MATLAB", McGraw- Hill Education, 2018.
3	John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.

COURSE OUTCOMES:

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

CO1:	Determine if a given system is linear/causal/stable.
CO2:	Determine the frequency components present in a deterministic signal.
CO3:	Characterize continuous LTI systems in the time domain and frequency domain.
CO4:	Characterize discrete LTI systems in the time domain and frequency domain.
CO5:	Compute the output of an LTI system in the time and frequency domains.

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	-	-	1
CO2	3	-	3	-	-	2	-	-	-	-	3	-	3	-
CO3	3	3	-	-	3	2	-	-	-	-	3	2	-	-
CO4	3	3	-	-	3	2	-	-	-	-	3	-	3	1
CO5	3	3	-	3	3	2	-	-	-	-	3	-	3	1
Avg.	3	3	3	3	3	2	-	-	-	-	3	2	3	1

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

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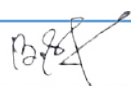


Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECT24302	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To give a comprehensive exposure to all types of devices and circuits constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits - To analyze the frequency response of small signal amplifiers - To design and analyze single stage and multistage amplifier circuits - To study about feedback amplifiers and oscillators principles - To understand the analysis and design of multi vibrators					

Unit-I	SEMICONDUCTOR DEVICES	(9)
PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator		
Unit-II	AMPLIFIERS	(9)
Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS, CG and Source follower		
Unit-III	MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER	(9)
Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – MOSFET input stages – tuned amplifiers – Gain and frequency response – Neutralization methods.		
Unit-IV	FEEDBACK AMPLIFIERS AND OSCILLATORS	(9)
Advantages of negative feedback – Voltage / Current, Series , Shunt feedback Amplifiers – positive feedback–Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts oscillators		
Unit-V	POWER AMPLIFIERS AND DC/DC CONVERTERS	(9)
Power amplifiers- class A-Class B-Class AB-Class C- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design.		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5 th Edition, 2010.
2	Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education / PHI, 2008.
3	Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", Oxford University Press, 7 th Edition, 2014.

REFERENCES:

1	Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3 rd Edition, 2010.
2	D.Schilling and C.Belove, "Electronic Circuits", McGraw Hill, 3 rd Edition, 1989.
3	Muhammad H.Rashid, "Power Electronics", Pearson Education / PHI , 2004.

COURSE OUTCOMES:

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

CO1:	Explain the structure and working operation of basic electronic devices.
CO2:	Design and analyze amplifiers.
CO3:	Analyze frequency response of BJT and MOSFET amplifiers
CO4:	Design and analyze feedback amplifiers and oscillator principles.
CO5:	Design and analyze power amplifiers and supply 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	3	2	1	-	-	-	-	1	2	1	1
CO2	3	2	2	3	2	2	-	-	-	-	1	2	1	1
CO3	3	3	3	2	1	2	-	-	-	-	1	2	1	1
CO4	3	3	2	3	2	2	-	-	-	-	1	2	1	1
CO5	3	2	3	2	2	1	-	-	-	-	1	2	1	1
Avg.	3	3	3	3	2	2	-	-	-	-	1	2	1	1

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

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECT24303	CONTROL SYSTEMS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To introduce the components and their representation of control systems • To learn various methods for analyzing the time response, frequency response and stability of the systems. • To learn the various approach for the state variable analysis.					

Unit-I	SYSTEMS COMPONENTS AND THEIR REPRESENTATION	(9)
Control System: Terminology and Basic Structure-Feed forward and Feedback control theory- Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems.		
Unit-II	TIME RESPONSE ANALYSIS	(9)
Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-Analytical design for PD, PI,PID control systems		
Unit-III	FREQUENCY RESPONSE AND SYSTEM ANALYSIS	(9)
Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation		
Unit-IV	CONCEPTS OF STABILITY ANALYSIS	(9)
Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.		
Unit-V	CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS	(9)
State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Digital control design using state feedback.		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
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REFERENCES:

1	J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.
2	K.Ogata, "Modern Control Engineering", PHI, 5th Edition, 2012.
3	S.K.Bhattacharya, "Control System Engineering", Pearson, 3rd Edition, 2013.
4.	Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7th Edition, 1995.

COURSE OUTCOMES:

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

CO1:	Compute the transfer function of different physical systems.
CO2:	Analyse the time domain specification and calculate the steady state error.
CO3:	Illustrate the frequency response characteristics of open loop and closed loop system response.
CO4:	Analyse the stability using Routh and root locus techniques.
CO5:	Illustrate the state space model of a physical system and discuss the concepts of sampled data control 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	3	3	2	2	2	-	-	-	2	3	3	3	3
CO2	3	3	3	3	2	3	-	-	-	2	2	3	3	3
CO3	3	2	3	3	2	2	-	-	-	2	3	3	2	3
CO4	3	3	3	2	2	2	-	-	-	2	2	3	3	3
CO5	2	2	3	3	2	3	-	-	-	2	3	2	2	3
Avg.	3	3	3	3	2	2	-	-	-	2	3	3	3	3

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Department	ECE	Programme Code & Name	106 - B.E ECE
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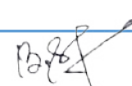
Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECTL24301	DIGITAL SYSTEMS DESIGN	L	T	P	C	100
		3	0	2	4	
Course Objectives	- To present the fundamentals of digital circuits and simplification methods - To practice the design of various combinational digital circuits using logic gates - To bring out the analysis and design procedures for synchronous and Asynchronous Sequential circuits - To learn integrated circuit families. - To introduce semiconductor memories and related technology					

Unit-I	BASIC CONCEPTS	(9)
Review of number systems-representation-conversions, Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms min term and max term, Simplification of Boolean expressions- Karnaugh map, Implementation of Boolean expressions using universal gates, Tabulation methods		
Unit-II	COMBINATIONAL LOGIC CIRCUITS	(9)
Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux.		
Unit-III	SYNCHRONOUS SEQUENTIAL CIRCUITS	(9)
Latches, Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment - Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.		
Unit-IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS	(9)
Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Fundamental and Pulse mode sequential circuits, Design of Hazard free circuits.		
Unit-V	LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES	(9)
Logic families- Propagation Delay, Fan - In and Fan - Out - Noise Margin - RTL ,TTL, ECL, CMOS - Comparison of Logic families - Implementation of combinational logic/sequential logic design using standard ICs, PROM, PLA and PAL, basic memory, static ROM, PROM, EPROM, EEPROM EAPROM.		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	M. Morris Mano and Michael D. Ciletti, 'Digital Design', Pearson, 5th Edition, 2013.(Unit - I - V)
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REFERENCES:

1	Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 4th Edition, 2002.
2	William I. Fletcher, "An Engineering Approach to Digital Design", Prentice- Hall of India, 1980.
3	Floyd T.L., "Digital Fundamentals", Charles E. Merrill publishing company, 1982.
4.	John. F. Wakerly, "Digital Design Principles and Practices", Pearson Education, 4 th Edition, 2007.

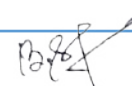
List of Exercises/Experiments

1. Study of logic gates and boolean theorem.	
2. Design of adders and subtractors	
3. Design of code converters	
4. Design of Multiplexers.	
5.Design of Demultiplexers.	
6. Design of Encoders.	
7.Design of Decoders	
8. Design of Magnitude Comparators	
9. Design and implementation of counters using flip-flops	
10. Design and implementation of shift registers	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

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

CO1:	Use Boolean algebra and simplification procedures relevant to digital logic.
CO2:	Design various combinational digital circuits using logic gates.
CO3:	Analyse and design synchronous sequential circuits.
CO4:	Analyse and design asynchronous sequential circuits. .
CO5:	Build logic gates and use programmable devices


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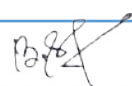
LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Digital trainer kits	15
2.	Digital ICs :ICs 7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151 / 74147 / 7445 / 7476/7491/ 555 / 7494 / 7447 / 74180 / 7485 / 7473 / 74138 / 7411 / 7474	50
3.	Bread Boards	15

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	-	2	-	-	-	3	3	3	3	2
CO2	-	-	-	-	-	-	-	-	-	2	1	2	3	2
CO3	-	3	3	2	-	2	-	-	-	2	2	3	3	2
CO4	-	-	-	-	-	-	-	-	-	3	2	2	3	1
CO5	-	3	3	3	-	-	-	-	-	2	2	3	3	2
Avg.	3	2.6	2.6	2.3	-	2	-	-	-	2	2	3	3	2

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


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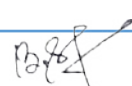
Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECL24301	ELECTRONIC DEVICES AND CIRCUITS LABORATORY	L	T	P	C	100
		0	0	3	1.5	
Course Objectives	- To learn the characteristics of PN Junction diode and Zener diode. - To understand the operation of rectifiers and filters. - To study the characteristics of amplifier.					

List of Exercises/Experiments	
1. Characteristics of PN Junction Diode and Zener diode.	
2. Full Wave Rectifier with Filters.	
3. Design of Zener diode Regulator.	
4. Common Emitter input-output Characteristics.	
5. MOSFET Drain current and Transfer Characteristics.	
6. Frequency response of CE and CS amplifiers.	
7. Frequency response of CB and CC amplifiers.	
8. Frequency response of Cascode Amplifier	
9. CMRR measurement of Differential Amplifier	
10. Class A Transformer Coupled Power Amplifier.	
Total No of Periods to be Taught	45 Periods

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Characteristics of PN Junction Diode and Zener diode.
CO2:	Design and Testing of BJT and MOSFET amplifiers.
CO3:	Operation of power amplifiers.


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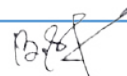


LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	CRO (30 MHz)	15 Nos
2.	Signal Generators / Function Generators (3 MHz)	15 Nos
3.	Dual Regulated Power Supplies (0-30 v)	15 Nos
4.	Bread Boards	15 Nos
5.	BC107, BC547, BF195C, BFW10, IN4001, IN4007	25 Nos
6.	Circuit Simulation Simulator	15 Users
7.	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	2	3	3	2	1	-	-	-	-	1	2	1	2
CO2	2	2	3	3	2	1	-	-	-	-	1	2	1	2
CO3	2		2		1	1	-	-	-	-	1	2	1	2
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	2	2	3	3	2	1	-	-	-	-	1	2	1	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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Department	ECE	Programme Code & Name	106 - B.E ECE
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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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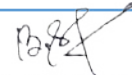


Department	ECE	Programme Code & Name	106 – B.E ECE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECT24401	ELECTROMAGNETIC FIELDS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To impart knowledge on the basics of static electric field and the associated laws • To impart knowledge on the basics of static magnetic field and the associated laws • To give insight into coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations • To gain the behaviour of the propagation of EM waves • To study the significance of Time varying fields.					

Unit-I	INTRODUCTION	(9)
Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem, Verify theorems for different path, surface and volume		
Unit-II	ELECTROSTATICS	(9)
Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law		
Unit-III	MAGNETOSTATICS	(9)
Lorentz force equation, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Calculation of magnetic field intensity for various current distributions Magnetic circuits, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques		
Unit-IV	TIME-VARYING FIELDS AND MAXWELL's EQUATIONS	(9)
Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields		
Unit-V	PLANE ELECTROMAGNETIC WAVES	(9)
Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	D.K. Cheng, Field and wave electromagnetics, 2nd ed., Pearson (India), 2002
2	M.N.O.Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford(Asian Edition), 2015

REFERENCES:

1	Edward C. Jordan & Keith G. Balmain, Electromagnetic waves and Radiating Systems, Second Edition, Prentice-Hall Electrical Engineering Series, 2012.
2	W.H. Hayt and J.A. Buck, Engineering electromagnetics, 7th ed., McGraw-Hill (India), 2006
3	B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011

COURSE OUTCOMES:

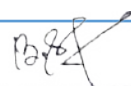
On completion of the course, the students will be able to

CO1:	Relate the fundamentals of vector, coordinate system to electromagnetic concepts
CO2:	Analyze the characteristics of Electrostatic field
CO3:	Interpret the concepts of Electric field in material space and solve the boundary conditions
CO4:	Explain the concepts and characteristics of Magneto Static field in material space and solve boundary conditions.
CO5:	Determine the significance of time varying 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	1	1	1	-	2	-	-	1	-	2	2	1	1
CO2	2	2	3	3	2	2	-	-	1	1	2	2	2	3
CO3	2	2	3	2	2	2	-	-	1	1	2	2	2	3
CO4	2	2	3	2	2	2	-	-	1	1	2	2	2	3
CO5	2	2	2	2	2	2	-	-	2	2	1	2	2	2
Avg.	2	2	2	2	2	2	-	-	1	1	2	2	2	2

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECT24402	LINEAR INTEGRATED CIRCUITS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To introduce the basic building blocks of linear integrated circuits - To learn the linear and non-linear applications of operational amplifiers - To introduce the theory and applications of analog multipliers and PLL - To learn the theory of ADC and DAC - To introduce the concepts of waveform generation and introduce some special function ICs					

Unit-I	BASICS OF OPERATIONAL AMPLIFIERS	(9)
Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations – MOSFET Operational Amplifiers		
Unit-II	APPLICATIONS OF OPERATIONAL AMPLIFIERS	(9)
Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper		
Unit-III	ANALOG MULTIPLIER AND PLL	(9)
Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronization		
Unit-IV	ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS	(9)
Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, A/D Converters – specifications - Flash type – Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters		
Unit-V	WAVE FORM GENERATORS AND SPECIAL FUNCTION ICs	(9)
Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, , Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Optocouplers and fibre optic IC		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition. (Unit I – V)
2	Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata Mc Graw-Hill, 2016 (Unit I – V)

REFERENCES:

1	Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015
2	Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
3	S.Salivahanan & V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", TMH, 2nd Edition, 4th Reprint, 2016.

COURSE OUTCOMES:

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

CO1:	Design linear and nonlinear applications of OP – AMPS
CO2:	Design applications using analog multiplier and PLL
CO3:	Design ADC and DAC using OP – AMPS
CO4:	Generate waveforms using OP – AMP Circuits
CO5:	Analyze special function ICs

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
CO2	2	3	3	2	-	-	-	-	-	-	-	2	1	1
CO3	1	-	-	2	-	-	-	-	-	-	-	2	1	1
CO4	1	-	-	2	-	-	-	-	-	-	-	2	1	1
CO5	1	2	3	3	-	-	-	-	-	-	3	2	1	1
Avg.	1.4	2.5	3	2.2	-	-	-	-	-	1	3	2	1	1

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

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECT24403	IMAGE PROCESSING	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To become familiar with digital image fundamentals • To get exposed to simple image enhancement techniques in Spatial and Frequency domain. • To learn concepts of degradation function and restoration techniques. • To study the image segmentation and representation techniques. • To become familiar with image compression and recognition methods.					

Unit-I	DIGITAL IMAGE FUNDAMENTALS	(9)
Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT		
Unit-II	IMAGE ENHANCEMENT	(9)
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.		
Unit-III	IMAGE RESTORATION	(9)
Image Restoration-degradation model, Properties, Noise models– Mean Filters– Order Statistics - Adaptive filters– Band reject Filters – Band pass Filters– Notch Filters– Optimum Notch Filtering - Inverse Filtering– Wiener filtering		
Unit-IV	IMAGE SEGMENTATION	(9)
Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Water shed segmentation algorithm		
Unit-V	IMAGE COMPRESSION AND RECOGNITION	(9)
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	RafaelC.Gonzalez, RichardE.Woods,'Digital Image Processing',Pearson,ThirdEdition,2010.
2	AnilK.Jain,'Fundamentals of Digital Image Processing',Pearson,2002.

REFERENCES:

1	Kenneth R.Castleman,'Digital Image Processing',Pearson,2006.
2	RafaelC.Gonzalez, Richard E.Woods,Steven Eddins,'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.
3	D,E.Dudgeon and RM.Mersereau,'Multidimensional Digital Signal Processing',Prentice Hall Professional Technical Reference, 1990.
4	WilliamK.Pratt,'DigitalImageProcessing',JohnWiley,NewYork,2002
5	Milan Sonkaetal'Image processing,analysis and machine vision',Brookes/Cole,Vikas Publishing House, 2nd edition, 1999.

COURSE OUTCOMES:

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

CO1:	Know and understand the basics and fundamentals of digital image processing,such as digitization, sampling, quantization, and 2D-transforms.
CO2:	Operate on images using the techniques of smoothing, sharpening and enhancement.
CO3:	Understand the restoration concepts and filtering techniques.
CO4:	Learn the basics of segmentation, features extraction, compression and recognition methods for color models.
CO5:	Comprehend image compression concepts and understand the basics and fundamentals of digital image processing,such as digitization, sampling, quantization, and 2D-transforms.

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	-	-	-	-	3	2	3	2
CO2	3	3	3	2	2	2	-	-	-	-	2	2	3	2
CO3	3	3	2	2	2	2	-	-	-	-	2	2	2	2
CO4	3	3	3	2	2	2	-	-	-	-	2	2	2	2
CO5	3	3	3	3	2	2	-	-	-	-	2	2	2	2
Avg.	3	3	3	2	2	2	-	-	-	-	3	2	3	2

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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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	ECE	Programme Code & Name	106 - B.E ECE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECTL24401	NETWORKS AND SECURITY	L	T	P	C	100
		3	0	2	4	
Course Objectives	• To learn the Network Models and datalink layer functions. • To understand routing in the Network Layer. • To explore methods of communication and congestion control by the Transport Layer. • To study the Network Security Mechanisms. • To learn various hardware security attacks and their countermeasures.					

Unit-I	NETWORK MODELS AND DATALINK LAYER	(9)
Overview of Networks and its Attributes – Network Models – OSI, TCP/IP, Addressing – Introduction to Datalink Layer – Error Detection and Correction – Ethernet(802.3)- Wireless LAN – IEEE 802.11, Bluetooth – Flow and Error Control Protocols		
Unit-II	NETWORK LAYER PROTOCOLS	(9)
Network Layer – IPv4 Addressing – Network Layer Protocols(IP,ICMP and Mobile IP) Unicast and Multicast Routing – Intradomain and Interdomain Routing Protocols – IPv6 Addresses – IPv6 – Datagram Format - Transition from IPv4 to IPv6		
Unit-III	TRANSPORT AND APPLICATION LAYERS	(9)
Transport Layer Protocols – UDP and TCP Connection and State Transition Diagram – Congestion Control and Avoidance(DEC bit, RED)- QoS - Application Layer Paradigms – Domain Name System – World Wide Web, HTTP, Electronic Mail		
Unit-IV	NETWORK SECURITY	(9)
OSI Security Architecture – Attacks – Security Services and Mechanisms – Encryption –Advanced Encryption Standard – Public Key Cryptosystems – RSA Algorithm – Hash Functions – Secure Hash Algorithm		
Unit-V	HARDWARE SECURITY	(9)
Introduction to hardware security, Hardware Trojans, Side – Channel Attacks – Physical Attacks and Counter measures – Design for Security. Introduction to Blockchain Technology		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Behrouz.A.Forouzan, Data Communication and Networking, Fifth Edition, TMH, 2017.(Unit– I,II,III)
2	William Stallings, Cryptography and Network Security, Seventh Edition, Pearson Education, 2017(Unit- IV)

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REFERENCES:

1	James.F.Kurose and Keith.W.Ross, Computer Networking – A Top – Down Approach, Sixth Edition, Pearson, 2017.
2	Doughlas .E.Comer, Computer Networks and Internets with Internet Applications, Fourth Edition, Pearson Education, 2008.

List of Exercises/Experiments

1. Implement the Data Link Layer framing methods,
i) Bit stuffing, (ii) Character stuffing
2. Implementation of Error Detection / Correction Techniques
i) LRC, (ii) CRC, (iii) Hamming code
3. Implementation of Stop and Wait, and Sliding Window Protocols
4. Implementation of Go back-N and Selective Repeat Protocols.
5. Implementation of Distance Vector Routing algorithm (Routing Information Protocol) (Bellman-Ford).
6. Implementation of Link State Routing algorithm (Open Shortest Path First) with 5 nodes (Dijkstra's).
7. Data encryption and decryption using Data Encryption Standard algorithm.
8. Data encryption and decryption using RSA (Rivest, Shamir and Adleman) algorithm.

Experiments using Tool Command Language

1. Implement and realize the Network Topology - Star, Bus and Ring using NS2.
2. Implement and perform the operation of CSMA/CD and CSMA/CA using NS2.

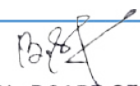
Total No of Periods to be Taught

30 Periods

COURSE OUTCOMES:

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

CO1:	Explain the Network Models, layers and functions.
CO2:	Categorize and classify the routing protocols.
CO3:	List the functions of the transport and application layer.
CO4:	Evaluate and choose the network security mechanisms.
CO5:	Discuss the hardware security attacks and countermeasures.


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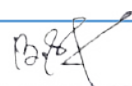
LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

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	3	3	2	2	1	-	-	-		1	1	3	1	-
CO2	3	2	3	1	1	-	-	-	-	1	1	3	1	-
CO3	3	2	1	2	1	-	-	-	-	1	1	3	1	-
CO4	3	3	3	2	1	-	-	-	-	1	1	3	1	-
CO5	3	3	1	1	1	-	-	-	-	1	1	3	1	-
Avg.	3	2.6	2	1.8	1	-	-	-	-	1	1	3	1	-

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECTL24402	DIGITAL SIGNAL PROCESSING	L	T	P	C	100
		3	0	2	4	
Course Objectives	• To learn discrete fourier transform, properties of DFT and its application to linear filtering. • To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands. • To understand the effects of finite precision representation on digital filters. • To understand the fundamental concepts of multi rate signal processing and its applications. • To introduce the concepts of adaptive filters and its application to communication Engineering.					

Unit-I	DISCRETE FOURIER TRANSFORM	(9)
Sampling Theorem, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, Discrete Fourier transform (DFT) – deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution, Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT)		
Unit-II	INFINITE IMPULSE RESPONSE FILTERS	(9)
Characteristics of practical frequency selective filters. Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade realizations		
Unit-III	FINITE IMPULSE RESPONSE FILTERS	(9)
Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations		
Unit-IV	FINITE WORD LENGTH EFFECTS	(9)
Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error – product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow		
Unit-V	DSP APPLICATIONS	(9)
Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor– Adaptive Filters: Introduction, Applications of adaptive filtering to equalization- DSP Architecture		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2	A. V. Oppenheim, R.W. Schaffer and J.R. Buck, —Discrete-Time Signal Processing”, 8th Indian Reprint, Pearson, 2004.

REFERENCES:

1	Emmanuel C. Ifeakor & Barrie. W. Jervis, “Digital Signal Processing”, Second Edition, Pearson Education / Prentice Hall, 2002.
2	Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Tata Mc Graw Hill, 2007.
3	Andreas Antoniou, “Digital Signal Processing”, Tata Mc Graw Hill, 2006.

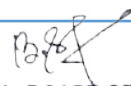
List of Exercises/Experiments

MATLAB / EQUIVALENT SOFTWARE PACKAGE/ DSP PROCESSOR BASED IMPLEMENTATION

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations.
7. Study of architecture of Digital Signal Processor
8. Perform MAC operation using various addressing modes
9. Generation of various signals and random noise
10. Implement an Up-sampling and Down-sampling operation in DSP Processor

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:	Apply DFT for the analysis of digital signals and systems
CO2:	Design IIR and FIR filters
CO3:	Characterize the effects of finite precision representation on digital filters
CO4:	Design multirate filters
CO5:	Apply adaptive filters appropriately in communication systems

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)	15
	Simulation Software and Signal processing tool box or equivalent Software in desktop systems	15
3.	Signal Generators (1MHz)	10
4.	CRO (20MHz)	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	3	3	2	2	-	-	-	1	1	3	3	2
CO2	3	3	3	3	2	2	-	-	-	1	1	2	2	2
CO3	3	3	2	2	2	2	-	-	-	1	1	1	2	2
CO4	3	3	2	2	3	1	-	-	-	1	1	2	2	3
CO5	3	2	2	2	3	2	-	-	-	1	1	2	2	1
Avg.	3	3	2	2	2	2	-	-	-	1	1	2	2	2

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECL24401	LINEAR INTEGRATED CIRCUITS LABORATORY	L	T	P	C	100
		0	0	2	1	
Course Objectives	• To gain hands on experience in designing electronic circuits. • To learn simulation software used in circuit design. • To learn the fundamental principles of amplifier circuits. • To differentiate feedback amplifiers and oscillators. • To differentiate the operation of various multivibrators.					

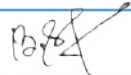
List of Exercises/Experiments

1. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance
2. RC Phase shift oscillator and Wien Bridge Oscillator
3. Hartley Oscillator and Colpitts Oscillator
4. RC Integrator and Differentiator circuits using Op-Amp
5. Clippers and Clampers
6. Instrumentation amplifier
7. Active low-pass, High pass & Band pass filters
8. PLL Characteristics and its use as frequency multiplier, clock synchronization
9. R-2R ladder type D-A converter using Op-Amp

SIMULATION USING SPICE (Using Transistor):

1. Tuned Collector Oscillator
2. Twin -T Oscillator / Wein Bridge Oscillator
3. Double and Stagger tuned Amplifiers
4. Bistable Multivibrator
5. Schmitt Trigger circuit with Predictable hysteresis
6. Analysis of power amplifier

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:	Analyze various types of feedback amplifiers
CO2:	Design oscillators, tuned amplifiers, wave-shaping circuits and multi vibrators
CO3:	Design and simulate feedback amplifiers, oscillators, tuned amplifiers, wave- shaping circuits and multi vibrators, filters using SPICE Tool.
CO4:	Design amplifiers, oscillators, D-A converters using operational amplifiers.
CO5:	Design filters using op-amp and perform an experiment on frequency response

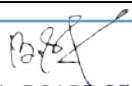
LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	CRO Arbitrary Function Generator/ signal generator	15 Nos
2.	Power Supplies (0 – 30V/3A)(0-30V/3A)(0-5V/3A) (+/-15V)	15 Nos
3.	SPICE Circuit Simulation Software:	(any public domain or commercial software)
4.	Digital Multimeter	10 Nos
5.	Digital LCR Meter	2 Nos
6.	Bread Boards	15 Nos
7.	Resistors, Capacitors, Inductors	sufficient quantities
8.	IC741, IC565, AD620	Each 15 Nos
9.	Standalone desktops PC	15 Nos
10.	Transistor/MOSFET (BJT-NPN-PNP and NMOS/PMOS)	50 Nos
11.	IC Tester	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	3	3	3	-	-	-	-	-	1	1	-	-	-
CO2	2	3	3	3	-	-	-	-	-	1	1	-	-	-
CO3	2	3	3	3	-	-	-	-	-	1	1	-	-	-
CO4	2	3	3	3	2	-	-	-	-	1	1	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	2	3	3	3	2	-	-	-	-	1	1	-	-	-

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


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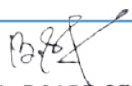
Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECL24402	IMAGE PROCESSING LABORATORY	L	T	P	C	100
		0	0	2	1	
Course Objectives	Understand the Image processing concepts					

List of Exercises/Experiments	
1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)	
2. Implementation of Relationships between Pixels	
3. Implementation of Transformations of an Image	
4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization	
5. Display of bit planes of an Image	
6.Display of FFT(1-D & 2-D) of an image	
7.Computation of Mean, Standard Deviation, Correlation coefficient of the given Image	
8.Implementation of Image Smoothing Filters(Mean and Median filtering of an Image)	
9.Implementation of image sharpening filters and Edge Detection using Gradient Filters	
10.Image Compression by DCT,DPCM, HUFFMAN coding	
11.Implementation of image restoring techniques	
12.Implementation of Image Intensity slicing technique for image enhancement	
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 simulation ideas of an image.
CO2:	Implement the experimental reasons behind Transformations.
CO3:	Understand Histogram functions and analyze it.
CO4:	Test the image compression techniques
CO5:	Understand the transition of image intensity.


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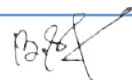


LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Simulation Software and Signal Processing Tool Box or Equivalent Software	15
2.	PCs	15

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	1	3
CO2	3	3	2	-	-	-	-	-	-	-	3	2	2	3
CO3	3	3	2	-	-	-	-	-	-	-	3	2	2	3
CO4	3	3	2	-	-	-	-	-	-	-	3	2	2	3
CO5	3	3	2	-	-	-	-	-	-	-	3	2	2	3
Avg.	3	3	2	-	-	-	-	-	-	-	3	2	2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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Department	ECE	Programme Code & Name	106 – B.E ECE
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECT24501	VLSI AND CHIP DESIGN	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Understand the fundamentals of IC technology components and their characteristics. - Understand combinational logic circuits and design principles. - Understand sequential logic circuits and clocking strategies. - Understand ASIC Design functioning and design. - Understand Memory Architecture and building blocks					

Unit-I	MOS TRANSISTOR PRINCIPLES	(9)
MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor Characteristic under Static and Dynamic Conditions, Technology Scaling, power consumption		
Unit-II	COMBINATIONAL LOGIC CIRCUITS	(9)
Propagation Delays, stick diagram, Layout diagrams, Examples of combinational logic design, Elmore's constant, Static Logic Gates, Dynamic Logic Gates, Pass Transistor Logic, Power Dissipation, Low Power Design principles		
Unit-III	SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES	(9)
Static Latches and Registers, Dynamic Latches and Registers, Pipelines, Non bistable Sequential Circuits. Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design		
Unit-IV	INTERCONNECT , MEMORY ARCHITECTURE AND ARITHMETIC CIRCUITS	(9)
Interconnect Parameters – Capacitance, Resistance, and Inductance, Electrical Wire Models, Sequential digital circuits: adders, multipliers, comparators, shift registers. Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks		
Unit-V	ASIC DESIGN AND TESTING	(9)
Introduction to wafer to chip fabrication process flow. Microchip design process & issues in test and verification of complex chips, embedded cores and SOCs, Fault models, Test coding. ASIC Design Flow, Introduction to ASICs, Introduction to test benches, Writing test benches in Verilog HDL, Automatic test pattern generation, Design for testability, Scan design: Test interface and boundary scan		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Jan D Rabaey, Anantha Chandrakasan, " Digital Integrated Circuits: A Design Perspective", PHI, 2016.(Units II, III and IV).
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2	Neil H E Weste, Kamran Eshraghian, " Principles of CMOS VLSI Design: A System Perspective," Addison Wesley, 2009.(Units - I, IV).
3	Michael J Smith , " Application Specific Integrated Circuits, Addison Wesley, (Unit - V)
4	Samir Palnitkar, " Verilog HDL:A guide to Digital Design and Synthesis", Second Edition,Pearson Education,2003.(Unit - V)

REFERENCES:

1	D.A. Hodges and H.G. Jackson, Analysis and Design of Digital Integrated Circuits, International Student Edition, McGraw Hill 1983
2	P. Rashinkar, Paterson and L. Singh, "System-on-a-Chip Verification-Methodology and Techniques", Kluwer Academic Publishers,2001.
3	Samih Mourad and Yervant Zorian, "Principles of Testing Electronic Systems", Wiley 2000.
4	M. Bushnell and V. D. Agarwal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers,2000.

COURSE OUTCOMES:

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

CO1:	In depth knowledge of MOS technology.
CO2:	Understand Combinational Logic Circuits and Design Principles.
CO3:	Strategies Understand Sequential Logic Circuits and Clocking.
CO4:	Understand Memory architecture and building blocks.
CO5:	Understand the ASIC Design Process and Testing.

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	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	2	-	-	-	-	-	-	1	3	3	3
CO3	2	3	2	3	1	1	-	-	-	-	2	3	2	3
CO4	-	-	1	1	-	-	-	-	-	-	3	3	3	2
CO5	-	-	-	-	-	2	-	-	-	1	-	3	2	2
Avg.	2	2	2	2	1	1.5	-	-	-	1	2	3	3	3

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

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECT24502	TRANSMISSION LINES AND RF SYSTEMS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To introduce the various types of transmission lines and its characteristics. - To understand high frequency line, power and impedance measurements. - To impart technical knowledge in impedance matching using Smith Chart. - To introduce passive filters and basic knowledge of active RF components. - To learn the concepts of a RF system transceiver design.					

Unit-I	TRANSMISSION LINE THEORY	(9)
General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion less line - Loading and different methods of loading - Line not terminated in Z_0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance -Open and short circuited lines - reflection factor and reflection loss		
Unit-II	HIGH FREQUENCY TRANSMISSION LINES	(9)
Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation less line - Open and short circuited lines - Power and impedance measurement on lines -Reflection losses - Measurement of VSWR and wavelength		
Unit-III	IMPEDANCE MATCHING IN HIGH FREQUENCY LINE	(9)
Impedance matching: Quarter wave transformer ,One Eighth wave line, Half wave line- Impedance matching by stubs- Single stub and double stub matching - Smith chart – Application of Smith chart, Solutions of problems using Smith chart - Single and double stub matching using Smith chart		
Unit-IV	WAVEGUIDES	(9)
Waves between parallel planes of perfect conductors- Transverse Electric waves and Transverse Magnetic waves, Characteristics of TE and TM waves, Transverse Electromagnetic waves, TM and TE waves in Rectangular waveguides, TM and TE waves in Circular waveguides		
Unit-V	RF SYSTEM DESIGN CONCEPTS	(9)
Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors, Fundamentals of MMIC, Basic concepts of RF design: Filters, couplers, power dividers, Amplifier power relations, Low noise amplifiers, Power amplifiers		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	John D Ryder, "Networks lines and fields", Prentice Hall of India, New Delhi, 2005. (Unit I–IV)
2	Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition, 2002 (Unit – V)
3	Annapurna Das, Sisir K. Das, "Microwave Engineering", McGraw Hill Education (India) private limited, Third edition, 2000. (Unit – V)

REFERENCES:

1	Reinhold Ludwig and Powel Bretchko, "RF Circuit Design" – Theory and Applications", Pearson Education Asia, First Edition, 2001.
2	D. K. Misra, "Radio Frequency and Microwave Communication Circuits"- Analysis and Design, John Wiley & Sons, 2004.
3	Richard Chi-Hsi Li - , "RF Circuit Design" – A John Wiley & Sons, Inc, Publications
4	W. Alan Davis, Krishna Agarwal, "Radio Frequency Circuit Design", John willy & Sons, 2001.

COURSE OUTCOMES:

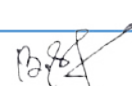
On completion of the course, the students will be able to

CO1:	Explain the characteristics of transmission lines and its losses.
CO2:	Calculate the standing wave ratio and input impedance in high frequency transmission lines.
CO3:	Comprehend the characteristics of TE and TM waves.
CO4:	Gain knowledge in sampling and quantization
CO5:	Design a RF transceiver system for wireless 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	3	3	3	3	2	1	-	-	1	-	1	2	1	1
CO2	3	2	2	3	2	1	-	-	1	-	1	2	1	1
CO3	3	3	3	2	1	2	-	-	1	-	1	2	1	1
CO4	3	3	2	3	2	1	-	-	1	-	1	2	1	1
CO5	3	2	3	2	2	1	-	-	1	-	1	2	1	1
Avg.	3	3	3	3	2	1	-	-	1	-	1	2	1	1

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSTL24503	JAVA PROGRAMMING	L	T	P	C	100
		3	0	2	4	
Course Objectives	• Teach principles of object oriented programming paradigm. • Impart fundamentals of Java, including defining classes, invoking methods, using class libraries, etc. • Learn how to design and program stand-alone java applications.					

Unit-I	INTRODUCTION	(9)
Object Oriented Programming concepts- History and Features of Java- Data types- Variables- Arrays- Operators- Control statements- Type conversion- Structure of java program- Class- Object- Method- Constructor- Static block- Static Data Member- Static Method- String- String Buffer Class		
Unit-II	INHERITANCE AND POLYMORPHISM	(9)
Types of Inheritance- Member Access rules- Usage of this and Super keyword- Method Overriding- Abstract class- Final keyword- Packages- Defining and Importing package- Interface- Streams		
Unit-III	EXCEPTION HANDLING AND MULTITHREADING	(9)
Exception Type- Try, Catch, Throw, Throws and Finally- Built-in Exceptions- User defined exception handling- Multithreading- Concepts- Thread life cycle- Creating thread-Using Thread class- Using Runnable interface-Synchronization- Thread priorities- Inter-thread communication		
Unit-IV	AWT CONTROLS	(9)
AWT class hierarchy- User interface component- Labels, Button –Text Components- Check Box- Check Box Group- Choice, List Box- Panels Scroll Pane- Menu- Scroll Bar- Working with Frame class- Colour- Fonts and layout managers- Java Event classes and Listener interfaces		
Unit-V	SWING	(9)
Introduction- Class- Hierarchy of swing components- Containers- Top level containers- JFrame- JWindow- JDialog- JPanel- JButton- JToggleButton- JCheckBox- JRadioButton- JLabel- JTextField- JTextArea- JList- JComboBox- JScrollPane		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Herbert schidt 'The complete reference" Tata Mc Graw Hill, New Delhi 12th edition 2022.
2	T.Budd 'An Introduction to Object Oriented Programming", Pearson Education, India 5th edition 2020.

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REFERENCES:

1	Y.Daniel Liang "Introduction to Java programming and Data structures", Pearson Education, Pearson education 13th edition 2024.
2	E Balagurusamy "Programming with Java", Tata McGraw Hill, Pearson education 7th edition 2023.
3	J. Nino, F.A Hosch "An Introduction to programming and OO DESIGN USING Java" John wiley & sons , New Jersey, 2009

List of Exercises/Experiments

1	Write a Java program to display the employee details using Scanner class.		
2.	Write a Java program for Method overloading and Constructor overloading.		
3.	Write a Java program to create user defined package.		
4.	Write a Java program for creating multiple catch blocks.		
5.	Write a Java program that implements a multi-thread application that has three threads.		
6.	Write a Java program for developing simple application using AWT controls.		
7.	Write a Java program for developing simple application using Swing.		
<table><tr><td>Total No of Periods to be Taught</td><td>30 Periods</td></tr></table>		Total No of Periods to be Taught	30 Periods
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 concept of OOPs and fundamentals of java
CO2:	Design an object oriented system using java as per needs and specifications.
CO3:	Design and develop java programs using inheritance, polymorphism, packages and interfaces.
CO4:	Apply exception handling and multithreading for developing efficient programs.
CO5:	Design and program stand-alone Java applications using AWT controls.


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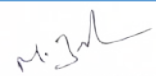
LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Hardware Requirements Computer / Laptop Processor: Minimum Intel i3 or above RAM: 4 GB (8 GB recommended) Hard Disk: At least 10 GB free space Keyboard & Mouse	30
2.	Software Requirements Operating System: Windows / Linux / macOS Java Development Kit (JDK) IDE (Integrated Development Environment): Eclipse / NetBeans / IntelliJ IDEA Text Editor (optional): Notepad / VS Code Web Browser (for downloading tools & references)	30

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	1	3	-	-	-	-	1	3	3	3
CO2	3	2	2	3	1	3	-	-	-	-	1	3	3	3
CO3	1	2	1	3	2	3	-	-	-	-	1	3	3	3
CO4	1	2	3	1	3	3	-	-	-	-	1	3	3	3
CO5	2	2	2	-	3	3	-	-	-	-	1	3	3	3
Avg.	2	2	2	2	2	3	-	-	-	-	1	3	3	3

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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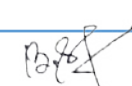
Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECTL24501	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C	100
		3	0	2	4	
Course Objectives	• Introduce the Analog communication techniques. • Get knowledge on data and pulse communication techniques. • Acquire technical knowledge in digital communication. • Gain knowledge in multi-user radio communication. • Analyze the performance of spread spectrum modulation techniques.					

Unit-I	ANALOG COMMUNICATION	(9)
Introduction to Communication Systems – Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM)		
Unit-II	PULSE AND DATA COMMUNICATION	(10)
Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM). Data Communication: Standards Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Data communication Hardware – serial and parallel interfaces		
Unit-III	DIGITAL COMMUNICATION	(9)
Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM)		
Unit-IV	MULTI-USER RADIO COMMUNICATION	(9)
Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Handover Techniques – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth		
Unit-V	SPREAD SPECTRUM MODULATION	(8)
Pseudonoise sequence, Direct sequence spread coherent binary phase shift keying ,Frequency hop spread spectrum, signal space dimensionality and processing gain, Applications		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Wayne Tomasi, Advanced Electronic Communication Systems, Pearson Education, Sixth Edition, 2014.
2	Simon Haykin, Communication Systems, John Wiley and Sons,Fourth Edition, 2012


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REFERENCES:

1	Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007
2	H.Taub, D L Schilling and G Saha, Principles of Communication, 4th Edition, Pearson Education, 2017.
3	Simon Haykin ,Digital Communication ,4th Edition John Wiley and Sons 2012

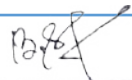
List of Exercises/Experiments

1. Study of Modulation kit	
2. Amplitude modulation	
3. Frequency modulation	
4. Phase modulation	
5. Pulse amplitude Modulation	
6. Pulse code Modulation	
7. Amplitude shift keying	
8. Frequency shift keying	
9. Phase shift keying	
10. Binary phase shift keying	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

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

CO1:	Apply DFT for the analysis of digital signals and systems
CO2:	Design IIR and FIR filters
CO3:	Characterize the effects of finite precision representation on digital filters
CO4:	Design multirate filters
CO5:	Apply adaptive filters appropriately in communication systems


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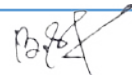


LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Kits for Signal Sampling, TDM, AM,PM, FM, PCM,PWM,PAM, Shift Keying	EACH 2
2.	CROs	15
3.	Dual Regulated Power Supplies (0 - 30V)	15

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	2	2	3	2	-
CO2	3	2	2	2	-	-	-	-	3	2	2	3	2	-
CO3	3	3	3	2	-	-	-	-	3	2	2	3	3	-
CO4	3	3	2	2	-	-	-	-	3	2	2	3	2	-
CO5	3	1	-	-	-	-	-	-	3	3	3	3	3	2
Avg.	3	3	3	2	-	-	-	-	3	3	3	3	3	2
1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy														


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Department	ECE	Programme Code & Name	106 - B.E ECE
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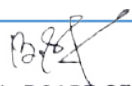
Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECL24501	VLSI LABORATORY	L	T	P	C	100
		0	0	2	1	
Course Objectives	• To learn Hardware Descriptive Language (Verilog/VHDL). • To learn the fundamental principles of Digital System Design using HDL and FPGA. • To learn the fundamental principles of VLSI circuit design in digital domain. • To learn the fundamental principles of VLSI circuit design in analog domain. • To provide hands on design experience with EDA platforms.					

List of Exercises/Experiments

- 1.Design of basic combinational and sequential (Flip-flops) circuits using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
- 2.Design an Adder/Multiplier (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
- 3.Design and implement Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software
- 4.Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
- 5.Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
- 6.Design 3-bit synchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
- 7.Design 4-bit Asynchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
- 8.Design and simulate a CMOS Basic Gates & Flip-Flops. Generate Manual/Automatic Layout .
- 9.Design and simulate a 4-bit synchronous counter using a Flip-Flops. Generate Manual/Automatic Layout
- 10.Design and Simulate a CMOS Inverting Amplifier.
- 11.Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.
- 12.Design and simulate simple 5 transistor differential amplifier.

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:	Write HDL code for basic as well as advanced digital integrated circuit
CO2:	Import the logic modules into FPGA Boards
CO3:	Synthesize Place and Route the digital Ips
CO4:	Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools
CO5:	Test and Verification of IC design

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	VLSI Simulation software/Altera Quartus/ equivalent EDA Tools	15 User License
2.	VLSI Simulation software/equivalent FPGA Boards	15 nos
3.	Personal Computer	15 nos
4.	Cadence/ Mentor Graphics/Open Source equivalent CAD VLSI design tool	5 users

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	-
CO2	3	3	1	1	-	-	-	-	-	-	-	2	1	-
CO3	1	2	2	2	-	-	-	-	-	1	1	2	2	-
CO4	-	1	3	3	1	-	-	-	-	1	1	2	2	-
CO5	3	3	3	3	1	-	-	-	-	1	1	2	2	-
Avg.	2.2	2.2	2.2	2.2	1	-	-	-	-	1	1	2	2	-

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

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Department	ECE	Programme Code & Name	106 – B.E ECE
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECT24601	MICROWAVE AND OPTICAL COMMUNICATION	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Study the properties of various Microwave components. • Learn the concept of Microwave generation techniques. • Introduce the microwave signal measurement techniques. • Study the various modes and characteristics of optical fibers. • Expose the various optical sources, detectors and transmission techniques.					

Unit-I	PASSIVE AND ACTIVE MICROWAVE DEVICES	(9)
High Frequency parameters-Formulation of S parameters-Properties of S parameters, Passive and Active devices: Attenuators-Phase shifters-Directional couplers-Hybrid Junctions-Circulator- Isolator, Impedance matching devices: Crystal and Schottkey diode-PIN diode switch-Gunn diode oscillator-IMPATT diode oscillator and amplifier.		
Unit-II	MICROWAVE GENERATION	(9)
High frequency effects in vacuum Tubes-Theory and application of Two cavity Klystron Amplifier- Reflex Klystron oscillator-Traveling wave tube amplifier-Magnetron oscillator-Backward wave Crossed field amplifier and oscillator		
Unit-III	MICROWAVE MEASUREMENTS	(9)
Measuring Instruments: Principle of operation and application of VSWR meter-Power meter- Spectrum analyzer-Network analyzer, Measurement of Impedance-Frequency-Power-VSWR- Q factor- Dielectric constant-Scattering coefficients-Attenuation-S-parameters		
Unit-IV	INTRODUCTION TO OPTICAL FIBERS	(9)
Introduction-general optical fiber communication system- basic optical laws and definitions optical modes and configurations -mode analysis for optical propagation through fibers-modes in planar wave guide-fiber optic cables classification of optical fiber-single mode fiber-graded index fiber		
Unit-V	OPTICAL SOURCES, DETECTORS AND MEASUREMENTS	(9)
Sources: Introduction of LED-LED structures, surface emitting LED-Edge emitting LED-Modulation of LED-LASER diodes- Detectors: PIN photo detector-Avalanche photo diodes. Measurements: attenuation measurement-dispersion measurement- Fiber Optic Numerical Aperture Measurements		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	David M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India, 2012.
2	Gred Keiser, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited, Fifth Edition, Reprint 2013.

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REFERENCES:

1	Robert E Colin, "Foundations for Microwave Engineering", John Wiley & Sons Inc, 2005.
2	Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2005.
3	Govind P. Agrawal, "Fiber-optic communication systems", third edition, John Wiley & sons, 2004.

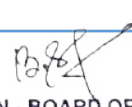
COURSE OUTCOMES:

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

CO1:	Discuss the various characteristics of devices used in microwave communication system.
CO2:	Explain the various Microwave signal generation techniques and design microwave amplifiers.
CO3:	Compute the microwave signals and parameters.
CO4:	Illustrate the various modes and characteristics of optical fibers
CO5:	Construct the optical sources and detectors.

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	-
CO2	3	2	3	2	-	-	-	-	-	-	-	3	3	-
CO3	3	2	2	2	-	-	-	-	-	-	-	3	2	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO5	3	2	2	2	-	-	-	-	-	-	-	3	2	-
Avg.	3	3	3	3	-	-	-	-	-	-	-	3	3	-
1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy														


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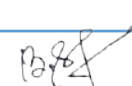


Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECTL24601	EMBEDDED SYSTEMS AND IOT DESIGN	L	T	P	C	100
		3	0	2	4	
Course Objectives	• Learn the architecture and features of 8051. • Study the design process of an embedded system. • Understand the real – time processing in an embedded system. • Learn the architecture and design flow of IoT. • Build an IoT based system.					

Unit-I	8051 MICROCONTROLLER	(9)
Microcontrollers for an Embedded System – 8051 – Architecture – Addressing Modes – Instruction Set – Program and Data Memory – Stacks – Interrupts – Timers/Counters – Serial Ports		
Unit-II	EMBEDDED SYSTEMS	(9)
Embedded System Design Process – Model Train Controller – ARM Processor – Instruction Set Preliminaries – CPU – Programming Input and Output – Supervisor Mode – Exceptions and Trap – Models for programs – Assembly, Linking and Loading – Compilation Techniques – Program Level Performance Analysis		
Unit-III	PROCESSES AND OPERATING SYSTEMS	(9)
Structure of a real – time system – Task Assignment and Scheduling – Multiple Tasks and Multiple Processes – Multirate Systems – Pre emptive real – time Operating systems – Priority based scheduling – Interprocess Communication Mechanisms – Distributed Embedded Systems –Design Example – Audio Player, Engine Control Unit and Video Accelerator		
Unit-IV	IOT ARCHITECTURE AND PROTOCOLS	(9)
Internet – of – Things – Physical Design, Logical Design – IoT Enabling Technologies – Domain Specific IoTs – M2M – IoT System Management with NETCONF – YANG – IoT Platform Design – Methodology – IoT Reference Model – Domain Model – Communication Model – IoT Reference Architecture – IoT Protocols - MQTT, CANBUS and BACNet		
Unit-V	IOT SYSTEM DESIGN	(9)
Basic building blocks of an IoT device – Raspberry Pi – Board – Linux on Raspberry Pi – Interfaces – Programming with Python – Case Studies: Home Automation, Smart Cities, Environment and Agriculture		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Mohammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D.McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Second Edition, Pearson Education, 2008.(Unit – I)
2	Marilyn Wolf, Computers as Components – Principles of Embedded Computing System Design, Third Edition, Morgan Kaufmann, 2012.(Unit – II,III)
3	Arshdeep Bahga, Vijay Madisetti, Internet – of- Things – A Hands on Approach, Universities Press, 2015.(Unit – IV,V)

REFERENCES:

1	Mayur Ramgir, Internet – of – Things, Architecture, Implementation and Security, First Edition, Pearson Education, 2020.
2	Lyla B.Das, Embedded Systems: An Integrated Approach, Pearson Education 2013.
3	Jane.W.S .Liu, Real – Time Systems, Pearson Education, 2003.

List of Exercises/Experiments

Experiments using 8051

1. Programming Arithmetic and Logical Operations in 8051.
2. Generation of Square waveform using 8051.
3. Programming using On – Chip ports in 8051.
4. Programming using Serial Ports in 8051.
5. Design of a Digital Clock using Timers/Counters in 8051.

Experiments using ARM

- 1.Interfacing ADC and DAC
- 2.Blinking of LEDs and LCD
- 3.Interfacing keyboard and Stepper Motor.
- 4.Interfacing Stepper Motor.
- 5.Miniprojects for IoT

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 architecture and features of 8051.
CO2:	Develop a model of an embedded system.
CO3:	List the concepts of real time operating systems.
CO4:	Learn the architecture and protocols of IoT.
CO5:	Design an IoT based system for any application.

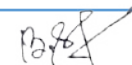
LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Embedded /IOT trainer kits	15
2.	Interface Kit : Bluetooth WiFi, Zig-bee , IR Sensor,Relay,LDR, Array of LED, LCD Display.	15
3.	ARDUINO KIT: NANO,UNO	5

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	-	-	-	-	-	-	3	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	3	2	1
CO3	3	3	2	2	2	-	-	-	-	-	-	2	1	1
CO4	3	3	2	2	2	-	-	-	-	-	-	3	3	2
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	2
Avg.	3	3	2.6	2.2	2.2	-	-	-	-	-	-	2.8	2.2	1.4

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSTL24401	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C	100
		3	0	2	4	
Course Objectives	• Study about uninformed and Heuristic search techniques. • Learn techniques for reasoning under uncertainty. • Introduce Machine Learning and supervised learning algorithms. • Study about ensembling and unsupervised learning algorithms. • Learn the basics of deep learning using neural networks.					

Unit-I	PROBLEM SOLVING	(9)
Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)		
Unit-II	PROBABILISTIC REASONING	(9)
Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning –Bayesian networks – exact inference in BN – approximate inference in BN – causal networks		
Unit-III	SUPERVISED LEARNING	(9)
Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests		
Unit-IV	ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	(9)
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization		
Unit-V	NEURAL NETWORKS	(9)
Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error back propagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyper parameter tuning, batch normalization, regularization, dropout		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2	Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.

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REFERENCES:

1	Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007
2	Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
3	Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4	Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013 (http://nptel.ac.in/)
5	Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

List of Exercises/Experiments

1. Implementation of Uninformed search algorithms (BFS, DFS).	
2. Implementation of Informed search algorithms (A*, memory-bounded A*).	
3. Implement naïve Bayes models.	
4. Implement Bayesian Networks.	
5. Build Regression models.	
6. Build decision trees and random forests.	
7. Build SVM models.	
8. Implement ensembling techniques.	
9. Implement clustering algorithms.	
10. Implement EM for Bayesian networks.	
11. Build simple NN models.	
12. Build deep learning NN models.	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

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

CO1:	Use appropriate search algorithms for problem solving.
CO2:	Apply reasoning under uncertainty.
CO3:	Build supervised learning models.
CO4:	Build ensembling and unsupervised models
CO5:	Build deep learning neural network models.


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LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Hardware Requirements Computer / Laptop Processor: Intel i5 or above (i7 recommended) RAM: Minimum 8 GB (16 GB recommended) Storage: At least 20 GB free space GPU (optional): For deep learning projects	30
2.	Software Requirements Operating System: Windows / Linux / macOS Programming Language: Python IDE / Tools: Jupyter Notebook, VS Code / PyCharm Libraries / Packages: NumPy , Pandas, Matplotlib, Scikit-learn, TensorFlow / Keras	30

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	1	3	-	-	-	-	1	3	3	3
CO2	3	2	2	3	1	3	-	-	-	-	1	3	3	3
CO3	1	2	1	3	2	3	-	-	-	-	1	3	3	3
CO4	1	2	3	1	3	3	-	-	-	-	1	3	3	3
CO5	2	2	2	-	3	3	-	-	-	-	1	3	3	3
Avg.	2	2	2	2	2	3	-	-	-	-	1	3	3	3

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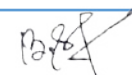


Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECL24601	MICROWAVE AND OPTICAL COMMUNICATION LABORATORY	L	T	P	C	100
		0	0	2	1	
Course Objectives	- Understand the working principle of optical sources, detector, fibers and microwave components. - Develop understanding of simple optical communication link. - Learn about the characteristics and measurements in optical fiber. - Know about the behaviour of microwave components. - Practice microwave measurement procedures.					

List of Exercises/Experiments	
OPTICAL EXPERIMENTS	
1. DC Characteristics of LED and PIN Photo diode	
2. Mode Characteristics of Fibers	
3. Measurement of connector and bending losses	
4. Fiber optic Analog and Digital Link- frequency response(analog) and eye diagram (digital)	
5. Numerical Aperture determination for Fibers	
6. Attenuation Measurement in Fibers	
MICROWAVE EXPERIMENTS	
1. Reflex klystron or Gunn diode characteristics and basic microwave parameter measurement such as VSWR, frequency, wavelength.	
2. Directional Coupler Characteristics.	
3. Radiation Pattern of Horn Antenna.	
4. S-parameter Measurement of the following microwave components (Isolator, Circulator, E plane Tee, H Plane Tee, Magic Tee)	
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:	Analyze the performance of simple optical link.
CO2:	Test microwave and optical components.
CO3:	Analyse the mode characteristics of fiber.
CO4:	Analyse the radiation of pattern of antenna.
CO5:	Measure the S-parameter of various Microwave Components.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Trainer kit for carrying out LED and PIN diode characteristics, Digital multi meter,.	2 Nos
2.	Digital multi meter	2 Nos
3.	Optical power meter	2 Nos
4.	Kit for measuring Numerical aperture and Attenuation of fiber	2 Nos
5.	MM/SM Glass and plastic fiber patch chords with connectors	2 Nos
6.	LEDs– 650 / 850 nm	2 Nos
7.	PiN PDs – 650 / 850 nm	2 Nos
8.	Directional coupler	2 Nos
9.	Microwave Horn antennas.	2 Nos
10.	Isolator and Circulator, Variable attenuator ,VSWR meter, E Plane Tee, H plane Tee.	2 Nos
11.	20 MHz Digital / Analog Oscilloscope.	2 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	-
CO2	3	3	1	1	-	-	-	-	-	-	1	-	2	-
CO3	1	2	2	2	-	-	-	-	-	-	1	1	2	-
CO4	-	1	3	3	1	-	-	-	-	-	1	1	2	-
CO5	3	3	3	3	1	-	-	-	-	-	1	1	2	-
Avg.	2.2	2.2	2.2	2.2	1	-	-	-	-	-	1	1	2	-

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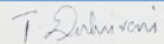


Department	ECE	Programme Code & Name	106 – B.E ECE
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Semester VII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGET24707	HUMAN VALUES AND ETHICS	L	T	P	C	100
		2	0	0	2	
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. - To promote sense of responsibility and understanding of the duties of citizen.					

Unit-I	DEMOCRATIC VALUES	(6)
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	(6)
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	(6)
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	(6)
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 21 st Century by Yuval Noah Harari		
Unit-V	SCIENTIFIC ETHICS	(6)
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		30 Periods


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TEXT BOOK:

1	Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2	Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

REFERENCES:

1	The Non religious: Understanding Secular People and Societies, Luke W.Galen Oxford University Press, 2016.
2	Secularism: A Dictionary of Atheism, Bullivant, Stephen; Lee, Lois, Oxford University Press, 2016.
3	The Oxford Handbook of Secularism, John R.Shook,OxfordUniversityPress,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 SoumitroBanerjee,IIScPress,January2022

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	0	0	0	0	0	3	3	0	0	0	3	0	0	0
CO2	0	0	0	0	0	3	3	0	0	0	3	0	0	0
CO3	0	0	0	0	0	3	3	0	0	0	3	0	0	0
CO4	0	0	0	0	0	3	3	0	0	0	3	0	0	0
CO5	0	0	0	0	0	3	3	0	0	0	3	0	0	0
Avg.	0	0	0	0	0	3	3	0	0	0	3	0	0	0

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

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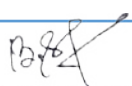


Department	ECE	Programme Code & Name	106 - B.E ECE
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Semester VII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECTL24701	WIRELESS AND MOBILE COMMUNICATION	L	T	P	C	100
		3	0	2	4	
Course Objectives	• Understand the fundamentals of wireless communication systems • Learn the fundamentals of multipath fading and propagation models. • Familiarize the concepts related to cellular concepts and spread spectrum. • Describe the equalization and diversity schemes as applied in mobile communication. • Provide the knowledge about multiple access techniques & wireless systems standards					

Unit-I	INTRODUCTION TO WIRELESS COMMUNICATIONS	(9)
Evolution of mobile radio communications, paging system, cordless telephone system, cellular telephone system, Modern wireless communication systems: 2G networks, 3G networks and personal area networks, 4G networks		
Unit-II	MOBILE RADIO PROPAGATION	(9)
Large Scale Path Loss: Free Space Propagation Model Ground Reflection(Two-Ray)Model – Three Basic Propagation Mechanism: Reflection - Diffraction- Scattering. Small Scale Fading And Multipath: Small Scale Multipath Propagation, Factors Influencing Small-Scale Fading, Doppler Shift, Coherence Bandwidth, Doppler Spread And Coherence Time. Types Of Small- Scale Fading: Fading Effects Due To Multipath Time Delay Spread, Fading Effects Due To Doppler Spread		
Unit-III	CELLULAR CONCEPT	(9)
Cellular concept – Frequency reuse – Channel assignment strategies – Handoff strategies – Interference & system capacity – Trunking & grade of service – Improving coverage and capacity in cellular system		
Unit-IV	EQUALIZATION & DIVERSITY TECHNIQUES	(9)
Equalization: Fundamentals of Equalizers, Linear equalizers, Non-linear equalizers, Decision feedback equalizers, MLSE. Diversity Techniques: Space diversity: MRC, EGC Selection diversity, Polarization diversity, Frequency diversity, and Time diversity		
Unit-V	MULTIPLE ACCESS TECHNIQUES & WIRELESS SYSTEM STANDARDS	(9)
Multiple Access Techniques-FDMA, TDMA, FHMA,SDMA and CDMA systems, Wireless Systems Standards: AMPS and ETACS architecture –GSM- -PACS		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Ekram Hossain, DongInKim, Vijay K.Bhargava, "Cooperative Cellular Wireless Networks", Cambridge University Press, 2011.
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REFERENCES:

1	Stallings W., "Wireless communications and networks", Pearson Education Limited, Third edition, 2013.
2	Jochen Schiller, Mobile Communications, Addison Wesley, Second edition, 2003
3	Gottapu Sasibhushana Rao, "Mobile Cellular Communications", Pearson Education, Noida, India, First edition, 2012.

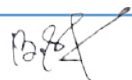
List of Exercises/Experiments

1.Modeling of wireless communication systems using Matlab(Two ray channel and Okumura –Hata model)	
2. Modeling and simulation of Multipath fading channel.	
3. Design, analyze and test Wireless standards and evaluate the performance measurements such as BER, PER, BLER, throughput, capacity, ACLR, EVM for 4G and 5G using Matlab.	
4. Modulation: Spread Spectrum – DSSS Modulation & Demodulation.	
5. Wireless Channel equalization: Zero-Forcing Equalizer (ZFE),MMSE Equalizer(MMSEE),Adaptive Equalizer (ADE),Decision Feedback Equalizer (DFE).	
6. Modeling and simulation of TDMA, FDMA and CDMA for wireless communication	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

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

CO1:	Describe the evolution of wireless communication
CO2:	Discuss the implications of multipath parameters in mobile communication.
CO3:	Identify the design concept of control signaling for call, connection management and spread spectrum in communication systems.
CO4:	Explain suitable equalization and diversity technique to combat the multipath fading effects.
CO5:	Illustrate the suitable signaling and multipath mitigation techniques for wireless channel and system under consideration


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LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Simualtion Software	15
2.	PCs	15

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	2	2	-	-	-	-	-	-	2	3	1	-
CO2	3	2	2	2	-	-	-	-	-	-	2	3	2	-
CO3	3	2	2	2	-	-	-	-	-	-	2	2	2	-
CO4	3	2	2	2	-	-	-	-	-	-	2	3	2	-
CO5	3	2	1	2	-	-	-	-	-	-	2	2	2	-
Avg.	3	2	2	2	-	-	-	-	-	-	2	3	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
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
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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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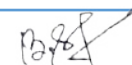
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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2402	IMAGE PROCESSING AND COMPUTER VISION	L	T	P	C	100
		3	0	0	3	
Course 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

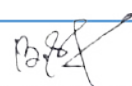
REFERENCES:

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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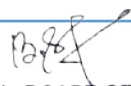
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Mapping of COs with POs and PSOs

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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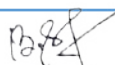
Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2403	4G / 5G COMMUNICATION NETWORKS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To learn the evolution of wireless networks. • 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:

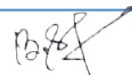
On completion of the course, the students will be able to

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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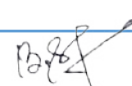
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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2405	EMBEDDED AND REAL TIME SYSTEMS	L 3	T 0	P 0	C 3	100
Course Objectives	- 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.

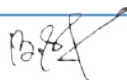
REFERENCES:

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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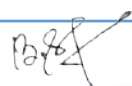
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Mapping of COs with POs and PSOs

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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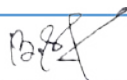
REFERENCES:

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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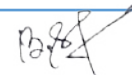
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Mapping of COs with POs and PSOs

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:

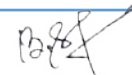
On completion of the course, the students will be able to

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

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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

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

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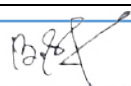
Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2401	NEXT GENERATION NETWORKS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Study the properties of communication and Networks. • Acquire the knowledge of IP Networks. • Measure and analyze the performance of various switching platforms. • Study about the various features of 5G Networks. • Expose the various internet connectivity and enabled networks.					

Unit-I	INTRODUCTION TO NEXT GENERATION NETWORKS	(9)
Communicating in the new Era - New Era of Networking - Technologies influencing change - IPE Everywhere - Optical fiber anywhere - wireless access, building blocks for NGN - Multi service Flexible Networks architecture - VPNs, Optical Networks - Wire line & Wireless Networks – NGN Services, Network Infrastructure convergence - services convergence		
Unit-II	IP NETWORKS	(9)
IP past, present and future - IP influence and confluence - IP Network convergence – LAN Technologies - IP Routing, LAN Switching - WAN's, WAN Technologies and Topologies – Wireless IP LANS, Mobility Networks, Global IP Networks - Global capacity, Globally Resilient IP - Internet –A Network of Networks		
Unit-III	MULTI SERVICE NETWORKS	(9)
Origin of multi service ATM, Next Generation Multi service Networks, Next Generation Multi service ATM switching, multi service provisioning platforms (MSPP) & Multi service switching platform(MSSP)		
Unit-IV	5G NETWORK SERVICE	(9)
Drivers for 5G- 5G Architecture- Internet of Things-Mobility-Quality of Service control-Emerging approaches for Resource over-Provisioning-Small cells for 5G mobile Networks		
Unit-V	NEXT GENERATION NETWORKS APPLICATIONS	(9)
Internet connectivity, e-commerce, call center, third party application service provision, WAP,WiMAX, integrated billing, security and directory enable networks		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Dr Jingming Li Salina, Pascal Salina, "Next Generation Networks Perspectives and Potentials", Wiley, Second Edition,2007.
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2	Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, Wiley, Second Edition,2015.
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REFERENCES:

1	Alexander Kukushkin, “Introduction to mobile network engineering : GSM, 3G-WCDMA, LTE and teh road to 5G”, Wiley,First Edition,2018.
2	Ying Zhang, “Network Function Virtualization”, Wiley,First Edition,2018.

COURSE OUTCOMES:

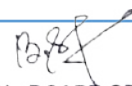
On completion of the course, the students will be able to

CO1:	Enumerate the communication based on flexible Network Architecture.
CO2:	Explain the various types of Internet protocols and its performance.
CO3:	Illustrate various Multi service ATM switching and analyze the performance of Multi service switching platform.
CO4:	Construct the 5G network and analyzing its performance.
CO5:	Construct the security and directory enable 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	2	-	-	-	-	-	-	-	3	3	-
CO2	3	2	3	3	-	-	-	-	-	-	-	3	2	-
CO3	3	2	2	2	-	-	-	-	-	-	-	3	2	-
CO4	3	3	3	1	-	-	-	-	-	-	-	3	3	-
CO5	3	2	3	2	-	-	-	-	-	-	-	3	2	-
Avg.	3	2.5	3	2.4	-	-	-	-	-	-	-	3	2.5	-

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2402	HIGH SPEED NETWORKS	L 3	T 0	P 0	C 3	100
Course Objectives	- Study the Architecture of high speed networks. - To understand about traffics and congestion control in networks. - To know the performance of Transmission control Protocol. - Study the services related to networks. - Understand the concepts of quality of support					

Unit-I	HIGH SPEED NETWORKS	(9)
Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection – ATM Cell – ATM Service Categories – AAL. High Speed LAN's: Fast Ethernet – Gigabit Ethernet– Fibre Channel – Wireless LANS		
Unit-II	CONGESTION AND TRAFFIC MANAGEMENT	(9)
Queuing Analysis – Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control		
Unit-III	TCP AND ATM CONGESTION CONTROL	(9)
TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats – ABR Capacity allocations – GFR traffic management		
Unit-IV	INTEGRATED AND DIFFERENTIATED SERVICES	(9)
Integrated Services Architecture – Approach, Components, Services- Queuing Discipline – FQ – PS – BRFQ – GPS – WFQ – Random Early Detection – Differentiated Services		
Unit-V	PROTOCOLS FOR QOS SUPPORT	(9)
RSVP – Goals & Characteristics, Data Flow, RSVP operations – Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking – Protocol details – RTP – Protocol Architecture – Data Transfer Protocol– RTCP		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	William Stallings, "High speed networks and internet", Second Edition, Pearson Education

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REFERENCES:

1	Warland, Pravin Varaiya, "High performance communication networks", Second Edition , Jean Harcourt Asia Pvt. Ltd., , 2001.
2	Irvan Pepelnjk, Jim Guichard, Jeff Aparcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003
3	Abhijit S. Pandya, Ercan Sea, "ATM Technology for Broad Band Telecommunication Networks", CRC Press, New York, 2004.

COURSE OUTCOMES:

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

CO1:	Identify the high speed network environment for different type of applications.
CO2:	Illustrate the TCP and ATM Congestion Control for High speed networks with respect to some protocol design issues.
CO3:	Establish the resource allocation and service management approaches.
CO4:	Explain the protocol operations and its Quality of Service support.
CO5:	Construct the network management 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	2	3	-	-	-	-	-	-	-	-	2	2	2
CO2	3	2	1	-	-	-	-	-	-	-	-	3	2	3
CO3	3	2	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	1	1	-	-	-	-	-	-	-	-	2	2	1
CO5	3	1	1	-	-	-	-	-	-	-	-	3	2	3
Avg.	3	1.6	1.8	-	-	-	-	-	-	-	-	2.6	2.2	2

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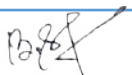


Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2403	FUNDAMENTALS OF MEMS	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To introduce the diverse technological and functional approaches of MEMS/NEMS and applications. • To understand the microstructures and fabrication methods. • To provide an insight of micro and nano sensors, actuators. • To emphasis the need for NEMS technology. • To update the ongoing trends and real time applications of MEMS and NEMS technology.					

Unit-I	INTRODUCTION TO MEMS and NEMS	(6)
Overview of Micro electro mechanical systems and Nano Electro mechanical systems, devices and technologies, Laws of scaling- Materials for MEMS and NEMS - Applications of MEMS and NEMS		
Unit-II	MICRO-MACHINING AND MICROFABRICATION TECHNIQUES	(6)
Photolithography- Micro manufacturing, Bulk micro machining, surface micro machining, LIGA		
Unit-III	MICRO SENSORS AND MICRO ACTUATOR	(6)
Micromachining : Capacitive Sensors- Piezoresistive Sensors- Piezoelectric actuators		
Unit-IV	NEMS TECHNOLOGY	(6)
Atomic scale precision engineering- Nano Fabrication techniques – NEMS for sensors and actuators.		
Unit-V	MEMS and NEMS APPLICATION	(6)
Bio MEMS- Optical NEMS- Micro motors- Smart Sensors - Recent trends in MEMS and NEMS		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:	
1	Chang Liu, "Foundations of MEMS", Pearson International Edition, 2011, 2nd Edition.
2	Tai-Ran Hsu, "MEMS and Microsystems: design , manufacture, and Nanoscale"- 2nd Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2008.


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REFERENCES:

1	Marc F madou“ Fundamentals of micro fabrication” CRC Press 2002 2nd Edition Marc Madou.
2	M.H.Bao “Micromechanical transducers :Pressure sensors, accelerometers and gyroscopes”,Elsevier, Newyork, 16 Oct 2000, 1st Edition.
3	Maluf, Nadim “An introduction to Micro Electro-mechanical Systems Engineering “AR Tech house, Boston, June 30 2004, 2nd Edition.
4	Mohamed Gad – el – Hak “MEMS Handbook” Edited CRC Press 2001, 1st Edition.

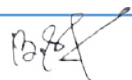
List of Exercises/Experiments

1. Simulation of MEMS sensors and actuators using Multi physics tool	
2. Simulation of a typical piezo resistive sensor	
3.Simulation of a typical Piezoelectric actuator	
4. Simulation study of a bio sensor	
5. Simulation study of a micro motor	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

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

CO1:	Explain the material properties and the significance of MEMS and NEMS for industrial automation.
CO2:	Demonstrate knowledge delivery on micromachining and micro fabrication.
CO3:	Apply the fabrication mechanism for MEMS sensor and actuators
CO4:	Apply the concepts of MEMS and NEMS to models ,simulate and process the sensors and actuators.
CO5:	Improved Employability and entrepreneurship capacity due to knowledge up gradation onMEMS and NEMS technology.


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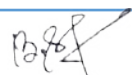
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	COMSOL Multiphysics Tool	15 User
2.	PCs	15

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	1	1	-	-	-	-	-	-	1	3	2
CO2	2	1	2	2	1	-	-	-	-	-	-	1	1	2
CO3	2	2	2	1	3	-	-	-	-	-	-	2	3	3
CO4	3	2	2	2	3	-	-	-	-	-	-	2	2	3
CO5	3	2	3	3	3	-	-	-	-	-	-	2	1	2
Avg.	2.4	1.8	2	1.8	2.4	-	-	-	-	-	-	1.6	2	2.4

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2404	WIRELESS BROAD BAND NETWORKS	L 3	T 0	P 0	C 3	100
Course Objectives	- To study the various network layer and transport layer protocols for wireless networks - To study the architecture and interference mitigation techniques in 3G standards. - To learn about 4G technologies and LTE-A in mobile cellular network. - To learn about the layer level functionalities in interconnecting networks. - To study the emerging techniques in 5G network.					

Unit-I	WIRELESS PROTOCOLS	(9)
Mobile network layer- Fundamentals of Mobile IP, data forwarding procedures in mobile IP, IPv4, IPv6, IP mobility management, IP addressing - DHCP, Mobile transport layer-Traditional TCP, congestion control, slow start, fast recovery/fast retransmission, classical TCP improvements- Indirect TCP, snooping TCP, Mobile TCP		
Unit-II	3G EVOLUTION	(9)
IMT-2000 - W-CDMA, CDMA 2000 - radio & network components, network structure, packet-data transport process flow, Channel Allocation, core network, interference-mitigation techniques,UMTS-services, air interface, network architecture of 3GPP, UTRAN – architecture, High Speed Packet Data-HSDPA,HSUPA		
Unit-III	4G EVOLUTION	(9)
Introduction to LTE-A – Requirements and Challenges, network architectures – EPC, E- UTRAN architecture - mobility management, resource management, services, channel -logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure		
Unit-IV	LAYER LEVEL FUNCTIONS	(9)
Characteristics of wireless channels - downlink physical layer, uplink physical layer, MAC scheme - frame structure, resource structure, mapping, synchronization, reference signals and channel estimation,SC-FDMA, interference cancellation–CoMP,Carrier aggregation,Services -multimedia broadcast/multicast, location-based services		
Unit-V	5G EVOLUTION	(9)
5G Roadmap - Pillars of 5G - 5G Architecture, The 5G internet - IoT and context awareness - Networking reconfiguration and virtualization support - Mobility QoS control - emerging approach for resource over provisioning, Small cells for 5G mobile networks- capacity limits and achievable gains with densification - Mobile data demand, Demand Vs Capacity, Small cell challenges, conclusion and future directions		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Kaveh Pahlavan, "Principles of wireless networks", Prentice-Hall of India, 2008
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REFERENCES:

1	VijayK.Garg, "Wireless Network Evolution-2G&3G". Prentice Hall, 2008.
2	ClintSmith, P. E, Dannel Collins, "3G Wireless Networks" Tata McGraw-Hill, 2 nd Edition, 2011.
3	Sassan Ahmadi, "LTE-Advanced—A practical systems approach to understanding the 3G PP LTE Releases 10 and 11 radio access technologies", Elsevier, 2014.

COURSE OUTCOMES:

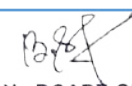
On completion of the course, the students will be able to

CO1:	Design and implement the various protocols in wireless networks.
CO2:	Analyze the architecture of 3G network standards.
CO3:	Analyze the difference of LTE-A network design from 4G standard.
CO4:	Design the interconnecting network functionalities by layer level functions.
CO5:	Explore the current generation (5G) network architecture.

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	1	1
CO2	3	3	2	1	3	2	-	-	-	-	-	3	2	2
CO3	3	3	3	3	2	1	-	-	-	-	3	3	2	2
CO4	2	3	3	3	2	2	-	-	-	-	3	2	1	2
CO5	2	-	3	3	2	2	-	-	-	-	3	2	2	1
Avg.	2.6	2.75	2.6	2.6	2.4	1.6	-	-	-	2	3	2.6	1.6	1.6

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2405	SOFTWARE DEFINED RADIO	L 2	T 0	P 2	C 3	100
Course Objectives	- To introduce the concepts of software radios - To know about RF implementation challenges for software defined radios - To understand the digital generation of signals - To learn the software and hardware requirements for software defined radios.					

Unit-I	INTRODUCTION TO SOFTWARE RADIO	(6)
The Need for Software Radios. Characteristics and Benefits of a Software Radio. Design Principles of a Software Radio		
Unit-II	RF IMPLEMENTATION	(6)
Purpose of RF front – end, Dynamic range, RF receiver front – end topologies, Enhanced flexibility of the RF chain with software radios, Importance of the components to overall performance, Transmitter architectures and their issues, Noise and distortion in the RF chain, Hybrid DDS – PLL systems, Applications of Direct Digital Synthesis		
Unit-III	DIGITAL GENERATION OF SIGNALS	(6)
Comparison of direct digital synthesis with analog signal synthesis, Approaches to direct digital synthesis, Analysis of spurious signals, Performance of direct digital synthesis systems, Applications of direct digital synthesis		
Unit-IV	SMART ANTENNAS	(6)
Benefits of smart antennas, Structures for beam forming systems, Smart antenna algorithms, Hardware implementation of smart antennas, Digital Hardware Choices-Key hardware elements		
Unit-V	HARDWARE AND SOFTWARE FOR SDR & CASE STUDIES	(6)
DSP Processors, FPGA, ASICs. Trade-offs, Object oriented programming, Object Brokers, GNU Radio-USRP. Case Studies: SPEAK easy, JRTS, SDR-3000		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:	
1	Jeffrey Hugh Reed, "Software Radio: A Modern Approach to Radio Engineering," Prentice Hall Professional, 2002.

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2	Tony J Roupheal, "RF and DSP for SDR," Elsevier Newnes Press, 2008.
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REFERENCES:

1	P. Kenington, "RF and Baseband Techniques for Software Defined Radio," Artech House, 2005.
2	Paul Burns, "Software Defined Radio for 3G," Artech House, 2002.
3	Behrouz. F. Bourjney "Signal Processing for Software defined Radios", Lulu 2008.

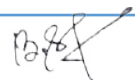
List of Exercises/Experiments

1. Study of SDR hardware kit.	
2. Design and Implementation of digital modulation schemes using SDR.	
3. Implementation of synchronization techniques using SDR.	
4. Channel Coding Techniques using SDR.	
5. Study of channel estimation techniques using SDR.	
6. Study of MIMO concepts using SDR	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

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

CO1:	Demonstrate an understanding in the evolving paradigm of Software defined radio and technologies for its implementation.
CO2:	Analyse Radio frequency implementation issues.
CO3:	Implement Smart antenna techniques for software defined radio.
CO4:	Compare various digital synthesis procedures.
CO5:	Comprehend various hardware and software requirements for software defined radios.


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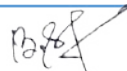
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.N O	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Software define Radio Kits	15

Mapping of COs with POs and PSOs

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

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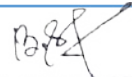
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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2406	MASSIVE MIMO NETWORKS	L 2	T 0	P 2	C 3	100
Course Objectives	- To gain knowledge about massive MIMO networks. - To understand the massive MIMO propagation channels. - To learn about channel estimation in single cell and multicell massive MIMO systems. - To comprehend the concepts of massive MIMO deployment in the context of single cell and multicell deployment.					

Unit-I	MASSIVE MIMO NETWORKS	(6)
Definition of Massive MIMO, Correlated Rayleigh Fading, System Model for Uplink and Downlink, Basic Impact of Spatial Channel Correlation, Channel Hardening and Favourable Propagation, Local Scattering Spatial Correlation Model		
Unit-II	THE MASSIVE MIMO PROPAGATION CHANNEL	(6)
Favorable Propagation and Deterministic Channels-Capacity Upper Bound-Distance from Favorable Propagation-Favorable Propagation and Linear Processing-Singular Values and Favorable Propagation, Favorable Propagation and Random Channels-Independent Rayleigh Fading-Uniformly Random Line-of-Sight (UR-LoS)-Independent Rayleigh Fading versus UR-LoS - Finite-Dimensional Channels		
Unit-III	SINGLE-CELL SYSTEMS	(6)
Uplink Pilots and Channel Estimation - Orthogonal Pilots- De-Spreading of the Received Pilot Signal-MMSE Channel Estimation, Uplink Data Transmission - Zero-Forcing -Maximum-Ratio, Downlink Data Transmission-Linear Precoding-Zero-Forcing-Maximum-Ratio, Discussion- Interpretation of the Effective SINR Expressions-Implications for Power Control-Scaling Laws and Upper Bounds on the SINR - Near-Optimality of Linear Processing when $M \gg K$ - Net Spectral Efficiency - Limiting Factors: Number of Antennas and Mobility		
Unit-IV	MULTI-CELL SYSTEMS	(6)
Uplink Pilots and Channel Estimation, Uplink Data Transmission - Zero-Forcing -Maximum-Ratio, Downlink Data Transmission -Zero-Forcing - Maximum-Ratio, Discussion -Asymptotic Limits with Infinite Numbers of Base Station Antennas - The Effects of Pilot Contamination - Non-Synchronous Pilot Interference		
Unit-V	CASE STUDIES	(6)
Single-Cell Deployment Example: Fixed Broadband Access in Rural Area, Multi-Cell Deployment: Preliminaries and Algorithms, Multi-Cell Deployment Examples: Mobile Access - Dense Urban Scenario - Suburban Scenario - Minimum Per-Terminal Throughput Performance -Additional Observations - Comparison of Power Control Policies		
Total No of Periods to be Taught		30 Periods


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TEXT BOOK:

1	Thomas L. Marzetta, Erik G. Larsson, Hong Yang, Hien Quoc Ngo, "Fundamentals of Massive MIMO", Cambridge University Press 2016. (UNITS II-V)
2	Emil Björnson, Jakob Hoydis and Luca Sanguinetti (2017), "Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency", Foundations and Trends, Now, 2017. (UNIT I)

REFERENCES:

1	Long Zhao, Hui Zhao, Kan Zheng, "Wei Xiang Massive MIMO in 5G Networks: Selected Applications", Springer 2018.
2	Leibo Liu, Guiqiang Peng, Shaojun Wei, "Massive MIMO Detection Algorithm and VLSI Architecture", Springer 2019.

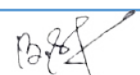
List of Exercises/Experiments

1. Massive MIMO hybrid beamforming.	
2. Single cell massive MIMO downlink communications	
3. Multicell massive MIMO downlink communications.	
4. Precoding in massive MIMO single cell and multicell downlink communications.	
5. Channel estimation in massive MIMO system	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

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

CO1:	Understand and explain massive MIMO networks
CO2:	Analyze massive MIMO propagation channels and their capacity bounds
CO3:	Examine channel estimation techniques for single cell system.
CO4:	Analyze channel estimation techniques for multi cell system.
CO5:	Explain the concepts underlining the deployment of single and multicell massive MIMO systems.


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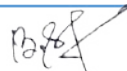
LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)	15
2.	MATLAB with Simulink and Signal Processing Tool Box or Equivalent Software in desktop systems	15
3.	Signal Generators (1MHz)	10
4.	CRO (20MHz)	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	2	1	1	2	2	-	-	-	-	2	3	1	2
CO2	3	3	2	2	2	2	-	-	-	-	1	2	2	1
CO3	3	2	2	2	2	2	-	-	-	-	1	3	3	2
CO4	3	3	2	2	2	2	-	-	-	-	1	3	1	3
CO5	3	2	2	2	2	2	-	-	-	-	2	3	3	2
Avg.	3	2.4	1.8	1.8	2	2	-	-	-	-	1.4	3	2	2

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2407	SATELLITE COMMUNICATION	L 3	T 0	P 0	C 3	100
Course Objectives	- Understand the basics of satellite orbits - Understand the satellite segment and earth segment - Understand Link Power budget calculation - Understand the various satellite access and coding technology - Understand the applications of satellite					

Unit-I	SATELLITE ORBITS	(9)
Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse- Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion		
Unit-II	SPACE SEGMENT	(9)
Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders Antenna Subsystem		
Unit-III	SATELLITE LINK DESIGN	(9)
Basic link analysis, Uplink and Downlink Design equation, Free space loss-Atmospheric effects, Ionospheric scintillation, Rain induced attenuation and interference, system noise temperature, Link Design with and without frequency reuse		
Unit-IV	SATELLITE ACCESS AND CODING TECHNIQUES	(9)
Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, PAMA and DAMA Assignment Methods, compression – encryption, Coding Schemes		
Unit-V	SATELLITE APPLICATIONS	(9)
INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, LEO, MEO, Satellite Navigational System. GPS-Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH)		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	Dennis Roddy, "Satellite Communication", 4th Edition, McGraw Hill International, 2017.
2	Timothy Pratt, Charles, W. Bostain, Jeremy E. Allnutt, "Satellite Communication", 3rd Edition, Wiley Publications, 2021.

REFERENCES:

1	Tri T. Ha, "Digital Satellite Communications", 2nd edition, McGraw Hill Education, 2017.
2	Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communications Systems Engineering", 2nd edition, Prentice Hall/Pearson, 2013.

COURSE OUTCOMES:

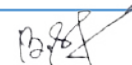
On completion of the course, the students will be able to

CO1:	Identify the satellite Orbits.
CO2:	Analyze the satellite subsystems.
CO3:	Evaluate the satellite link power budget.
CO4:	Identify access technology for satellite.
CO5:	Design various satellite 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	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
Avg.	3	3	3	3	2	3	1	-	1	-	1	3	3	3

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2408	OPTICAL COMMUNICATION & NETWORKS	L 3	T 0	P 0	C 3	100
Course Objectives	- To Study About The Various Optical Fiber Modes, Configuration Of Optical Fibers - To Study Transmission Characteristics Of Optical Fibers. - To Learn About The Various Optical Sources, Detectors And Transmission Techniques. - To Explore Various Idea About Optical Fiber Measurements And Various Coupling Techniques. - To Enrich The Knowledge About Optical Communication Systems And Networks.					

Unit-I	INTRODUCTION TO OPTICAL FIBER COMMUNICATION	(9)
Introduction - The General Systems - Advantages of Optical Fiber Communication- Ray Theory Transmission : Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays – Electromagnetic Mode Theory for Optical Propagation: Modes in a Planar Guide, Phase and group velocity - Cylindrical Fiber: Step index fibers, Graded index fibers - Single mode fibers: Cutoff wavelength		
Unit-II	TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS	(9)
Attenuation - Material absorption losses in silica glass fibers: Intrinsic absorption, Extrinsic absorption - Linear scattering losses: Rayleigh Scattering, Mie Scattering -Nonlinear scattering losses: Stimulated Brillouin Scattering, Stimulated Raman Scattering – Fiber Bend Loss – Dispersion- Chromatic dispersion: Material dispersion, Waveguide dispersion- Intermodal dispersion : Multimodestep index fiber, Multimode graded index fiber		
Unit-III	OPTICAL SOURCES AND OPTICAL DETECTORS	(9)
The laser : Introduction - Basic concepts: Absorption and emission of radiation, Population inversion , Optical feedback and laser oscillation, Threshold condition for laser oscillation- Optical emission from semiconductors: The PN junction, Spontaneous emission, Carrier recombination, Stimulated emission and lasing, Hetero junctions- LED: Introduction- Power and Efficiency - LED structures: Planar LED, Dome LED, Surface emitter LED, Edge emitter LED- LED Characteristics. Optical Detectors: Introduction ,Optical Detection Principles, Quantum Efficiency, Resposivity, P-N Photodiode ,P-I-N Photo Diode and Avalanche Photodiode		
Unit-IV	OPTICAL FIBER MEASUREMENTS	(9)
Introduction- Total Fiber Attenuation Measurement, Fiber Dispersion Measurements In TimeDomain and Frequency Domain, Fiber Cut off Wavelength Measurements, Numerical Aperture Measurements. Fiber Diameter Measurements, ReflectanceAnd Optical Return Loss, Field Measurements		

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Unit-V	OPTICAL NETWORKS	(9)
Introduction- Optical Network Concepts: Optical Networking Terminology, Optical Network Node And Switching Elements, Wavelength Division Multiplexed Networks, Public Telecommunications Network Overview- Optical Network Transmission Modes, Layers And Protocols: Synchronous Networks, Asynchronous Transfer Mode, Open System Interconnection Reference Model, Optical Transport Network, Internet Protocol- Wavelength Routing Networks: Routing And Wavelength Assignment- Optical Switching Networks: Optical Circuit Switched Networks, Optical Packet Switched Networks, Multiprotocol Label Switching, Optical Burst Switching Networks- Optical Network Deployment : Long Haul Networks, Metropolitan area networks, Access networks, Local Area Networks- Optical Ethernet: Network protection, restoration and survivability		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	JohnM.Senior, "Optical Fiber Communication", Pearson Education, Fouth Edition. 2010
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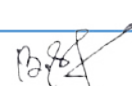
REFERENCES:

1	Gred Keiser, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013.
2	Govind P. Agrawal, "Fiber-Optic Communication Systems", Third Edition, John Wiley & Sons, 2004.
3	J. Gower, "Optical Communication System", Prentice Hall of India, 2001
4	Rajiv Ramaswami, "Optical Networks", Second Edition, Elsevier, 2004.

COURSE OUTCOMES:

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

CO1:	Realize Basic Elements In Optical Fibers, Different Modes and Configurations.
CO2:	Analyze the Transmission Characteristics associated With dispersion and Polarization Techniques.
CO3:	Design Optical Sources and Detectors with their use in Optical Communication System.
CO4:	Construct Fiber Optic Receiver Systems, Measurements and Techniques.
CO5:	Design Optical Communication Systems and its Networks.


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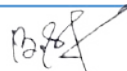
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Mapping of COs with POs and PSOs

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

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


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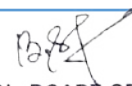
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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2409	POSITIONING AND NAVIGATION SYSTEMS	L 3	T 0	P 0	C 3	100
Course Objectives	- To explain the fundamentals of navigation systems. - To understand the inertial navigation systems - To acquire knowledge on radio navigation. - To have an overview of global positioning systems - To learn the hybrid navigation systems.					

Unit-I	NAVIGATION CONCEPTS	(9)
Fundamentals of navigation systems and Position Fixing – Categories of navigation - Geometric concepts of Navigation –The Earth in inertial space - Different Coordinate Systems – Coordinate Transformation - Euler angle formulations - Direction cosine matrices formulation - Quaternion formulation		
Unit-II	INERTIAL NAVIGATION SYSTEMS	(9)
Inertial sensors - Gyroscopes -Types - Mechanical - Electromechanical-Optical Gyro -Ring Laser gyro- Fiber optic gyro-Accelerometers – Pendulous type – Force Balance type – MEMs - Basic Principles of Inertial Navigation – Types - Platform and Strap down - Mechanization INS system - Rate Corrections - Acceleration errors –Schuler Tuning		
Unit-III	RADIO NAVIGATION & AIR TRAFFIC MANAGEMENT	(9)
Different types of radio navigation- ADF, VOR, DME, TACAN,VORTAC - Doppler – Hyperbolic Navigations – Air Traffic Management – RADAR Surveillance- Airborne Collision Avoidance Systems		
Unit-IV	GLOBAL POSITIONING SYSTEM	(9)
Overview of GPS: Basic concept, system architecture, , GPS Signals Signal structure, anti-spoofing (AS), selective availability, GPS for position and velocity determination, GPS aided Geo-augmented navigation (GAGAN) architecture -GPS error sources-clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver		
Unit-V	HYBRID NAVIGATION &RELATIVE NAVIGATION SYSTEMS	(9)
Hybrid Navigation - Introduction to Kalman filtering – Case Studies -Integration of GPS and INS using Kalman Filter - Relative Navigation – fundamentals – Equations of Relative Motion for circular orbits (Clohessy_Wiltshire Equations) - Sensors for Rendezvous Navigation - Relative positioning - Point positioning and differential positioning - Differential GPS (DGPS) and Space based Augmentation system (SBAS)-Concepts -Relative GPS-Formation Flying - Figure of Merit (FOM)		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Myron Kyton,Walfred Fried,'Avionics Navigation Systems',JohnWiley & Sons,2 edition,1997.
2	Nagaraja,N.S."Elements of Electronic Navigation",Tata McGraw-HillPub.Co.,New Delhi, 2nd edition, 1975.

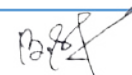
REFERENCES:

1	George MSiouris,'Aerospace Avionics System;A Modern Synthesis',AcademicPressInc., 1993.
2	Albert Helfrick,'Practical Aircraft Electronic Systems',Prentice Hall Education,Career & Technology, 1995.
3	Albert D.Helfrick,'Modern Aviation Electronics',Second Edition,PrenticeHallCareer& Technology, 1994.

COURSE OUTCOMES:

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

CO1:	Understand the advanced concepts of Positioning and Navigation systems and exposure on various Navigation systems
CO2:	Know about Gyroscopes and accelerometers and Inertial Navigation systems and its types and Mechanisation
CO3:	Explain the different Radio Navigation aids and its usage for civil and military aircrafts and satellites
CO4:	Explain the Satellite Navigation – GPS and its usage in aircraft and spacecraft applications
CO5:	Deploy these skills effectively in the analysis and understanding of hybrid navigation systems and Relative navigation in a spacecraft.


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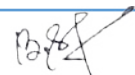
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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	-	-	-	-	-	3	3	2
CO2	3	3	3	2	2	2	-	-	-	-	-	2	3	2
CO3	3	3	3	2	2	2	-	-	-	-	-	2	3	2
CO4	3	3	3	2	2	2	-	-	-	-	-	2	2	2
CO5	3	3	3	3	2	2	-	-	-	-	-	2	2	2
Avg.	3	3	3	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	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2410	ADVANCED WIRELESS COMMUNICATION TECHNIQUES	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To understand the evolving paradigm of cooperative communication • To understand concepts related to green wireless communication • To enable the student to understand the different power saving strategies and energy efficient signal, system and network design. • To expose the student to the energy saving techniques To provide understand in go nprotocols and networks related to green future wireless communication technologies.					

Unit-I	CO OPERATIVE COMMUNICATIONS AND GREEN CONCEPTS	(9)
Network architectures and research issues in cooperative cellular wireless networks ; Cooperative communications in OFDM and MIMO cellular relay networks: issues and approaches; Fundamental trade-offs on the design of green radio networks, Green modulation and coding schemes		
Unit-II	CO OPERATIVE TECHNIQUES	(9)
Cooperative techniques for energy efficiency, Cooperative base station techniques for cellular wireless networks; Turbo base stations; Antenna architectures for cooperation; Cooperative communications in 3GPP LTE-Advanced, Partial information relaying and Coordinated multi-point transmission in LTE-Advanced		
Unit-III	RADIO NAVIGATION & AIR TRAFFIC MANAGEMENT	(9)
Distributed space-time block codes ; Collaborative relaying in downlink cellular systems ; Radio resource optimization; Adaptive resource allocation ; Cross-layer scheduling design for cooperative wireless two-way relay networks ; Network coding in relay-based networks		
Unit-IV	GLOBAL POSITIONING SYSTEM	(9)
Base Station Power-Management Techniques- Opportunistic spectrum and load management, Energy-saving techniques in cellular wireless base stations , Power-management for base stations in smart grid environment, Cooperative multi cell processing techniques for energy-efficient cellular wireless communications		
Unit-V	HYBRID NAVIGATION &RELATIVE NAVIGATION SYSTEMS	(9)
Hybrid Navigation - Introduction to Kalman filtering – Case Studies -Integration of GPS and INS using Kalman Filter - Relative Navigation – fundamentals – Equations of Relative Motion for circular orbits (Clohessy_Wiltshire Equations) - Sensors for Rendezvous Navigation - Relative positioning - Point positioning and differential positioning - Differential GPS (DGPS) and Space based Augmentation system (SBAS)-Concepts -Relative GPS-Formation Flying - Figure of Merit (FOM)		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	EkramHossain,DongInKim,VijayK.Bhargava,“CooperativeCellularWireless Networks”,Cambridge University Press, 2011.
2	Ekram Hossain,Vijay K.Bhargava(Editor),GerhardP.Fettweis(Editor),“Green Radio Communication Networks”, Cambridge University Press, 2012.

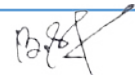
REFERENCES:

1	F.Richard Yu,Yu,ZhangandVictorC.M.Leung“ Green Communications and Networking”, CRC press, 2012.
2	Ramje Prasad and Shingo Ohmori,DinaSimunic,“Towards Green ICT”,River Publishers,2010.
3	JinsongWu, Sundeep Rangan and Honggang Zhang,“GreenCommunications:Theoretical Fundamentals, Algorithms and Applications”, CRC Press, 2012.

COURSE OUTCOMES:

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

CO1:	The student would be able to appreciate the necessity and the design aspects of cooperative communication
CO2:	The student would be able to appreciate the necessity and the design aspects of green wireless communication.
CO3:	The student would be able to evolve new techniques in wireless communication
CO4:	The students would be able to demonstrate the feasibility of using mathematical models using simulation tools.
CO5:	The student would be able to demonstrate the impact of the green engineering solutions in a global, economic, environmental and societal context.


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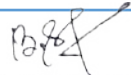
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Mapping of COs with POs and PSOs

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

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


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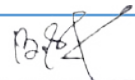


Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2411	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To introduce the concepts of discrete time random signal • To know about multirate signal processing and its applications • To understand the spectrum estimation techniques • To learn the concept of prediction theory and filtering					

Unit-I	MULTIRATE SIGNAL PROCESSING	(6)
Review of Convolution, DFT and ZT, Multirate Signal Processing - Decimation, Interpolation, Sampling Rate Conversion by a rational factor – digital filter banks, sub band coding, Quadrature Mirror Filter		
Unit-II	DISCRETE TIME RANDOM PROCESSES	(6)
Stationary random processes, Autocorrelation, Rational Power Spectra, Filters for generating random Processes from white noise and inverse filter – AR, MA and ARMA processes – relationship between autocorrelation and the filter parameters		
Unit-III	LINEAR PREDICTION AND FILTERING	(6)
Linear Prediction – Forward and Backward - Wiener filters for filtering and prediction – FIR Wiener Filter – IIR Wiener Filter – Kalman Filter		
Unit-IV	ADAPTIVE FILTERING	(6)
FIR adaptive filters – adaptive filters based on steepest descent method – LMS algorithm – Variants of LMS algorithm – adaptive echo cancellation – adaptive channel equalization – RLS Algorithm		
Unit-V	SPECTRUM ESTIMATION	(6)
Estimation of power spectra from finite duration observations of signals – Non parametric methods of spectrum estimation – the Bartlett and the Welch method – Parametric spectrum estimation – AR, MA and ARMA		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:	
1	John G. Proakis & Dimitris G.Manolakis, —Digital Signal Processing – Principles, Algorithms & Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2	P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc. 1993.


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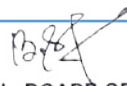
1	Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint 2008.
2	Haykin, Adaptive Filter Theory, 4th Edition, Pearson Education, New Delhi, 2006.
3	Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw Hill, 2000.

List of Exercises/Experiments

1. Study of autocorrelation and Cross Correlation of random signals.	
2. Design and Implementation of Multirate Systems.	
3. Design and Implementation of Wiener Filter.	
4. Design and Implementation of FIR Linear Predictor.	
5. Design of adaptive filters using LMS algorithm.	
6. Spectrum Estimation using Bartlett and Welch Methods.	
Total No of Periods to be Taught	30 Periods

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)	15
2.	MATLAB with Simulink and Signal Processing Tool Box or Equivalent Software in desktop systems	15
3.	Signal Generators (1MHz)	10
4.	CRO (20MHz)	10


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COURSE OUTCOMES:

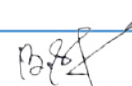
On completion of the course, the students will be able to

CO1:	Comprehend multirate signal processing and demonstrate its applications
CO2:	Demonstrate an understanding of the power spectral density and apply to discrete random signals and systems.
CO3:	Apply linear prediction and filtering techniques to discrete random signals for signal detection and estimation.
CO4:	Analyze adaptive filtering problems and demonstrate its application.
CO5:	Apply power spectrum estimation techniques to random signals.

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	2	3	3
CO2	3	3	3	2	2	2	-	-	-	-	2	3	2	2
CO3	3	3	3	2	2	2	-	-	-	-	2	2	2	1
CO4	3	3	3	2	2	2	-	-	-	-	2	3	2	2
CO5	3	3	2	2	1	1	-	-	-	-	1	2	3	1
Avg.	3	3	3	2	2	2	-	-	-	-	2	3	2	2

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2412	SPEECH PROCESSING	L	T	P	C	100
		2	0	2	3	
Course Objectives	• Study the fundamentals of speech signal and extracts values. • Understand different speech coding techniques for speech. • Learn to build speech enhancement, text-to-speech synthesis.					

Unit-I	FUNDAMENTALS OF SPEECH	(6)
The Human speech production mechanism, Discrete-Time model of speech production, Speech perception - human auditory system, Phonetics - articulatory phonetics, acoustic phonetics, and auditory phonetics, Categorization of speech sounds, Spectrographic analysis of speech sounds, Pitch frequency, Pitch period measurement using spectral and cepstral domain, Formants, Evaluation of Formants for voiced and unvoiced speech		
Unit-II	SPEECH FEATURES AND DISTORTION MEASURES	(6)
Significance of speech features in speech-based applications, Speech Features – Cepstral Coefficients, Mel Frequency Cepstral Coefficients (MFCCs), Perceptual Linear Prediction (PLP), Log Frequency Power Coefficients (LFPCs), Speech distortion measures–Simplified distance measure, LPC-based distance measure, Spectral distortion measure, Perceptual distortion measure		
Unit-III	SPEECH CODING	(6)
Need for speech coding, Waveform coding of speech – PCM, Adaptive PCM, DPCM, ADPCM, Delta Modulation, Adaptive Delta Modulation, G.726 Standard for ADPCM, Parametric Speech Coding – Channel Vocoder, Linear Prediction Based Vocoder, Code Excited Linear Prediction (CELP) based Vocoder, Sinusoidal speech coding techniques, Hybrid coder, Transform domain coding of speech		
Unit-IV	SPEECH ENHANCEMENT	(6)
Classes of Speech Enhancement Algorithms, Spectral-Subtractive Algorithms - Multiband Spectral Subtraction, MMSE Spectral Subtraction Algorithm, Spectral Subtraction Based on Perceptual Properties, Wiener Filtering - Wiener Filters in the Time Domain, Wiener Filters in the Frequency Domain, Wiener Filters for Noise Reduction, Maximum-Likelihood Estimators, Bayesian Estimators, MMSE and Log-MMSE Estimator, Subspace Algorithms		
Unit-V	SPEECH SYNTHESIS AND APPLICATION	(6)
A Text-to-Speech systems (TTS), Synthesizers technologies – Concatenative synthesis, Use of Formants for concatenative synthesis, Use of LPC for concatenative synthesis, HMM-based synthesis, Sinewave synthesis, Speech transformations, Watermarking for authentication of a speech, Emotion recognition from speech		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Shaila D. Apte, Speech and Audio Processing, Wiley India (P) Ltd, New Delhi, 2012
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2	Philipos C. Loizou, Speech Enhancement Theory and Practice, Second Edition, CRC Press, Inc., United States, 2013
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REFERENCES:

1	Rabiner L. R. and Juang B. H, Fundamentals of speech recognition, Pearson Education, 2003
2	Thomas F. Quatieri, Discrete-time speech signal processing - Principles and practice, Pearson, 2012.
3	Sophoncles J. Organdies, "Optimum Signal Processing ", McGraw Hill, 2000.

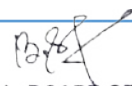
List of Exercises/Experiments

1. Write a MATLAB Program to classify voiced and unvoiced segment of speech using various time-domain measures.
2. Write a MATLAB Program to calculate the MFCC for a speech signal..
3. Implement ITU-T G.722 Speech encoder in MATLAB.
4. Write a MATLAB Program to implement Wiener Filters for Noise Reduction.
5. Design a speech emotion recognition system using DCT and WPT in MATLAB.

Total No of Periods to be Taught	30 Periods
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LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)	15
2.	MATLAB with Simulink and Signal Processing Tool Box or Equivalent Software in desktop systems	15
3.	Signal Generators (1MHz)	10
4.	CRO (20MHz)	10


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COURSE OUTCOMES:

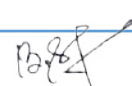
On completion of the course, the students will be able to

CO1:	Understand the fundamentals of speech.
CO2:	Extract various speech features for speech related applications
CO3:	Choose an appropriate speech coder for a given application
CO4:	Build a speech enhancement system.
CO5:	Build a text-to-speech synthesis system for various 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	3	-	-	-	-	1	2	3	3	2
CO2	2	2	3	1	3	-	-	-	-	2		2	3	2
CO3	2	3	2	2	3	-	-	-	-	1		2	2	2
CO4	3	2	2	3	3	-	-	-	-	1	2	2	2	2
CO5	3	2	2	2	3	-	-	-	-	1	2	3	3	3
Avg.	3	3	3	3	3	-	-	-	-	2	1	1	1	-

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


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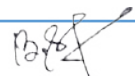
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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2413	DEEP LEARNING ARCHITECTURES	L 3	T 0	P 0	C 3	100
Course Objectives	- Study the concepts and principles of neural networks. - Understand the major architecture of deep networks. - Learn the basics of Convolutional Neural Networks. - Introduce the basics of Recurrent Neural Networks. - Familiarize the use of deep learning in real time applications.					

Unit-I	INTRODUCTION	(9)
Introduction to machine learning- Maximum likelihood estimation, Building machine learning algorithm, Neural Networks- Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent		
Unit-II	DEEP LEARNING & ARCHITECTURES	(9)
Machine Learning Vs. Deep Learning, Representation Learning, Width Vs. Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines		
Unit-III	CONVOLUTIONAL NEURAL NETWORKS	(9)
CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning – Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet		
Unit-IV	RECURRENT AND RECURSIVE NETS	(9)
Recurrent and Recursive Nets – Recurrent Neural Networks – Bidirectional RNNs -Deep Recurrent Networks – Recursive Neural Networks – Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short Term Memory Networks- Applications		
Unit-V	PROTOCOLS FOR QOS SUPPORT	(9)
Large-Scale deep learning – Computer Vision – Speech Recognition – Natural Language Processing- Images segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative adversarial networks		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Ian Good fellow, Yoshua Bengio and Aaron Courville, “ Deep Learning”, MIT Press, First edition,2017
2	Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, First edition,2017.

REFERENCES:

1	Cosma Rohilla Shalizi, “Advanced Data Analysis from an Elementary Point of View”, Cosma Rohilla Shalizi, Second Edition, 2021
2	Umberto Michelucci “Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks” A press, First edition, 2018.

COURSE OUTCOMES:

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

CO1:	Describe the fundamental issues and basics of machine learning
CO2:	Discuss the architecture of Neural Network
CO3:	Develop and implement Convolutional Neural Networks
CO4:	Apply the use RNN for language modeling and time series prediction
CO5:	Establish the various applications of deep 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	3	-	-	-	-	-	-	-	-	2	2	2
CO2	3	2	1	-	-	-	-	-	-	-	-	3	2	3
CO3	3	2	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	1	1	-	-	-	-	-	-	-	-	2	2	1
CO5	3	1	1	-	-	-	-	-	-	-	-	3	2	3
Avg.	3	1.6	1.8	-	-	-	-	-	-	-	-	2.6	2.2	2

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

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2414	PATTERN RECOGNITION	L 3	T 0	P 0	C 3	100
Course Objectives	- Learn about supervised and unsupervised pattern classifiers. - Study the different clustering techniques. - Familiarize about different feature extraction techniques. - Explore the role of Hidden Markov model and SVM in pattern recognition. - Understand the application of Fuzzy logic and genetic algorithms for pattern classifier					

Unit-I	PATTERN CLASSIFIER	(8)
Overview of Pattern recognition- Discriminant functions- Supervised learning- Parametric estimation - Maximum Likelihood Estimation - Bayesian parameter Estimation - Problems with Bayes approach		
Unit-II	CLUSTERING	(9)
Clustering for unsupervised and supervised learning and classification - Clustering concept - C Means algorithm Hierarchical clustering - Graph theoretic approach to pattern Clustering		
Unit-III	FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION	(10)
Principle component analysis - Independent component analysis - Linear discriminant analysis Feature selection through functional approximation- Elements of formal grammars Syntactic description – Stochastic grammars- Structural Representation		
Unit-IV	HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE	(8)
State Machines- Hidden Markov Models- Training- Classification- Support vector Machine - Feature Selection- Case study- Recent development in patterns using SVM		
Unit-V	RECENT ADVANCES	(9)
Introduction to Fuzzy logic- Fuzzy Pattern Classifiers - Pattern Classification using Genetic Algorithms- Case Study Using Fuzzy Pattern Classifiers		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, First Edition, 2010.
2	Andrew Webb, "Statistical Pattern Recognition", Arnold publishers, Second Edition, 1999.

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REFERENCES:

1	Menahem Friedman , Abraham Kandel, “Introduction to Pattern Recognition Statistical, Structural, Neural and Fuzzy Logic Approaches”, World Scientific publishing, First Edition,2020.
2	S.Theodoridis and K.Koutroumbas, “Pattern Recognition”, Academic Press, Fourth Edition. 2009.
3	R.O.Duda, P.E.Hart and D.G.Stork, “Pattern Classification”, John Wiley, Second Edition, 2001.

COURSE OUTCOMES:

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

CO1:	Describe the fundamental issues and basics of machine learning.
CO2:	Discuss the architecture of Neural Network
CO3:	Develop and implement Convolutional Neural Networks
CO4:	Apply the use RNN for language modeling and time series prediction
CO5:	Establish the various applications of deep 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	-	-	-	3	2	3	-	3	3	2	3
CO2	3	2	2	-	-	-	2	2	3	-	2	2	3	2
CO3	2	2	2	-	-	-	3	3	3	-	1	1	2	2
CO4	3	2	2	-	-	-	3	2	2	-	2	2	2	2
CO5	3	2	2	-	-	-	3	2	3	-	2	2	2	2
Avg.	3	3	3	-	-	-	2	2	2	-	1	1	1	1

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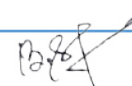
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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2415	MULTIMEDIA COMPRESSION TECHNIQUES	L 3	T 0	P 0	C 3	100
Course Objectives	- Understand the basic ideas of compression algorithms related to multimedia. - Introduce the components of text, speech, audio, image and video. - Study the basic principles of audio Compression. - Familiarize the fundamental concepts of Image Compression . - Learn the standards and techniques of video compression.					

Unit-I	FUNDAMENTALS OF COMPRESSION	(9)
Introduction to multimedia-Graphics, Image and Video representations – Fundamental concepts of video, digital audio – Storage requirements of multimedia applications – Need for compression – Taxonomy of compression Algorithms– Error Free Compression – Lossy Compression.		
Unit-II	TEXT COMPRESSION	(8)
Compression principles-source encoders and destination encoders –source encoding- text compression, Huffman coding Adaptive Huffman coding –arithmetic coding –Shannon Fano coding		
Unit-III	AUDIO COMPRESSION	(9)
Audio compression Techniques – μ Law and A Law companding - Speech compression - Frequency domain and filtering – Basic subband coding –Application to speech coding – G.722 – Application to audio coding – MPEG audio		
Unit-IV	IMAGE COMPRESSION	(9)
Image Compression: Fundamentals — Compression Standards – JPEG Standard –Sub-band coding – Wavelet Based compression – Implementation using Filters-EZW, SPIHT coders-JPEG 2000 standards - JBIG and JBIG2 standards		
Unit-V	VIDEO COMPRESSION	(10)
Video compression techniques and Standards–MPEG video coding: MPEG-1 and MPEG-2 video coding: MPEG-3 and MPEG-4–Motion estimation and compensation techniques–H.261 Standard – DVI technology – DVI real time compression – Current Trends in compression standards		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Fred Halshall "Multimedia Communication - Applications, Networks, Protocols and Standards", Pearson Education, Second Edition 2007.
2	Tay Vaughan, "Multimedia: Making it Work", 7 th Edition, TMH 2008 98.

REFERENCES:

1	Marcus Goncalves "Voice over IP Networks", Mc Graw Hill, Second Edition 1999.
2	KR. Rao, Z S Bojkovic, D A Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Education, First Edition 2002.
3	R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education Ranjan Parekh, "Principles of Multimedia", Second Edition TMH 2007.

COURSE OUTCOMES:

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

CO1:	Describe the fundamentals of compression techniques
CO2:	Illustrate the principles and standards of text compression techniques
CO3:	Explain the standards of Audio compression techniques
CO4:	Develop the techniques and standards of Image compression
CO5:	Determine the various real time applications using video compression

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	3	2
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO3	3	3	3	3	-	-	-	-	-	2	-	3	3	3
CO4	3	3	3	3	-	-	-	-	-	2	-	3	3	3
CO5	3	3	3	3	-	-	-	-	-	2	-	3	3	3
Avg.	3	3	3	3	-	-	-	-	-	2	1	1	1	1

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

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2416	DIGITAL VIDEO PROCESSING	L 3	T 0	P 0	C 3	100
Course Objectives	- Organize the fundamental knowledge about the processing of digital video signal in its time and frequency domain analysis - Analyze the motion estimation algorithms used in multi resolution video processing - Analyze the various coding Techniques used in video coding - Analyze the basic compression standards required for the transmission of video signal. - Analyze the error control mechanism and applications of Digital Video.					

Unit-I	VIDEO FORMATION, SAMPLING AND FOURIER ANALYSIS	(8)
Video Capture and Display - Analog Video Raster - Digital Video – notation and formats - Fourier Analysis of Video Signals - Spatial and Temporal Frequencies - Sampling Video in Two Dimensions: Progressive versus Interlaced Scans		
Unit-II	TWO-DIMENSIONAL MOTION ESTIMATION	(10)
Optical Flow - Optical Flow Equation and Ambiguity in Motion Estimation - Motion Estimation Criteria. Block-Matching Algorithm - Exhaustive and fast algorithms - Multi-resolution Motion Estimation - Application of Motion Estimation in Video Coding		
Unit-III	WAVEFORM-BASED VIDEO CODING	(10)
Block-Based Transform Coding: The Discrete Cosine Transform - DCT-Based Image Coders and the JPEG Standard - Predictive Coding: Spatial-Domain linear Prediction – Motion - Compensated Temporal Prediction		
Unit-IV	VIDEO COMPRESSION STANDARDS	(9)
Basic compression techniques - Video compression standards (H.261 and H.263- Overview – highlights - MPEG1 - MPEG2 - MPEG4 profiles and features		
Unit-V	ERROR CONTROL AND APPLICATIONS OF DIGITAL VIDEO	(8)
Error control in video communications, Digital video system and its applications		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	"Video Processing and Communications" by Yao Wang, Joern Ostermann, and Ya-Qin Zhang, Pr
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REFERENCES:

1	"Digital Video Processing," by Nurat Tekalp, Prentice Hall Signal Processing Series, 1995.
2	"Fundamentals of Multimedia", by Ze-Nian Li, and Mark S. Drew, Pearson Prentice Hall, October 2003
3	"Digital Video Editing Fundamentals" by Wallace Jackson, Apress, 2016 Edition, ISBN-13 (electronic): 978-1-4842-1866-2.

COURSE OUTCOMES:

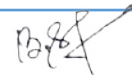
On completion of the course, the students will be able to

CO1:	Identify the importance of digital video applications in today's world
CO2:	Compare the motion estimation algorithms work in video processing
CO3:	Identify the various coding techniques used in video coding
CO4:	Compare the various and recent compression standards that exist
CO5:	Examine the video communication type of errors 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	1	1	1	-	-	-	-	-	-	-	3	-	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	-	2
CO3	3	1	1	3	-	-	-	-	-	-	-	3	-	2
CO4	3	1	1	3	-	-	-	-	-	-	-	3	-	2
CO5	3	3	3	2	-	-	-	-	-	-	-	3	-	3
Avg.	3	3	3	3	-	-	-	-	-	-	-	3	-	2.4

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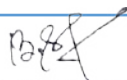
Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2417	DSP ARCHITECTURE AND PROGRAMMING	L	T	P	C	100
		2	0	2	3	
Course Objectives	• Study the architecture of programmable DSP processors • Learn to implement various standard DSP algorithms in DSP Processors • Use the Programmable DSP Processors to build real-time DSP systems					

Unit-I	ARCHITECTURES FOR PROGRAMMABLE DSP PROCESSORS	(6)
Basic Architectural features, DSP Computational building blocks, Bus architecture and memory, Data addressing capabilities, Address generation Unit, Programmability and program execution, Speed issues, Features for external interfacing		
Unit-II	TMS320C5X PROGRAMMABLE DSP PROCESSOR	(6)
Architecture of TMS320C54xx DSP processors, Addressing modes – Assembly language Instructions -Memory space, interrupts, and pipeline operation of TMS320C54xx DSP Processor, On-Chip peripherals, Block Diagram of TMS320C54xx DSP starter kit		
Unit-III	TMS320C6X PROGRAMMABLE DSP PROCESSOR	(6)
Commercial TI DSP processors, Architecture of TMS320C6x DSP Processor, Linear and Circular addressing modes, TMS320C6x Instruction Set, Assembler directives, Linear Assembly, Interrupts, Multichannel buffered serial ports, Block diagram of TMS320C67xx DSP Starter Kit and Support Tools		
Unit-IV	IMPLEMENTATION OF DSP ALGORITHMS	(6)
DSP Development system, On-chip, and On-board peripherals of C54xx and C67xx DSP development boards, Code Composer Studio (CCS) and support files, Implementation of Conventional FIR, IIR, and Adaptive filters in TMS320C54xx/TMS320C67xx DSP processors for real-time DSP applications, Implementation of FFT algorithm for frequency analysis in real-time		
Unit-V	APPLICATIONS OF DSP PROCESSORS	(6)
Voice scrambling using filtering and modulation, Voice detection and reverse playback, Audio effects, Graphic Equalizer, Adaptive noise cancellation, DTMF signal detection, Speech thesis using LPC, Automatic speaker recognition		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012
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2	RulphChassaing and Donald Reay, Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK, Second Edition, Wiley India (P) Ltd, New Delhi, 2008
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REFERENCES:

1	B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications", Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2	TMS320C5416/6713 DSK user manual at https://www.ti.com

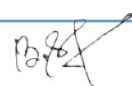
List of Exercises/Experiments

1. Real-Time Sine Wave Generation.	
2. Programming examples using C, Assembly and linear assembly.	
3. Implementation of moving average filter.	
4. FIR implementation with a Pseudorandom noise sequence as input to a filter.	
5. Fixed point implementation of IIR filter	
6. FFT of Real-Time input signal	
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 architectural features of DSP Processors.
CO2:	Comprehend the organization of TMS320C54xx DSP processors.
CO3:	Build solutions using TMS320C6x DSP Processor
CO4:	Implement DSP Algorithms
CO5:	Study the applications of DSP Processors.


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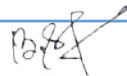
LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)	15
2.	TMS320C54xx/TMS320C67xx DSP Development board	15
3.	Code Composer Studio (CCS)	15
4.	Function Generator and Digital Storage Oscilloscope	15
5.	Microphone and speaker	5

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	2	2	2	-	-	1	-	2	3	3	3
CO3	3	3	2	2	2	2	-	-	1	-	2	2	2	2
CO4	3	3	3	2	2	2	-	-	1	-	2	2	3	2
CO5	3	3	3	3	2	2	-	-	1	-	2	2	3	2
Avg.	3	3	3	2	2	2	-	-	1	-	2	2	3	2

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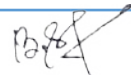


Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2418	ASIC DESIGN	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Identify the fundamentals of ASIC, CMOS logic and logical effort. - Enable the concepts of logic cells and I/O cells. - Introduce the basics of physical design and partitioning methods. - Learn about the floor planning and routing algorithms.					

Unit-I	INTRODUCTION TO ASIC, CMOS LOGIC AND ASIC LIBRARY DESIGN	(8)
Types of ASICs - Design flow - CMOS transistors - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance - Logical effort		
Unit-II	PROGRAMMABLE ASICS, LOGIC CELLS AND I/O CELLS	(8)
Anti fuse - static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA – Altera FLEX - Altera MAX - DC & AC outputs - DC & AC inputs - Clock input - Power input - Xilinx I/O blocks		
Unit-III	ASIC CONSTRUCTION	(9)
Physical design – CAD tools – System Partitioning – Power dissipation – FPGA Partitioning – Partitioning methods – Measuring connectivity – The Kernighan-Lin Algorithm – The Ratio-cut Algorithm – The look ahead Algorithm		
Unit-IV	FLOOR PLANNING, PLACEMENT AND ROUTING	(10)
Floor Planning Goals and Objectives, Measurement of Delay in floor planning, Floor planning tools, I/O and Power planning, Clock planning, Placement Algorithms. Routing: Global routing, Detailed routing, Special routing		
Unit-V	VERILOG HDL	(10)
Basics of the Verilog language – Operators – Hierarchy – Procedures and Assignments – Timing controls and delay – Tasks and Functions – Control statements – Logic-gate Modeling – Modeling delay		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	M.J.S.Smith, " Application Specific Integrated Circuits", Pearson, First edition, 2003.
2	Samir Palnitkar, "Verilog HDL – A Guide to Digital Design and Synthesis", Pearson, Second


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REFERENCES:

1	Roger Woods, John Mc Allister, Dr. Ying Yi, Gaye Lightbod, "FPGA-based Implementation of Signal Processing Systems", Wiley, Second Edition, 2008.
2	Steve Kilts, "Advanced FPGA Design," Wiley Inter-Science, Second Edition, 2007.

COURSE OUTCOMES:

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

CO1:	Describe the delay and delay minimization of circuits by using the logical effort technique.
CO2:	Explain the concepts of logic cells and I/O cells.
CO3:	Interpret the various partitioning algorithms for ASIC construction.
CO4:	Apply the algorithms of floor planning, placement and routing to optimize the area, power and speed.
CO5:	Develop digital circuits using Verilog HDL.

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	2	2	2	2
CO2	3	3	3	2	2	-	-	-	-	2	2	2	2	2
CO3	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	3	3	3	3
Avg.	3	3	3	2.6	2.6	-	-	-	-	2.6	2.6	2.6	2.6	2.6

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

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2419	LOW POWER IC DESIGN	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To learn the fundamentals of low power low voltage VLSI design. - To understand the impact of power on system performances. - To understand the different design approaches. - To develop the low power low voltage memories.					

Unit-I	FUNDAMENTALS OF LOW POWER CIRCUITS	(6)
Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects – Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect		
Unit-II	LOW-POWER DESIGN APPROACHES	(6)
Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits, Architectural Level Approach – Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures		
Unit-III	LOW-VOLTAGE LOW-POWER ADDERS	(6)
Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low Voltage Low Power Design Techniques – Trends of Technology and Power Supply Voltage, Low Voltage Low-Power Logic Styles		
Unit-IV	LOW-VOLTAGE LOW-POWER MULTIPLIERS	(6)
Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier		
Unit-V	LOW-VOLTAGE LOW-POWER MEMORIES	(6)
Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:	
1	Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", TMH, 2011.
2	Kiat-Seng Yeo, Kaushik Roy, "Low-Voltage, Low-Power VLSI Subsystems", TMH Professional Engineering, 2004.

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REFERENCES:

1	Ming-BO Lin, "Introduction to VLSI Systems: A Logic, Circuit and System Perspective", CRC Press, 2012.
2	Anantha Chandrakasan, "Low Power CMOS Design", IEEE Press, /Wiley International, 1998
3	Kaushik Roy, Sharat C. Prasad, "Low Power CMOS VLSI Circuit Design", John Wiley, & Sons, 2000.
4	Gary K. Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Press, 2002

List of Exercises/Experiments

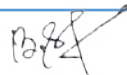
1. Modeling and sources of power consumption.
2. Power estimation at different design levels (mainly circuit, transistor, and gate).
3. Power optimization for combinational circuits.
4. Power optimization for sequential circuits.
5. Power optimization for RT and algorithmic levels.

Total No of Periods to be Taught

30 Periods

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	PCs	15
2.	Simulation Software (P Spice/ Tanner/Model Sim)	15


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COURSE OUTCOMES:

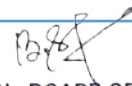
On completion of the course, the students will be able to

CO1:	Understand the fundamentals of Low power circuit design.
CO2:	Attain the knowledge of architectural approaches.
CO3:	Analyze and design Low-Voltage Low-Power combinational circuits.
CO4:	Learn the design of Low-Voltage Low-Power Memories
CO5:	Design and develop Low Power, Low Voltage 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	2	3	2	-	-	-	-	-	2	2	2	2
CO2	3	2	1	2	3	-	-	-	-	-	1	2	2	1
CO3	3	3	3	2	2	-	-	-	-	-	1	2	2	2
CO4	2	3	3	3	3	-	-	-	-	-	1	2	3	3
CO5	3	3	3	2	2	-	-	-	-	-	2	2	2	3
Avg.	2.8	2.8	2.4	2.4	2.4	-	-	-	-	-	1.8	2	2	2

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


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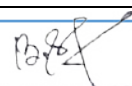
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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2420	VLSI TESTING AND VERIFICATION	L 3	T 0	P 0	C 3	100
Course Objectives	- Introduce the different types of faults in digital circuits at gate level. - Enable the concepts of fault simulation and test generation. - Learn about the scan based testing with respect to search space, speed and fault coverage. - Expose the architecture of built-in self-test to handle the design complexity of the circuit. - Understand the different test architectures of VLSI circuits.					

Unit-I	FAULT MODELING	(9)
Importance of testing - Testing during the VLSI lifecycle - Challenges in the VLSI testing: Test generation - Fault models - Levels of abstraction in VLSI testing - Historical review of VLSI test technology - Functional versus structural testing - Fault models - Fault equivalence - Single-Fault model - Fault collapsing - Delay fault		
Unit-II	FAULT SIMULATION AND TEST GENERATION	(9)
Simulation model - Timing models - Fault simulation: Serial, Parallel, Deductive, Concurrent - Combinational test generations - ATPG for combinational circuits - D-Algorithm - Testability analysis - SCOAP measures for combinational circuits		
Unit-III	SCAN BASED TESTING	(9)
Design for testability basics - Ad Hoc approach - Structured approach - Scan cell designs - Scan architectures - Scan design rules - Scan design flow – Special purpose scan designs - RTL design for testability		
Unit-IV	BUILT-IN SELF-TEST	(9)
BIST design rules - Test pattern generation - Exhaustive testing - Pseudo-random testing – Pseudo exhaustive testing - Delay fault testing - Output response analysis - Logic BIST architectures - BIST architectures for circuits with and without scan chains		
Unit-V	BOUNDARY SCAN, CORE BASED TESTING AND TEST COMPRESSION AND COMPACTION	(9)
Digital boundary scan (IEEE Std. 1149.1): Test architecture and operations - On-Chip test support with boundary scan - Board and system-Level boundary-Scan control architectures. Test stimulus compression: Code - based schemes - Linear - decompression - Based schemes - Test response compaction		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Z.Navabi, "Digital System Test and Testable Design", Springer, Second edition, 2011.
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REFERENCES:

1	Laung-Terng Wang, Cheng-Wen Wu, and Xiaoping Wen, VLSI Test Principles and Architectures, The Morgan Kaufmann, Third edition, 2017.
2	Niraj K. Jha and Sandeep Gupta, "Testing of Digital Systems", Cambridge University Press,

COURSE OUTCOMES:

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

CO1:	Describe the different fault models of the circuit. Remember
CO2:	Explain the concepts of fault simulations and test generations.
CO3:	Illustrate scan based testing for VLSI circuits.
CO4:	Interpret the BIST techniques for improving testability.
CO5:	Develop the boundary scan based test architectures

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	2	2	2	2
CO2	3	3	3	2	2	-	-	-	-	2	2	2	2	2
CO3	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	3	3	3	3
Avg.	3	3	3	2.6	2.6	-	-	-	-	2.6	2.6	2.6	2.6	2.6

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

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2421	SYSTEM ON CHIP	L 3	T 0	P 0	C 3	100
Course Objectives	- Introduce design methodology and optimization of cores in system-on-Chip. - Understand the concept of Communication Buses in on-chip memories. - Learn the SoC design with interconnection structures. - Enable them understanding about Quality-of-Service in Network on chip. - Expose the students in Design and Validation of Cores in system on chip.					

Unit-I	DESIGN METHODOLOGY FOR LOGIC CORES , MEMORY AND ANALOG CORES	(9)
Introduction - Architecture of the present-day SoC - Design issues of SoC- Hardware-Software Co design – Core Libraries – EDA Tools- SoC Design Flow – guidelines for design reuse -- Design Process for Soft and Firm Cores -Design Process for Hard Cores -System Integration.- Embedded memories – design methodology for embedded memories – Specification of analog cores - High-Speed Circuits		
Unit-II	COMMUNICATION BUSES FOR SOC ARCHITECTURES	(9)
Introduction- AMBA Bus -Sonics SMART Interconnects- Core Connect Bus- STBus- FPGA On-Chip Buses- Open Standards- Wishbone- Other Specific Buses - Security		
Unit-III	NETWORK ON CHIP INTERCONNECTION STRUCTURES	(9)
Introduction- Bus-based Structures - Network on Chip – NoC Interconnection Structures- Topologies-routing- flow control- network components-router/switch- network interface- Links. Available NoC Implementations and Solutions –IBM Cell		
Unit-IV	QUALITY-OF-SERVICE IN NOCS	(9)
Architectures for QoS- Traffic Class Segregation in Space-Traffic Class Segregation in Time - Other Methods for Traffic Class Segregation - Fairness of Traffic Delivery- Monitoring and Feedback-Memory Controllers- Methods for QoS Analysis- Synthesis Methods for Supporting QoS- Meeting Average-Case Constraints		
Unit-V	SOC DESIGN CORES AND VALIDATION	(9)
Microprocessor Cores- V830R/AV Super scaler RISC Core- Design of PowerPC 603e G2 Core- Comments on Memory Core Generators- Core Integration and On-Chip Bus- Examples of SoC Core-Level Validation Core Interface Verification- SoC Design Validation		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	Rochit Rajsuman, "System-on-a-chip: Design and test", Advantest America R & D Center, Second edition 2000
---	---

REFERENCES:

1	Jose L. Ayala, Communication Architectures for Systems-on-Chip, CRC Press, First Edition, 2011.
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COURSE OUTCOMES:

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

CO1:	Enumerate complex issues in designing system-on-chip cores.
CO2:	Explain the Communication Buses in SoC based design.
CO3:	Express the interconnection structures in a SoC / NoC based system 0020 design.
CO4:	Develop Quality-of-Service in Network on chip
CO5:	Apply and eliminate the issues relevant to design of Cores.

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	2	2	2	2
CO2	3	3	3	2	2	-	-	-	-	2	2	2	2	2
CO3	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	3	3	3	3
Avg.	3	3	3	2.6	2.6	-	-	-	-	2.6	2.6	2.6	2.6	2.6
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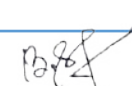
Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2422	COMPUTER AIDED DESIGN FOR VLSI	L 3	T 0	P 0	C 3	100
Course Objectives	- Understand the VLSI circuits physical design automation and fabrication. - Study the characteristic of Digital Electronics Design and its environment. - Represent the Layout and synthesis of CAD tools. - Express of VLSI CAD tools. - Implement the Programming of VLSI CAD.					

Unit-I	VLSI PHYSICAL DESIGN AUTOMATION & FABRICATION OF VLSI CIRCUITS	(9)
Introduction -- VLSI Physical Design cycle -- Design packing styles - System packing styles -- Fabrication materials -- Transistor Fundamentals -- Fabrication of VLSI circuits --Design rules -- Layout of Basic devices		
Unit-II	CHARACTERISTICS OF DIGITAL ELECTRONICS DESIGN & ITS ENVIRONMENTS	(10)
VLSI system design process -- Design system computer -- Design as Constraint optimization -- Four characteristics of Digital Electronic design -- Views and Topologies- connectivity & Spatial Dimensionality --Primitives - Environment -- Designing Level		
Unit-III	REPRESENTATION & SYNTHESIS TOOLS	(8)
Representation issues - types -- Cell contents generation - Manipulation -- Generation of Layouts outside the cells -- Cell and their environments-- Silicon compilers -- Post Layout Generations		
Unit-IV	STATIC AND DYNAMIC TOOLS ANALYSIS	(10)
Node Extraction -- Geometric Design - Electrical Rule checker-- Verification -- Circuit Level Simulator -- Logic Level Simulator--Functional Level simulator -- Behavioral Level simulator -- Simulation issues -- Event driven simulation -- Hardware & simulation		
Unit-V	OUTPUT DESIGN AIDS AND PROGRAMMABILITY	(8)
Circuit Boards - ICs-- Implementation issues -- Imperative Programming -- Declarative Programming -- Hierarchy		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Stephen Trimberger," Introduction to CAD for VLSI", Kluwer Academic publisher, 2002
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2	N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.
3	Steven M. Rubin "Computer Aids for VLSI Design", Addison Wesley Publishing 1987.,

REFERENCES:

1	Gaynor E. Taylor, G. Russell, "Algorithmic and Knowledge Based CAD for VLSI", Peter peregrinus ltd. London.
2	S H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
3	Sadiq M. Sait, Habib Youssef, "VLSI Physical Design automation: Theory and Practice", World Scientific 1999.

COURSE OUTCOMES:

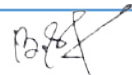
On completion of the course, the students will be able to

CO1:	Identify the automation and fabrication Techniques of VLSI circuits.
CO2:	Illustrate the characteristic of Digital Electronics Design and its environment.
CO3:	Represent the Layout of CAD tools and synthesis methods.
CO4:	Explain the VLSI CAD tools in static and dynamic mode
CO5:	Illustrate the VLSI CAD Programming.

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	2	2	2	2
CO2	3	3	3	2	2	-	-	-	-	2	2	2	2	2
CO3	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	3	3	3	3
Avg.	3	3	3	2.6	2.6	-	-	-	-	2.6	2.6	2.6	2.6	2.6

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week				Credit	Maximum Marks
UECPE2423	DIGITAL SYSTEM DESIGN USING FPGAs	L 3	T 0	P 0	C 3		100
Course Objectives	- Recognize the Programmable Logic - Infer PCB Design - Relate Design Languages - Illustrate the testing of Electronic System - Relate the System Level Design						

Unit-I	INTRODUCTION TO PROGRAMMABLE LOGIC	(9)
Electronic Circuits: Analogue and Digital - Continuous Time versus Discrete -Analogue versus Digital - Programmable Logic versus Discrete Logic- Programmable Logic versus Processors - Types of Programmable Logic Simple Programmable Logic Device (SPLD) - Complex Programmable Logic Device (CPLD)- Field Programmable Gate Array (FPGA)-PLD Configuration Technologies - Programmable Logic Vendors-Programmable Logic Design Methods and Tools- Typical PLD Design Flow		
Unit-II	PCB DESIGN	(9)
Structure of the PCB - PCB Design-PCB Manufacture-PCB Testing.-Environmental Issues - Case Study PCB Designs -CPLD Development Board-LCD and Hex Keypad Board-PC Interface Board- Digital I/O Board-Analogue I/O Board		
Unit-III	DESIGN LANGUAGES	(9)
Software Programming Languages - Introduction - C – C- JAVATM - Visual BasicTM- Scripting Languages - PHP - Hardware Description Languages- -VHDL – Verilog HDL – Verilog A- VHDL AMS-Verilog AMS – SPICE- SystemC – System Verilog- Mathematical Modeling Tools		
Unit-IV	TESTING THE ELECTRONIC SYSTEM	(9)
Integrated Circuit Testing - Digital IC Testing- Analogue IC Testing - Mixed-Signal IC Testing- Printed Circuit Board - 633 9.4 Boundary Scan Testing - Software Testing		
Unit-V	SYSTEM-LEVEL DESIGN	(9)
Electronic System-Level Design - DC Motor Control- Motor Control System Overview- MATLAB/ Simulink Model Creation and Simulation - Translating the Design to VHDL- Concluding Remarks - Digital Filter Design Introduction Filter- Overview - MATLAB/ Simulink Model Creation and Simulation Translating the Design to VHDL- Automating the Translation.		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	Ian Grout "Digital Systems Design with FPGA ",Elsevier, newness Publication, First Edition, 2015.

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REFERENCES:

1	Cem Unsalan and Bora Tar " Digital System Design with FPGA-Implementation using Verilog and VHDL" McGraw Hill Publication, Second Edition, 2018
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COURSE OUTCOMES:

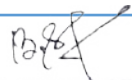
On completion of the course, the students will be able to

CO1:	Describe the Programmable Logic Rememner
CO2:	Extract PCB Design
CO3:	Interpret Design Languages
CO4:	Correlate the electronic system testing
CO5:	Conclude System level Design

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	2	2	2	2
CO2	3	3	3	2	2	-	-	-	-	2	2	2	2	2
CO3	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	3	3	3	3
Avg.	3	3	3	2.6	2.6	-	-	-	-	2.6	2.6	2.6	2.6	2.6

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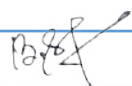
Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2424	VLSI SIGNAL PROCESSING	L 3	T 0	P 0	C 3	100
Course Objectives	- Understand Pipelining, and parallel processing. - Use VLSI design for digital filters - Optimize VLSI architectures for basic DSP algorithm - Analyze various parallel processing algorithms					

Unit-I	INTRODUCTION TO DSP SYSTEMS	(9)
Introduction To DSP Systems: Introduction; representation of DSP algorithms: Block Diagram, signal flow graph, data flow graph, dependence graph, Pipelining and Parallel processing of FIR filters, Pipelining and Parallel processing for low power systems		
Unit-II	RETIMING, ALGORITHMIC STRENGTH REDUCTION	(9)
Loop bound, iteration bound, Longest path matrix algorithm, Retiming – definitions and properties, Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application		
Unit-III	FAST CONVOLUTION, PIPELINING AND PARALLEL PROCESSING OF IIR FILTERS	(9)
Fast convolution – Cook-Toom algorithm, modified Cook-Toom algorithm, Pipelined and parallel Recursive filters – Look-Ahead pipelining in first-order IIR filters		
Unit-IV	BIT-LEVEL ARITHMETIC ARCHITECTURES	(9)
Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and Carry-save multipliers, Design of Lyon's bit-serial multipliers using Horner's rule		
Unit-V	NUMERICAL STRENGTH REDUCTION	(9)
Numerical strength reduction – sub-expression elimination, multiple constant multiplication, iterative matching, synchronous pipelining and clocking styles, clock skew in edge-triggered single phase Clocking, two-phase clocking, wave pipelining		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	R. Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and implementation ", Wiley, Interscience, 2007
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2	U. Meyer – Baese, “ Digital Signal Processing with Field Programmable Gate Arrays”, Springer, Second Edition, 2004.
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REFERENCES:

1	Mohammad Isamail and Terri Fiez, Analog VLSI signal and information processing, McGraw Hill, 1994
2	S.Y. Kung, H.J. White House, T. Kailath, VLSI and Modern Signal Processing, Prentice

COURSE OUTCOMES:

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

CO1:	Understand Pipelining, and parallel processing
CO2:	Use VLSI design for digital filters
CO3:	Optimize VLSI architectures for basic DSP algorithms
CO4:	Analyze various parallel processing algorithms
CO5:	Understand pipelining and clock timings.

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	2	2	2	2
CO2	3	3	3	2	2	-	-	-	-	2	2	2	2	2
CO3	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	3	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	3	3	3	3
Avg.	3	3	3	2.6	2.6	-	-	-	-	2.6	2.6	2.6	2.6	2.6

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2425	MIXED SIGNAL IC DESIGN TESTING	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To know about mixed-signal devices and the need for testing • To study the various techniques for testing. • To learn about ADC and DAC based testing. • To understand the Clock and Serial Data Communications • To study the general purpose measuring devices.					

Unit-I	MIXED – SIGNAL TESTING	(6)
Common Types of Analog and Mixed- Signal Circuits – Applications of Mixed-Signal Circuits - Post-Silicon Production Flow - Test and Packing – Characterization versus Production Testing - Test and Diagnostic Equipment - Automated Test Equipments – Wafer Probers – Handlers – E-Beam Probers – Focused Ion Beam Equipments – Forced –Temperature		
Unit-II	YIELD, MEASUREMENT ACCURACY, AND TEST TIME	(6)
Yield - Measurement Terminology - Repeatability, Bias, and Accuracy - Calibrations and Checkers - Tester Specifications - Reducing Measurement Error with Greater Measurement Time – Guardbands - Effects of Measurement Variability on Test Yield - Effects of Reproducibility and Process Variation on Yield - Statistical Process Control		
Unit-III	DAC TESTING	(6)
Basics of Data Converters -Principles of DAC and ADC Conversion, Data Formats, Comparison of DACs and ADCs, DAC Failure Mechanisms - Basic DC Tests - Transfer Curve Tests - Dynamic DAC Tests - Tests for Common DAC Applications		
Unit-IV	ADC TESTING	(6)
ADC Testing Versus DAC Testing - ADC Code Edge Measurements - Edge Code Testing Versus Center Code Testing, Step Search and Binary Search Methods, Servo Method, Linear Ramp Histogram Method, Histograms to Code Edge Transfer Curves, Rising Ramps Versus Falling Ramps, Sinusoidal Histogram Method - DC Tests and Transfer Curve Tests - Dynamic ADC Tests - Tests for Common ADC Applications		
Unit-V	CLOCK AND SERIAL DATA COMMUNICATIONS CHANNEL MEASUREMENTS	(6)
Synchronous and Asynchronous Communications - Time-Domain Attributes of a Clock Signal - Frequency-Domain Attributes of a Clock Signal - Communicating Serially Over a Channel - Bit Error Rate Measurement - Methods to Speed Up BER Tests in Production - Deterministic Jitter Decomposition - Jitter Transmission Tests		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

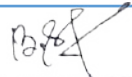
1	Gordon W.Roberts, Friedrich Taenzler, Mark Burns, "An Introduction to Mixed-signal IC Test and Measurement" Oxford University Press, Inc.2012 (Unit I - V).
2	M.L.Bushnell and V.D.Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002. (Unit - III)
	Bapiraju Vinnakota, "Analog and mixed-signal test", Prentice Hall, 1998.(Unit - II)
	Digital and Analogue Instrumentation: Testing and Measurement by Nihal Kularatna

List of Exercises/Experiments

List of Experiments	
1. PLL characteristics and its use as Frequency Multiplier, Clock synchronization	
2. R-2R Ladder Type and Flash Type ADC.	
3. DC power supply using LM317 and LM723.	
4. Design of asynchronous counter	
5. Design of synchronous counter.	
6. Implementation and Testing of RS Latch and Flip-flops	
Total No of Periods to be Taught	30 Periods

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Digital trainer kits	15
2.	Digital ICs :ICs 7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151 / 74147 / 7445 / 7476/7491/ 555 / 7494 / 7447 / 74180 / 7485 / 7473 / 74138 / 7411 / 7474	30
	Bread Boards	15


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COURSE OUTCOMES:

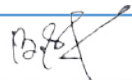
On completion of the course, the students will be able to

CO1:	Learn the fundamentals of mixed signal circuits.
CO2:	Define the various measurement terminologies
CO3:	Acquire knowledge of Analog to Digital Converters
CO4:	Learn testing of Analog to Digital Converters.
CO5:	Comprehend the attributes of a clock signal

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	3
CO2	3	3	2	2	1	2	-	-	-	-	2	3	2	3
CO3	3	3	2	2	2	2	-	-	-	-	2	3	2	3
CO4	3	3	3	2	2	1	-	-	-	-	2	1	2	2
CO5	3	3	3	2	2	2	-	-	-	-	3	2	1	2
Avg.	3	3	2.8	2.2	1.8	1.8	-	-	-	-	2.2	3	2	2

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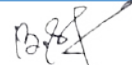


Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2426	ANALOG POWER IC DESIGN	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To study the basics of MOS Circuits. • To analyse the noise characteristics of amplifiers. • To study the performance parameters of amplifiers. • To comprehend the compensation techniques • To understand the detection and testing of faults.					

Unit-I	SINGLE STAGE AMPLIFIERS	(6)
Basic MOS physics and equivalent circuits and models, CS, CG and Source Follower, differential amplifier with active load, Cascode and Folded Cascode configurations with active load, design of Differential and Cascode Amplifiers – to meet specified SR, noise, gain, BW, ICMR and power dissipation, voltage swing, high gain amplifier structures		
Unit-II	HIGH FREQUENCY AND NOISE CHARACTERISTICS OF AMPLIFIERS	(6)
Miller effect, association of poles with nodes, frequency response of CS, CG and Source Follower, Cascode and Differential Amplifier stages, statistical characteristics of noise, noise in Single Stage amplifiers, noise in Differential Amplifiers		
Unit-III	FEEDBACK AND SINGLE STAGE OPERATIONAL AMPLIFIERS	(6)
Properties and types of negative feedback circuits, effect of loading in feedback networks, operational amplifier performance parameters, single stage Op Amps, two-stage Op Amps, input range limitations, gain boosting, slew rate, power supply rejection, noise in Op Amps		
Unit-IV	STABILITY , FREQUENCY COMPENSATION	(6)
Multipole Systems, Phase Margin, Frequency Compensation, Compensation Of Two Stage Op Amps, Slewing In Two Stage Op Amps, Other Compensation Techniques		
Unit-V	LOGIC CIRCUIT TESTING	(6)
Faults in Logic Circuits- Basic Concepts of Fault Detection- Design for Testability- Ad Hoc Techniques, Level-Sensitive Scan Design, Partial Scan, Built-in Self-Test		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:	
1	Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", TMH, 2011.
2	Kiat-Seng Yeo, Kaushik Roy, "Low-Voltage, Low-Power VLSI Subsystems", TMH Professional Engineering, 2004.


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REFERENCES:

1	Ming-BO Lin, "Introduction to VLSI Systems: A Logic, Circuit and System Perspective", CRC Press, 2012.
2	Anantha Chandrakasan, "Low Power CMOS Design", IEEE Press, /Wiley International, 1998
3	Kaushik Roy, Sharat C. Prasad, "Low Power CMOS VLSI Circuit Design", John Wiley, & Sons, 2000.
4	Gary K. Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Press, 2002

List of Exercises/Experiments

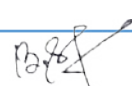
1. Design a CMOS inverter and analyze its characteristics.
2. Design a Common source amplifier and analyze its performance.
3. Design a Common drain amplifier and analyze its performance.
4. Design a Common gate amplifier and analyze its performance.
5. Design a differential amplifier with resistive load using transistors.
6. Design three stage and five stage ring oscillator circuit and compare its frequencies

Total No of Periods to be Taught

30 Periods

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	PCs	10
2.	Cadence/Tanner/equivalent EDA Tools	10


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COURSE OUTCOMES:

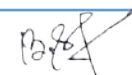
On completion of the course, the students will be able to

CO1:	Design amplifiers to meet user specifications.
CO2:	Analyse the frequency and noise performance of amplifiers.
CO3:	Design and analyse feedback amplifiers and one stage op amps .
CO4:	Analyse stability of op amp.
CO5:	Testing experience of logic 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	3	2	-	-	-	-	-	2	3	3	3
CO2	3	3	2	2	1	-	-	-	-	-	2	3	2	3
CO3	3	3	2	2	2	-	-	-	-	-	2	3	2	3
CO4	3	3	3	2	2	-	-	-	-	-	2	1	2	2
CO5	3	3	3	2	2	-	-	-	-	-	3	2	1	2
Avg.	3	3	2.6	2.2	1.8	-	-	-	-	-	2.2	2.4	2	2

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


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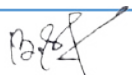
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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2427	EMBEDDED SENSING TECHNOLOGIES	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Discuss the overview of wireless sensor networks • Familiarize the architecture of different networks • Get the knowledge about various communication protocols • Acquire the different types of tracking technologies in WSN • Know about the implementation of protocols on WSN in various applications.					

Unit-I	OVERVIEW OF WIRELESS SENSOR NETWORKS	(9)
Opportunities and Challenges in Wireless Sensor Networks-Next Generation Technologies to Enable Sensor Networks-Sensor Network Management-Models for Programmability in Sensor Networks-Routing Techniques in Wireless Sensor Networks		
Unit-II	SENSOR NETWORKS ARCHITECTURE	(9)
Motivation and Objectives- SNs — Global View and Requirements- Individual Components of SN Nodes- Sensor Network Node- Wireless SNs as Embedded Systems-Tiered ArchitecturesSpectrum of Sensor Network Hardware- Task Decomposition and Allocation-Forming Tiered Architectures-Routing and Addressing in a Tiered Architecture- Drawbacks of Tiered ArchitecturesPower-Efficient Topologies for Wireless Sensor Networks		
Unit-III	COMMUNICATION PROTOCOLS FOR SENSOR NETWORKS	(9)
Introduction- Applications/Application Layer Protocols-Localization Protocols-Time Synchronization Protocols-Transport Layer Protocols- Network Layer Protocols-Data Link Layer Protocols		
Unit-IV	TRACKING TECHNOLOGIES IN WSN	(9)
Coverage in Wireless Sensor Networks-Location Management in Wireless Sensor Networks Positioning and Location Tracking in Wireless Sensor Networks-Tracking Techniques in Air Vehicle Based Decentralized Sensor Networks		
Unit-V	NETWORK SUPPORT FOR EMBEDDED APPLICATIONS	(9)
Introduction - Bluetooth Architecture- Bluetooth Interoperability with the Internet and Quality of Service- Implementation Issues in Bluetooth based Wireless Sensor Networks- Low Rate Wireless Personal Area Networks-Data Centric Storage in Wireless Sensor Networks		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Mohammad Ilyas, Imad Mahgaob, "Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems", CRC Press, First Edition, 2005.
2	Anna Hac, "Wireless Sensor Network Designs", John Wiley & Sons Ltd, First Edition, 2003

REFERENCES:

1	Feng Zhao, Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, First Edition, 2007
2	Kazem Sohraby, Daniel Minoli, and Taieb Znati, "Wireless Sensor Networks-Technology, Protocols and Applications", John Wiley & Sons Ltd, First Edition, 2012.
3	Bhaskar Krishnamachari, "Networking Wireless Sensors", Cambridge Press, First Edition, 2005

COURSE OUTCOMES:

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

CO1:	Describe the basics of wireless sensor networks
CO2:	Illustrate about the sensor network components, architecture and design Principles of WSN.
CO3:	Explain the need of communication protocols
CO4:	Develop the various tracking technologies in WSN
CO5:	Discover the various embedded 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	1	-	-	-	-	-	1	-	3	2	1
CO2	3	2	2	1	-	-	-	-	-	1	-	3	2	1
CO3	3	2	2	1	-	-	-	-	-	1	-	3	2	1
CO4	3	3	3	2	-	-	-	-	-	1	-	3	2	1
CO5	3	3	3	2	-	-	-	-	-	1	-	3	2	1
Avg.	3	2.6	2.6	1.7	-	-	-	-	-	1	-	3	2	1

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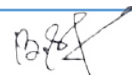
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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2428	IOT FOR INDUSTRIAL APPLICATIONS	L 3	T 0	P 0	C 3	100
Course Objectives	- Understand the IoT concepts and architecture in industrial systems - Familiarize the architecture design skills in industrial IoT. - Learn the network Layer and Middle wares. - Introduce the tools of Software Design and WAN Technologies for IoT - Understand the state of art development in Industry 4.0 and its applications.					

Unit-I	INTRODUCTION TO IIoT	(9)
Introduction, Key IIoT technologies, Catalysts and precursors of IIoT, Innovation and the IIoT, Key opportunities and benefits, Applications of IIoT: Healthcare, Oil and Gas Industry, Logistics and the Industrial Internet, Retail applications, IoT innovations and design methodologies		
Unit-II	IIoT REFERENCE ARCHITECTURE	(9)
The IIC Industrial Internet Reference Architecture-Industrial Internet Architecture Framework Gateway-Mediated Edge-Connectivity-Key System Characteristics-Data Management-Designing Low-Power Device Networks-RS232 Serial Communications		
Unit-III	ACCESS NETWORK LAYER AND MIDDLEWARES	(9)
Access networks connecting remote edge networks: Carrier Ethernet, Profinet, Synchronous real time, Middleware Transport protocols: Reliable transport protocol (RTP), Constrained application protocol (CoAP), Application Program Interface Design, Technical perspective		
Unit-IV	SOFTWARE DESIGN AND WAN TECHNOLOGIES FOR IIoT	(9)
Middleware Software patterns: Publish patterns, subscribe patterns, MQTT, XMPP, AMQP, DDS, Delay tolerant networks, Design of Web services for IIoT, HTTP Verb binding-Proximity network communication protocols, IIoT WAN protocols: SigFox, LoRaWAN, nWave, Dash7		
Unit-V	INDUSTRY 4.0 SECURITY AND ITS SMART APPLICATIONS	(9)
Security in Industrial systems, Securing the OT, Network level potential threats, System level potential threats, Identity access management- Introduction to Industry 4.0, Characteristics of Industry 4.0, Design principles and Building blocks, Smart manufacturing, smart factories, Real world smart factories		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Alasdair Gilchrist, "Industry 4.0 - Industrial Internet of Things", Springer, A Press, USA, First Edition, 2016.
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REFERENCES:

1	Olivier Hersent, David Boswarthick and Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Willy Publications, Second Edition, 2012
2	Sabina Jeschke, Christian Brecher Houbing Song and Danda B. Rawat Editors, "Industrial Internet of Things Cyber Manufacturing Systems", Springer, First Edition, 2017.
3	O. Vermesan, "Digitizing the Industry: Internet of things connecting Physical Digital and Virtual Worlds", River Publishers, The Netherlands, First Edition, 2016.

COURSE OUTCOMES:

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

CO1:	Examine the technologies, Catalysts and precursors of IIoT using suitable use cases
CO2:	Describe the Industrial IoT Reference Architecture Framework
CO3:	Illustrate the Access Network Layer and Middleware protocols
CO4:	Discover software industrial IoT Systems
CO5:	Experiment IoT based solutions for real time 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	2	1	1	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	2	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	3	3	-
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	-
Avg.	3	2.8	2.8	2.5	-	-	-	-	-	-	-	2.9	2.9	-

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

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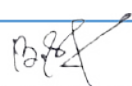


Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2429	ROBOTICS AND AUTOMATION	L 3	T 0	P 0	C 3	100
Course Objectives	- Recognize various types of Robots and the functional elements of Robotics - Impart knowledge of robot drive systems - Plan various types of end effectors - Demonstrate on various sensors used in Robotic automation - Score knowledge of basics of Robot Programming and robotic Applications.					

Unit-I	BASIC CONCEPTS	(9)
Introduction - brief history - definition - anatomy, types – classification - specification and need based applications - role and need of robots for the immediate problems of the society – future of mankind and automation - ethical issues; Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov's laws of robotics		
Unit-II	POWER SOURCES AND SENSORS	(9)
Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.		
Unit-III	MANIPULATORS, ACTUATORS AND GRIPPERS	(9)
Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations		
Unit-IV	KINEMATICS AND PATH PLANNING	(9)
Solution of inverse kinematics problem – multiple solution jacobian work envelop – hill climbing techniques – robot programming languages		
Unit-V	CASE STUDIES AND OTHER RESEARCH TRENDS IN ROBOTICS	(9)
Multiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot. Cognitive robotics - Evolutionary robotics –Humanoids		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, Industrial Robotics, Technology, Programming & Applications, Tata McGraw Hill Education Pvt. Ltd 2012, 2nd Edition, New Delhi*
2	S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill, 2009, 2nd Edition


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	Groover M.P.-Automation, production systems and computer integrated manufacturing – Pearson Education 4th Edition, 2015.*
	Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2011.

REFERENCES:

1	S B Niku, Introduction to Robotics, Analysis, Control, Applications, 2nd Edition, Wiley Publication, 2015.
2	Mikell P. Groover, Automation, Production Systems & Computer Integrated Manufacturing, PHI Learning Pvt. Ltd. , New Delhi, ISBN:987-81-203-3418-2, 2012.
3	John Craig, Introduction to Robotics, Mechanics and Control, 3rd Edition, Pearson Education, 009

COURSE OUTCOMES:

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

CO1:	Categorize the basic concepts of robotics.
CO2:	Select appropriate drive for Robotic applications.
CO3:	Compare And Select robot and end effectors as per application.
CO4:	Select proper sensors for robot as per application requirement.
CO5:	Survey about the fundamentals of robot programming and 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	2	3	1	1
CO2	3	2	2	-	2	-	-	-	-	2	2	3	1	1
CO3	3	3	2	-	2	-	-	-	-	2	2	3	1	1
CO4	3	2	1	-	1	-	-	-	-	1	2	3	1	1
CO5	3	2	2	-	2	-	-	-	-	3	2	3	1	1
Avg.	3	3	2	-	2	-	-	-	-	3	2	3	1	1

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

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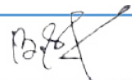
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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2430	IOT BASED SYSTEMS DESIGN	L 3	T 0	P 0	C 3	100
Course Objectives	- To understand the basics of IoT. - To get knowledge about the various services provided by IoT. - To familiarize themselves with various communication techniques and networking. - To know the implementation of IoT with different tools. - To understand the various applications in IoT.					

Unit-I	INTRODUCTION TO INTERNET OF THINGS	(9)
Rise of the machines – Evolution of IoT – Web 3.0 view of IoT – Definition and characteristics of IoT – IoT Enabling Technologies – IoT Architecture – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects - IoT levels and deployment templates – A panoramic view of IoT applications		
Unit-II	MIDDLEWARE AND PROTOCOLS OF IOT	(9)
Middleware technologies for IoT system (IoT Ecosystem Overview – Horizontal Architecture Approach for IoT Systems – SOA based IoT Middleware) Middleware architecture of RFID,WSN,SCADA,M2M – Interoperability challenges of IoT-Protocols for RFID,WSN,SCADA,M2M- Zigbee, KNX,BACNet,MODBUS - Challenges Introduced by 5G in IoT Middleware(Technological Requirements of 5G Systems - Perspectives and a Middleware Approach Toward 5G (COMPaaS Middleware) – Resource management in IoT		
Unit-III	COMMUNICATION AND NETWORKING	(9)
IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition –Application Layer Protocols: CoAP and MQTT- Data aggregation & dissemination		
Unit-IV	IOT IMPLEMENTATION TOOLS	(9)
Introduction to Python, Introduction to different IoTtools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python, Implementation of IoT with Raspberry Pi		
Unit-V	APPLICATIONS AND CASE STUDIES	(9)
Home automations - Smart cities – Environment – Energy – Retail – Logistics – Agriculture – Industry - Health and life style – Case study		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	Honbo Zhou, "Internet of Things in the cloud:A middleware perspective", CRC press, 2012.
2	Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", VPT, 1st Edition, 2014.

REFERENCES:

1	Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.Publication, 2015.
2	Constandinos X. Mavromoustakis, George Mastorakis, Jordi MongayBatalla, "Internet of Things (IoT) in 5G Mobile Technologies" Springer International Publishing Switzerland 2016.
3	Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things" Springer-Verlag Berlin Heidelberg, 2011.

COURSE OUTCOMES:

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

CO1:	Articulate the main concepts, key technologies, strength and limitations of IoT.
CO2:	Identify the architecture, infrastructure models of IoT.
CO3:	Analyze the networking and how the sensors are communicated in IoT .
CO4:	Analyze and design different models for IoT implementation.
CO5:	Identify and design the new models for market strategic interaction.

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	1	3	-	-	-	2	3	3	3	3
CO2	3	2	2	2	1	-	-	-	-	1	2	3	3	3
CO3	3	3	3	2	1	2	-	-	-	3	2	3	2	2
CO4	3	3	2	2	3	-	-	-	-	-	1	3	3	3
CO5	3	2	3	3	2	1	-	-	-	2	1	3	2	2
Avg.	3	2.8	2.4	2.2	1.6	2	-	-	-	2	1.8	3	2.6	2.6

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

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2431	ARM BASED EMBEDDED SYSTEM	L 3	T 0	P 0	C 3	100
Course Objectives	- Understand the Architecture and High-Level Languages - Apply the thumb Instruction set - Understand the Architectural Supports - Analyze the ARM CPU Cores - Understand the ARM Applications					

Unit-I	INTRODUCTION TO ARM AND HIGH-LEVEL LANGUAGES	(9)
The Acorn RISC Machine - Architectural inheritance - The ARM programmer's model – ARM development tools - Data types - Floating-point data types-The ARM floating-point architecture-Expressions - Conditional statements- Loops- Functions and procedures-Use of memory- Run-time environment		
Unit-II	THE THUMB INSTRUCTION SET	(9)
The Thumb bit in the CPSR- The Thumb programmer's model - Thumb branch instructions- Thumb software-interrupt instruction- Thumb data processing instructions- Thumb single register data transfer instructions - Thumb multiple register data transfer instructions- Thumb breakpoint instruction - Thumb implementation- Thumb applications		
Unit-III	ARCHITECTURAL SUPPORTS FOR SYSTEM DEVELOPMENT	(9)
The ARM memory interface -The Advanced Microcontroller Bus Architecture (AMBA) - The ARM reference peripheral specification -Hardware system prototyping tools -The ARMulator - The JTAG boundary scan test architecture - The ARM debug architecture - Embedded Trace – Signal processing support		
Unit-IV	ARM CPU CORES	(9)
The ARM710T, ARM720T and ARM740T- The ARM810- The Strong ARM SA-110 - The ARM920T and ARM940T - The ARM946E-S and ARM966E-S -The ARM1020E		
Unit-V	EMBEDDED ARM APPLICATIONS	(9)
The VLSI Ruby II Advanced Communication Processor- The VLSI ISDN Subscriber Processor - The One C™ VWS22100 GSM chip - The Ericsson-VLSI Bluetooth Baseband Controller 13.5 –The ARM7500 and ARM7500FE - The ARM7100 - The SA-1100		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Steve Furber , "ARM System-on-Chip Architecture", Pearson, Second Edition, 2013.
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REFERENCES:

- | | |
|---|---|
| 1 | ARM System Developers Guide, Designing and Optimizing System Software, by Andrew n.sloss, Dominic symes and Chris wright, Elsevier, Second Edition, 2004. |
|---|---|

COURSE OUTCOMES:

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

CO1: Describe the Architecture and and High-Level Languages.

CO2: Analyze the thumb Instruction Set.

CO3: Apply the Architectural Supports.

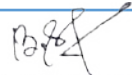
CO4: Analyze the ARM CPU Cores.

CO5: Apply the ARM 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	2	3	3	-	-	-	-	-	-	-	2	1	1	-
CO2	3	2	2	-	-	-	-	-	-	-	1	1	1	-
CO3	1	1	1	-	-	-	-	-	-	-	1	1	1	-
CO4	1	1	1	-	-	-	-	-	-	-	1	1	1	-
CO5	1	1	1	-	-	-	-	-	-	-	1	1	1	-
Avg.	3	3	3	-	-	-	-	-	-	-	2	1	1	-

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2432	INDUSTRY 5.0	L 3	T 0	P 0	C 3	100
Course Objectives	- To improve the previous industrial revolution by developing technologies in a human-centric way. - To introduce the concepts of Industry 5.0 a need of the students across all Engineering disciplines. - To emphasize on the latest technologies like sustainable manufacturing, circular economy, and resilient business models. - Analyze the ARM CPU Cores .					

Unit-I	INTRODUCTION TO INDUSTRY 5.0	(10)
Introduction of Various Industrial Revolutions, Digitalisation and the Networked Economy, Drivers, Enablers, Compelling Forces and Challenges for Industry 5.0, Comparison of Industry 5.0 Factory and Today's Factory, Trends of Industrial Big Data and Predictive Analytics for Smart Business Automation and Transformation Processes		
Unit-II	IMPORTANCE OF INTERNET OF THINGS (IOTs)	(9)
Introduction to Internet of Things (IoT), Industrial Internet of Things (IIoT), Internet of Services, Fundamental of Predictive Analytics, Smart Logistics, Smart Devices and Products		
Unit-III	TECHNOLOGY EVOLUTION	(10)
Basics of cyber Physical Systems, Process Automations and Collaborative robots, Fundamental to artificial Intelligence, Mobile Computing, Cyber Security, Ethical technology, Responsive and distributed supply chain system, Human-centric and Value-oriented approaches		
Unit-IV	TECHNOLOGY IMPLEMENTATION	(8)
3D printing, Solar energy sector, Healthcare sector, Maintain records related to education, finance, clean bioenergy generation and Intelligent NextG Wireless Networks		
Unit-V	CASE STUDIES	(8)
Case studies on CNC/NC automation, In-house, Healthcare services		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	Uthayan Elangovan, Industry 5.0, "The Future of the Industrial Economy", First Edition, Taylor & Francis, ISBN: 978-1-032-04127-8, 2022.

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2	Alessandro Massaro, "Electronics in Advanced Research Industries: Industry 4.0 to Industry 5.0 Advances", Wiley-IEEE Press, 2021, ISBN: 2021028944.
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REFERENCES:

1	Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 2016.
2	Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.

COURSE OUTCOMES:

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

CO1:	Understand Industry 5.0 and its applications.
CO2:	Gain knowledge about the rate of modern technology creation in demand to different industrial sectors
CO3:	Integrate IOTs with machine tool operations in the manufacturing units.
CO4:	Impact of enabling technologies on existing systems.
CO5:	Design personalized products based upon customer needs.

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	-	-	-	-	-	-	-	2	1	1	-
CO2	3	2	2	-	-	-	-	-	-	-	1	1	1	-
CO3	1	1	1	-	-	-	-	-	-	-	1	1	1	-
CO4	1	1	1	-	-	-	-	-	-	-	1	1	1	-
CO5	1	1	1	-	-	-	-	-	-	-	1	1	1	-
Avg.	3	3	3	-	-	-	-	-	-	-	2	1	1	-

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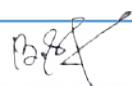
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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2433	REAL TIME OPERATING SYSTEM	L 3	T 0	P 0	C 3	100
Course Objectives	- Introduce the basic concepts of Real Time Systems. - Understand the concepts of task assignment and task scheduling. - Impart knowledge of Real Time Operating Systems. - Learn methods for Real Time database design concepts - Know about the evaluation techniques and clock synchronization.					

Unit-I	INTRODUCTION TO REAL TIME SYSTEMS	(9)
Structure of real time system – Need for RTOS- Task classes- Performance measures for real time system -Properties, traditional performance measures, perform ability, cost functions and hard deadlines – Estimating program run times		
Unit-II	TASK ASSIGNMENT AND TASK SCHEDULING	(9)
Introduction– Classical uniprocessor scheduling algorithms: Rate monotonic scheduling algorithm- Preemptive earliest deadline first algorithm– Using primary and alternative task– Task assignment: Utilization balancing algorithm –A next Fit algorithm for RM Scheduling – A Bin Packing assignment algorithm Fault tolerant scheduling		
Unit-III	FEATURES OF REAL TIME OPERATING SYSTEMS	(9)
Messages-Queues –mailboxes-pipes-timer function-events-memory management-Interrupt basic system design using an RT (OS design principles, interrupt routines, task structures and priority.)- RTOS Case Studies: Vx Works and Micro OS-II		
Unit-IV	REAL TIME DATABASE	(9)
Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two– phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems		
Unit-V	EVALUATION TECHNIQUES AND CLOCK SYNCHRONIZATION	(9)
Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy–Software error models. Clock Synchronization–Clock, A Nonfault–Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	C.M. Krishna and Kang G. Shin, "Real Time Systems", TMH Publication, First Edition 1997.
2	David E. Simon, "An Embedded Software Primer", Pearson Education Asia Publication, Second Edition 1999

REFERENCES:

1	Laplanter, P. A. "Real-Time Systems Design and Analysis", Wiley-IEEE Press, First Edition 2004
2	Raj Kamal, "Embedded system: Architecture Programming and Design", TMH Publication, Third Edition, 2009.
3	Abbott, D. "Linux for Embedded and Real-Time Applications", Newnes, 256 p., First Edition, 2002.

COURSE OUTCOMES:

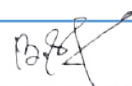
On completion of the course, the students will be able to

CO1:	Summarize the basic concepts of Real Time Systems.
CO2:	Describe the concepts of task assignment and task scheduling.
CO3:	Explain the Real Time Operating Systems.
CO4:	Analyze the key performance aspects of Real Time Database.
CO5:	Analyze the Evaluation Techniques and Clock Synchronization.

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	-	-	-	-	1	1	-	1
CO2	-	-	-	-	-	-	-	-	-	-	1	-	1	-
CO3	1	2	-	-	-	2	-	-	-	-	1	3	-	2
CO4	3	3	3	-	-	-	-	-	-	-	1	1	3	-
CO5	1	1	2	-	-	2	-	-	-	-	1	3	-	1
Avg.	3	3	3	-	-	2	-	-	-	-	1	3	3	2

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


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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2434	IOT SENSOR TECHNOLOGIES	L 3	T 0	P 0	C 3	100
Course Objectives	- To provide in depth knowledge about the sensing mechanism. - To make students understand about the use of sensors in design of IoT based systems. - To familiarize students various types of sensors used to measure the physical quantities - To develop reasonable level of competence in the design, construction and development of sensor suitable to the system requirements. - To Introduce students the current state of the art in sensor technology.					

Unit-I	SENSOR FUNDAMENTALS AND PROPERTIES	(9)
Introduction to IoT, Need for sensors in IoT, Data Acquisition – sensor characteristics – electric charges, fields, potentials – capacitance – magnetism – inductance – resistance – piezoelectric – pyroelectric – Hall effect thermoelectric effects – sound waves – heat transfer – light – dynamic models of sensors. Need of actuators, all types of actuators and their working. Identification of sensor and actuator for real-time application		
Unit-II	OPTICAL, RADIATION AND DISPLACEMENT SENSORS	(9)
Photosensors: Photodiode, phototransistor and photo resistor, imaging sensors, UV detectors, Basic Characteristics of radiation sensors, Thermal infrared sensors, X-ray and Nuclear Radiation Sensors, Fibre Optic Sensors, Capacitive and Inductive Displacement Sensor, Electromagnetism and Inductance, Magnetic Field Sensors		
Unit-III	PRESENCE, FORCE, PRESSURE, FLOW SENSORS	(9)
Potentiometric Sensors, Piezoresistive Sensors, Capacitive Sensors for presence, Inductive and Magnetic Sensors, Strain gages, Pressure sensitive films, piezoelectric force sensor, Piezoelectric Cables, Piezo resistive Sensors, Capacitive Sensors, VRP Sensors, Optoelectronic Pressure Sensors, Indirect Pressure Sensor, Vacuum Sensors, Thermal Transport Sensors, Ultrasonic Sensors, Level Sensors		
Unit-IV	HUMIDITY, MOISTURE CHEMICAL AND BIOLOGICAL SENSORS	(9)
Microphones: Characteristics, Resistive, condenser, Electret, Optical, Pizeoelectric, Dynamic, Concept of humidity, Capacitive Humidity Sensors, Resistive Humidity Sensors, Thermal Conductivity Sensors, Optical Hygrometers, Oscillating Hygrometer, Soil Moisture ,Artificial Microsystems for Sensing Airflow, Temperature, and Humidity by Combining MEMS and CMOS Technologies		

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Unit-V	CURRENT TRENDS IN SENSORS AND TECHNOLOGY	(9)
Smart Sensors: Introduction, Primary sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, The Automation Applications: Onboard Automobile sensors, Home appliances sensors, Aerospace Sensors, Sensors for Environmental Monitoring		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York.
2	Jon. S. Wilson, "Sensor Technology Hand Book", 2011, 1st edition, Elsevier, Netherland

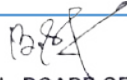
REFERENCES:

1	Edited by Qusay F Hasan, Atta ur rehman Khan, Sajid A madani, "Internet of Things Challenges, Advances, and Application", CRC Press
2	Triethy HL - Transducers in Electronic and Mechanical Designs, Mercel Dekker, 2003
3	Gerd Keiser, "Optical Fiber Communications", 2017, 5th edition, McGraw-Hill Science, Delhi.
4	John G Webster, Halit Eren, "Measurement, Instrumentation and sensor Handbook", 2014, 2nd edition, CRC Press, Taylor and Fransis Group, New York.

COURSE OUTCOMES:

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

CO1:	Understand the sensing mechanism and structural details of sensors.
CO2:	Explain principles and working of the sensors.
CO3:	Evaluate the performance of various types of sensors.
CO4:	Select the sensor suitable to system requirements.
CO5:	Understand the current state of the art in sensor technology


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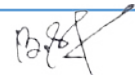
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Mapping of COs with POs and PSOs

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

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


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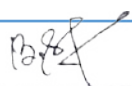
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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2435	WIRELESS SENSOR NETWORKS AND IOT	L 3	T 0	P 0	C 3	100
Course Objectives	- Learn the need of wireless sensor Networks. - Understand the WSN node Architecture and Network Architecture. - Identify the Wireless Sensor Network Platforms. - Study the IoT communication protocols for the WSNs. - Develop the skill to build IoT systems and sensor interfacing and its application					

Unit-I	INTRODUCTION TO WSN	(9)
Introduction-Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks-Enabling technologies for wireless sensor networks		
Unit-II	ARCHITECTURES	(9)
Single-node architecture,hardware components,energy consumption of sensor nodes,operating Systems and execution environments, network architecture, sensor network scenarios, optimization goals and figures of merit, gateway concepts		
Unit-III	NETWORKING SENSORS	(9)
Physical layer rand transceiver design considerations, MAC protocols, Low duty cycle protocols and wakeup concepts-S-MAC, mediation device protocol, wakeup radio concepts, Contention-based protocol, Schedule-based protocols, Address and Name Management in WSN		
Unit-IV	INTERNET OF THINGS	(9)
Introduction, Evolution of IoT,IoTversus M2M,Protocols-802.15.4,Zigbee,ISA100.11A, Architectural components of WSN, Machine-to-Machine Communications, Infrastructure Protocols, Internet protocol version 6 (IPv6)		
Unit-V	APPLICATIONS of IoT	(9)
Hybrid Navigation - Introduction to Kalman filtering – Case Studies -Integration of GPS and INS using Kalman Filter - Relative Navigation – fundamentals – Equations of Relative Motion for circular orbits (Clohessy_Wiltshire Equations) - Sensors for Rendezvous Navigation - Relative positioning - Point positioning and differential positioning - Differential GPS (DGPS) and Space based Augmentation system (SBAS)-Concepts -Relative GPS-Formation Flying - Figure of Merit (FOM)		
Total No of Periods to be Taught		45 Periods


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TEXT BOOK:

1	HolgerKarl, AndreasWillig, "Protocols and Architectures for Wireless Sensor Networks", JohnWiley, FirstEdition, 2005. (UnitI-III)
2	Misra, A. Mukherjee, and A. Roy, "Introduction to IoT" Cambridge University Press, First

REFERENCES:

1	MSingh, PMKhilar, "Geometric Constraint- Based Range Free Localization Scheme for Wireless Sensor Networks", International Journal of Sensors, First Edition, 2017.
2	R. Swain and P. M. Khilar, Heterogeneous Fault Diagnosis for "Wireless Sensor Networks", International Journal of Adhoc Networks, Elsevier Science, First Edition, 2018.

COURSE OUTCOMES:

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

CO1:	Describe the fundamentals of wireless sensor networks
CO2:	Illustrate the concepts, of WSN node Architecture and Network Architecture.
CO3:	Determine the new ideas for solving wireless sensor network design Protocols.
CO4:	Discuss the IoT communication protocols for the WSNs.
CO5:	Employ to build IoT systems and sensor interfacing 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	2	3	-	-	-	-	-	-	-	3	2	2	3
CO2	3	2	1	-	-	-	-	-	-	-	3	3	2	3
CO3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
CO4	3	1	1	-	-	-	-	-	-	-	3	2	2	3
CO5	3	1	1	-	-	-	-	-	-	-	3	3	2	3
Avg.	3	2	3	-	-	-	-	-	-	-	3	2	2	3

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Department	ECE	Programme Code & Name	106 - B.E ECE
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECPE2436	DESIGN OF EMBEDDED SYSTEMS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To provide a clear understanding on the basic concepts, Building Blocks of Embedded Systems. • To teach the fundamentals of Embedded processor Modeling , Bus Communication in processors, Input/output interfacing . • To introduce on processor scheduling algorithms , Basics of Real time operating system. • To discuss on aspects required in developing a new embedded processor, different Phases & Modeling of embedded system. • To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.					

Unit-I	INTRODUCTION TO EMBEDDED SYSTEMS	(9)
Introduction to Embedded Systems –Structural units in Embedded processor, selection of processor & memory devices- DMA, Memory management methods- memory mapping, cache replacement concept, Timer and Counting devices, Watchdog Timer, Real Time Clock		
Unit-II	EMBEDDED NETWORKING AND INTERRUPTS SERVICE MECHANISM	(9)
Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols - RS232 standard – RS485 –USB – Inter Integrated Circuits (I2C) – interrupt sources , Programmed-I/O busy-wait approach without interrupt service mechanism- ISR concept— multiple interrupts – context and periods for context switching, interrupt latency and deadline -Introduction to Basic Concept Device Drivers		
Unit-III	RTOS BASED EMBEDDED SYSTEM DESIGN	(9)
Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance-comparison of commercial RTOS features - RTOS Lite, Full RTOS, VxWorks, µC/OS-II, RT Linux		
Unit-IV	SOFTWARE DEVELOPMENT TOOLS	(9)
Software Development environment-IDE, assembler, compiler, linker, simulator, debugger, Incircuit emulator, Target Hardware Debugging, need for Hardware-Software Partitioning and Co-Design. Overview of UML, Scope of UML modeling, Conceptual model of UML, Architectural, UML basic elements-Diagram- Modeling techniques - structural, Behavioral, Activity Diagrams		

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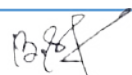
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Unit-V	EMBEDDED SYSTEM APPLICATION DEVELOPMENT	(9)
Objectives, different Phases & Modeling of the Embedded product Development Life Cycle (EDLC), Case studies on Smart card- Adaptive Cruise control in a Car -Mobile Phone software for key inputs		
Total No of Periods to be Taught		45 Periods

REFERENCES:	
1	Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.
2	Peckol, "Embedded system Design",JohnWiley&Sons,2010
3	Shibu.K.V, "Introduction to Embedded Systems", TataMcgraw Hill,2009
4	Lyla B Das," Embedded Systems-An Integrated Approach",Pearson2013
5	Elicia White,"Making Embedded Systems",O'Reilly Series,SPD,2011

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
CO2:	Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
CO3:	Foster ability to understand the role of embedded systems in industry.
CO4:	Design real time embedded systems using the concepts of RTOS.
CO5:	Apply the embedded knowledge to new product development.


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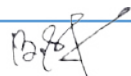
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Mapping of COs with POs and PSOs

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

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


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Mecheri, Salem Dt-636453, Tamilnadu



Department	Mechanical	Programme Code & Name				114 - Mechanical
Semester						
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				114 - Mechanical
Semester						
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	Mechanical	Programme Code & Name	114-Mechanical
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Semester

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	-	-	-

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Department	Mechanical	Programme Code & Name				114-Mechanical
Semester						
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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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

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Department	Mechanical	Programme Code & Name	114-Mechanical
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Semester

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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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	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	-

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Mecheri, Salem Dt-636453, Tamilnadu



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

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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	-	-

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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

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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

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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

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

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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,nshelf 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	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	
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

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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

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



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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:

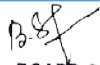
On completion of the course, the students will be able to

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	-	-	-

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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. et al., “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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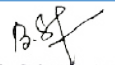
Semester

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	-	-	-

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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	-	-	-

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

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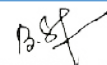


Department	BME	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
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	-

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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	-	-	-	-	-	-	-	-	-	-

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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

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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	-	-	-

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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
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:

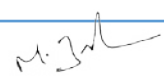
1	E. Balagurusamy, Programming in ANSI C, McGraw Hill, 9th Edition, 2024.
2	Kernighan & Ritchie, The C Programming Language, 2nd Edition, 1988.

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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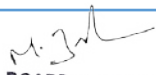
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Department		CSE		Programme Code & Name			OPEN TO ALL DEPARTMENTS	
Course Code	Course Name			Hours/Week			Credit	Maximum Marks
UCSOE2402	Introduction to Data Structures			L	T	P	C	100
				2	0	2	3	
Course Objectives	• To understand fundamental data structures. • 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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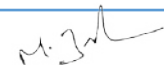
1	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson, 2nd Edition, 1997.
2	Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures, Galgotia, 1976.

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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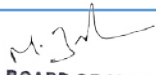
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Department		CSE	Programme Code & Name				OPEN TO ALL DEPARTMENTS	
Course Code	Course Name		Hours/Week			Credit	Maximum Marks	
UCSOE2403	Data Science Fundamentals		L	T	P	C	100	
			2	0	2	3		
Course Objectives		• Familiarize students with the data science 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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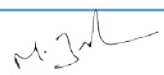


Total No of Periods to be Taught	30 Periods
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TEXT BOOK:	
1	David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2	Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

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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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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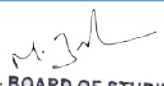
1	Glenn J. Myatt, Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, John Wiley Publishers, 2007.
2	Data Analysis and Data Mining, 2nd Edition, John Wiley & Sons Publication, 2014.

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
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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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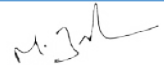
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Department		CSE		Programme Code & Name			OPEN TO ALL DEPARTMENTS	
Course Code	Course Name			Hours/Week		Credit	Maximum Marks	
UCSOE2405	Artificial Intelligence and Machine Learning Fundamentals			L	T	P	C	100
				2	0	2	3	
Course Objectives	- Understand 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:

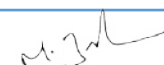
- | | |
|---|---|
| 1 | Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997. |
| 2 | I. Bratko, “Prolog: Programming for Artificial Intelligence”, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011. |
| 3 | C. Muller & Sarah Alpaydin, Ethem. Introduction to machine learning. 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:

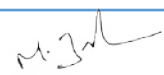
1	Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.
2	Samuel Greengard, The Internet of Things, The MIT Press, 2015.

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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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

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	
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

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	
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

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	
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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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/P Os	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	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	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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Mecheri, Salem Dt-636453, Tamilnadu



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

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	
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

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Department	Mechanical	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMEOE2401	REVERSE ENGINEERING	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To Applying the fundamental concepts and principles of reverse engineering in product design and development. • Applying the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development. • Applying the concept and principles of material identification and process verification in reverse engineering of product design and development. • Applying the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development. • Analyzing the various legal aspect and applications of reverse engineering in product design and development.					

Unit-I	INTRODUCTION TO REVERSE ENGINEERING & GEOMETRIC FORM	(6)
Definition – Uses – The Generic Process – Phases – Computer Aided Reverse Engineering - Surface and Solid Model Reconstruction – Dimensional Measurement – Prototyping.		
Unit-II	MATERIAL CHARACTERISTICS, PART DURABILITY AND LIFE LIMITATION	(6)
Alloy Structure Equivalency – Phase Formation and Identification – Mechanical Strength – Hardness –Part Failure Analysis – Fatigue – Creep and Stress Rupture – Environmentally Induced Failure		
Unit-III	MATERIAL IDENTIFICATION AND PROCESS de VERIFICATION	(6)
Material Specification - Composition Determination - Microstructure Analysis - Manufacturing Process Verification.		
Unit-IV	DATA PROCESSING, PART PERFORMANCE AND SYSTEM COMPATIBILITY	(6)
Statistical Analysis – Data Analysis – Reliability and the Theory of Interference – Weibull Analysis – Data Conformity and Acceptance – Data Report – Performance Criteria – Methodology of Performance Evaluation – System Compatibility.		
Unit-V	ACCEPTANCE, LEGALITY AND INDUSTRIAL APPLICATIONS OF REVERSE ENGINEERING	(6)
Legality of Reverse Engineering – Patent – Copyrights –Trade Secret – Third-Party Materials – Reverse Engineering in the Automotive Industry; Aerospace Industry; Medical Device Industry.		
Total No of Periods to be Taught		30


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TEXT BOOK:

1	Reverse Engineering, Kathryn, A. Ingle, McGraw-Hill, 1994
2	Reverse Engineering, Linda Wills, Kluiver Academic Publishers, 1996

REFERENCES:

1	Co-ordinate Measurement and reverse engineering, Donald R. Honsa, ISBN 1555897, American Gear Manufacturers Association
2	Data Reverse Engineering, Aiken, Peter, McGraw-Hill, 1996
3	Design Recovery for Maintenance and Reuse, T J Biggerstaff, IEEE Corpn. July 1991
4	White paper on RE, S. Rugaban, Technical Report, Georgia Instt. of Technology, 1994

List of Exercises/Experiments

1.	Study of reverse engineering concepts, workflow, and industrial applications.
2.	Measurement of engineering components using Vernier caliper, micrometer, and height gauge.
3.	Hardness testing of engineering materials using Rockwell/Brinell methods.
4.	Study of creep and stress rupture characteristics of materials.
5.	3D Laser scanning of components.
6.	Reverse engineering of Automotive components-cam shaft.
7.	Material identification and process verification of welded components.
8.	Preparation of technical inspection and data analysis reports.
9.	Case study on reverse engineering applications in automotive systems.
10.	Reverse engineering of dental components - Bio medical applications.
Total No of Periods to be Taught	
30	


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COURSE OUTCOMES:

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

CO1:	Apply the fundamental concepts and principles of reverse engineering in product design and development.
CO2:	Apply the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
CO3:	Apply the concept and principles of material identification and process verification in reverse engineering of product design and development.
CO4:	Apply the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development.
CO5:	Analyze the various legal aspect and applications of reverse engineering in product design and development

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Vernier caliper	05 Each
2.	Micrometer	05 Each
3.	Height Gauge with Surface Plate	05 Each
4.	Rockwell Hardness Testing Machine	01 No
5.	Brinell Hardness Testing Machine	01 No
6.	Tool Maker Microscope	01 No
7.	Reverse Engineering software and 3D Modeling software	15 License
8.	3D Printer (FDM Type)	01 No
9.	3D Laser Scanner	01 No
10.	Surface Roughness Tester	01 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	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	1	2	-	1	-	-	-	-	-	-	-	-
CO4	3	3	1	2	-	1	-	-	-	-	-	-	-	-
CO5	1	2	1	1	-	1	-	-	-	-	-	-	-	-
Avg.	3	2	1	1	-	-	-	-	-	-	-	-	-	-

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Department	Mechanical	Programme Code & Name	Open to all departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMEOE2402	NON DESTRUCTIVE TESTING	L	T	P	C	100
		2	0	2	3	
Course Objectives	- Understanding the basic importance of NDT in quality assurance. - Imbibing the basic principles of various NDT techniques, its applications, limitations, codes and standards. - Equipping themselves to locate a flaw in various materials, products. - Applying apply the testing methods for inspecting materials in accordance with industry specifications and standards. - Acquiring the knowledge on the selection of the suitable NDT technique for a given application.					
Unit-I	INTRODUCTION TO NDT & VISUAL TESTING					(6)
Concepts of Non-destructive testing-relative merits and limitations-NDT Versus mechanical testing, Fundamentals of Visual Testing – vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods – mirrors, magnifiers, boroscopes and fibroscopes – light sources and special lighting.						
Unit-II	LIQUID PENETRANT & MAGNETIC PARTICLE TESTING					(6)
Liquid Penetrant Inspection: principle, applications, advantages and limitations, dyes, developers and cleaners, Methods & Interpretation. Magnetic Particle Inspection: Principles, applications, magnetization methods, magnetic particles, Testing Procedure, demagnetization, advantages and limitations, – Interpretation and evaluation of test indications.						
Unit-III	EDDY CURRENT TESTING & THERMOGRAPHY					(6)
Eddy Current Testing: Generation of eddy currents– properties– eddy current sensing elements, probes, Instrumentation, Types of arrangement, applications, advantages, limitations – Factors affecting sensing elements and coil impedance, calibration, Interpretation/Evaluation. Thermography- Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods, applications.						
Unit-IV	ULTRASONIC TESTING & AET					(6)
Ultrasonic Testing: Types of ultrasonic waves, characteristics, attenuation, couplants, probes, EMAT. Inspection methods-pulse echo, transmission and phased array techniques, types of scanning and displays, angle beam inspection of welds, time of flight diffraction (TOFD) technique, Thickness determination by ultrasonic method, Study of A, B and C scan presentations, calibration. Acoustic Emission Technique – Introduction, Types of AE signal, AE wave propagation, Source location, Kaiser effect, AE transducers, Principle, AE parameters, AE instrumentation, Advantages & Limitations, Interpretation of Results, Applications.						
Unit-V	RADIOGRAPHY TESTING					(6)
Sources-X-rays and Gamma rays and their characteristics-absorption, scattering. Filters and screens, Imaging modalities-film radiography and digital radiography (Computed, Direct, Real Time, CT scan). Problems in shadow formation, exposure factors, inverse square law, exposure charts, Penetrameters, safety in radiography.						
Total No of Periods to be Taught		30				


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TEXT BOOK:

1	Baldev Raj, T. Jayakumar and M. Thavasimuthu, Practical Non Destructive Testing, Alpha Science International Limited, 3rd edition, 2002.
2	J. Prasad and C. G. K. Nair, Non-Destructive Test and Evaluation of Materials, Tata McGraw Hill Education, 2nd edition, 2011.

REFERENCES:

1	ASM Metals Handbook, V-17, "Non-destructive Evaluation and Quality Control", American Society of Metals, USA, 2001.
2	Barry Hull and Vernon John, "Non-destructive Testing", Macmillan, 1989.
3	Chuck Hellier, "Handbook of Non-destructive Evaluation", Mc Graw Hill, 2012.
4	Louis Cartz, "Non-destructive Testing", ASM International, USA, 1995.

List of Exercises/Experiments

1. Conducting experiment using liquid penetrant testing.	
2. Study of lighting conditions and their effect on defect visibility.	
3. Conducting experiment using magnetic particle testing.	
4. Study of demagnetization techniques and evaluation of indications.	
5. Conducting experiment using ultrasonic testing.	
6. Study of A-scan, B-scan, and C-scan presentations.	
7. Conducting experiment using electromagnetic testing.	
8. Study of Eddy Current Sorter	
9. Conducting experiment using acoustic emission testing.	
10. Study of inverse square law and exposure charts.	
Total No of Periods to be Taught	30


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COURSE OUTCOMES:

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

CO1:	Realize the importance of NDT in various engineering fields.
CO2:	Have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures.
CO3:	Calibrate the instrument and inspect for in-service damage in the components by means of Eddy current testing as well as Thermography testing.
CO4:	Differentiate various techniques of UT and AET and select appropriate NDT methods for better evaluation.
CO5:	Interpret the results of Radiography testing and also have the ability to analyse the influence of various parameters on the testing.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Dye penetrant kits.	01 No
2.	Test specimens with surface cracks.	02 Nos
3.	Ultrasonic flaw detectors.	01 No
4.	Eddy current instruments.	01 No
5.	Magnetic Particle Testing Instruments.	01 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	2	3	-	-	2	2	-	-	2	1	2	-
CO2	3	1	2	2	-	-	2	2	-	-	2	2	2	1
CO3	3	2	1	2	-	-	2	2	-	-	2	2	2	-
CO4	3	1	2	2	-	-	2	2	-	-	2	2	2	2
CO5	3	2	2	2	-	-	2	2	-	-	2	2	2	1
Avg.	2.8	1.6	1.8	2.2	-	-	2	2	-	-	2	1.8	2	1.3

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


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Department	Mechanical	Programme Code & Name	Open to all departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMEOE2403	ADDITIVE MANUFACTURING TECHNOLOGY	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To introduce the development of Additive Manufacturing (AM), various business opportunities and applications - To familiarize various software tools, processes and techniques to create physical objects that satisfy product development / prototyping requirements, using AM. - To be acquainted with vat polymerization and direct energy deposition processes - To be familiar with powder bed fusion and material extrusion processes. - To gain knowledge on applications of binder jetting, material jetting and sheet lamination processes					

Unit-I	INTRODUCTION	(6)
Overview - Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping- Rapid Tooling - Rapid Manufacturing - Additive Manufacturing. AM Process Chain- ASTM/ISO 52900 Classification - Benefits. Applications: Building Printing - Bio Printing - Food Printing-Electronics Printing. Business Opportunities and Future Directions – Case studies: Automobile, Aerospace, Healthcare.		
Unit-II	DESIGN FOR ADDITIVE MANUFACTURING (DfAM)	(6)
Concepts and Objectives - AM Unique Capabilities - Part Consolidation – Topology Optimization- Generative design - Lattice Structures - Multi-Material Parts and Graded Materials - Data Processing: CAD Model Preparation - AM File formats: STL-Problems with STL- AMF Design for Part Quality Improvement: Part Orientation - Support Structure - Slicing - Tool Path Generation – Design rules for Extrusion based AM.		
Unit-III	VAT POLYMERIZATION AND DIRECTED ENERGY DEPOSITION	(6)
Photo polymerization: Stereolithography Apparatus (SLA)- Materials -Process – top down and bottom up approach - Advantages - Limitations - Applications. Digital Light Processing (DLP) - Process - Advantages - Applications. Continuous Liquid Interface Production (CLIP)Technology. Directed Energy Deposition: Laser Engineered Net Shaping (LENS)- Process - Material Delivery -Materials -Benefits -Applications.		
Unit-IV	POWDER BED FUSION AND MATERIAL EXTRUSION	(6)
Powder Bed Fusion: Selective Laser Sintering (SLS): Process - Powder Fusion Mechanism - Materials and Application. Selective Laser Melting (SLM), Electron Beam Melting (EBM): Materials - Process - Advantages and Applications. Material Extrusion: Fused Deposition Modeling (FDM)- Process-Materials -Applications and Limitations.		
Unit-V	OTHER ADDITIVE MANUFACTURING PROCESSES	(6)
Sources-X-rays and Gamma rays and their characteristics-absorption, scattering. Filters and screens, Imaging modalities-film radiography and digital radiography (Computed, Direct, Real Time, CT scan). Problems in shadow formation, exposure factors, inverse square law, exposure charts, Penetrameters, safety in radiography.		
Total No of Periods to be Taught		30


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TEXT BOOK:

1	Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani “Additive manufacturing technologies”. 3rd edition Springer Cham, Switzerland. (2021). ISBN: 978-3-030-56126-0
2	Andreas Gebhardt and Jan-Steffen Hötter “Additive Manufacturing: 3D Printing for Prototyping and Manufacturing”, Hanser publications, United States, 2015, ISBN: 978-1-56990-582-1.

REFERENCES:

1	Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing”, Hanser Gardner Publication, Cincinnati., Ohio, 2011, ISBN :9783446425521.
2	Milan Brandt, “Laser Additive Manufacturing: Materials, Design, Technologies, and Applications”, Woodhead Publishing., United Kingdom, 2016, ISBN: 9780081004333.
3	Amit Bandyopadhyay and Susmita Bose, “Additive Manufacturing”, 1st Edition, CRC Press., United States, 2015, ISBN-13: 978-1482223590.
4	Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer., United States ,2006, ISBN: 978-1-4614-9842-1.
5	Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press., United States, 2011, ISBN: 9780849334092.

List of Exercises/Experiments

1. Modelling and converting CAD models into STL file.	
2. Manipulation and error fixing of STL file.	
3. Design and fabrication of parts by varying part orientation and support structures.	
4. Fabrication of parts with material extrusion AM process.	
5. Fabrication of parts with vat polymerization AM process.	
6. Design and fabrication of topology optimized parts.	
7. Extrusion based AM machine	
8. Resin based AM machine	
9. Mechanical design software	
10. Open-source AM software for STL editing, manipulation and slicing	
Total No of Periods to be Taught	30


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COURSE OUTCOMES:

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

CO1:	Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.
CO2:	Acquire knowledge on process of transforming a concept into the final product in AM technology.
CO3:	Elaborate the vat polymerization and direct energy deposition processes and its applications.
CO4:	Acquire knowledge on process and applications of powder bed fusion and material extrusion.
CO5:	Evaluate the advantages, limitations, applications of binder jetting, material jetting and sheet lamination processes.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Workstations	15 Nos
2.	FDM - 3D printers	01 No
3.	SLA/DLP resin printers	01 No
4.	Mechanical design software (Solid Edge, Solidworks)	15 License
5.	Hybrid AM machines	01 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	1	3	1	-	-	-	-	-	-	1	1	3	2
CO2	2	1	3	1	-	-	-	-	-	-	1	1	3	2
CO3	2	1	3	1	-	-	-	-	-	-	1	1	3	2
CO4	2	1	3	1	-	-	-	-	-	-	1	1	3	2
CO5	2	1	3	1	-	-	-	-	-	-	1	1	3	2
Avg.	2	1	3	1	-	-	-	-	-	-	1	1	3	2

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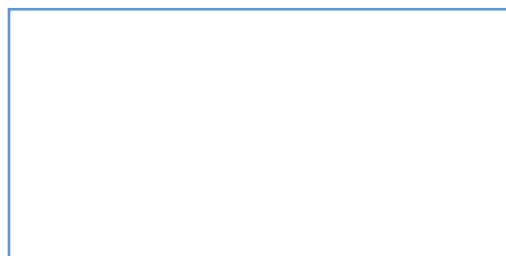
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Department	Mechanical	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMEOE2404	ENERGY TECHNOLOGY	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To introduce students to the basic principles, characteristics, and importance of renewable energy sources, highlighting their differences compared to conventional fossil fuels. - To prepare students for careers in energy engineering by equipping them with technical knowledge, analytical skills, and practical exposure to renewable energy systems. - To enable students to compare and evaluate different renewable energy technologies, selecting the most suitable options based on local resources, environmental conditions, and economic feasibility. - To explain the scientific and engineering principles behind harnessing renewable energy sources such as solar, wind, biomass, hydro, and emerging technologies. - To develop the ability to critically assess current developments, innovations, and future directions in renewable energy, fostering advanced technical understanding of global energy challenges.					
Unit-I	INTRODUCTION					(9)
Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources						
Unit-II	CONVENTIONAL ENERGY					(9)
Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.						
Unit-III	NON-CONVENTIONAL ENERGY					(9)
Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrius rotor and Gravina rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.						
Unit-IV	BIOMASS ENERGY					(9)
Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, alkaline fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, solid polymer electrolyte fuel cell, magneto hydrodynamic power generation, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.						
Unit-V	ENERGY CONSERVATION					(9)
Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers, distillation columns, dryers, ovens and furnaces and boilers, steam economy in chemical plants, energy conservation.						
Total No of Periods to be Taught		45				





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TEXT BOOK:

1	Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.
2	Rai, G.D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 1984.
3	Bansal, N.K., Kleeman, M. and Meliss, M., Renewable Energy Sources and Conversion Technology, Tata McGraw Hill, 1990.
4	Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.

REFERENCES:

1	Nejat Vezirog, Alternate Energy Sources, IT, McGraw Hill, New York.
2	El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.
3	Sukhatme. S.P., Solar Enery - Thermal Collection and Storage, Tata McGraw hill, New Delhi, 1981.

COURSE OUTCOMES:

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

CO1:	Students will be able to describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.
CO2:	Students will excel as professionals in the various fields of energy engineering
CO3:	Compare different renewable energy technologies and choose the most appropriate based on local conditions
CO4:	Explain the technological basis for harnessing renewable energy sources.
CO5:	Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level.

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	2	3	3	-	-	1	1	-	3	1	1	3
CO2	2	3	1	3	3	-	-	1	1	-	3	2	1	3
CO3	2	2	2	3	3	1	-	1	1	-	3	2	1	3
CO4	2	2	1	3	3	1	1	1	-	1	3	1	1	3
CO5	2	2	1	3	3	1	1	1	-	1	3	2	1	3
Avg.	2	2	1	3	3	2	1	1	1	1	3	2	1	3

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


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Department	Mechanical	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMEOE2405	RENEWABLE ENERGY TECHNOLOGIES	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To know the Indian and global energy scenario - To learn the various solar energy technologies and its applications. - To educate the various wind energy technologies. - To explore the various bio-energy technologies. - To study the ocean and geothermal technologies					

Unit-I	ENERGY SCENARIO	(9)
Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans		
Unit-II	SOLAR ENERGY	(9)
Solar radiation – Measurements of solar radiation and sunshine – Solar spectrum - Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.		
Unit-III	WIND ENERGY	(9)
Wind data and energy estimation – Betz limit - Site selection for windfarms – characteristics - Wind resource assessment - Horizontal axis wind turbine – components - Vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues - Applications		
Unit-IV	BIO-ENERGY	(9)
Bio resources – Biomass direct combustion – thermochemical conversion - biochemical conversion mechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration – Carbonisation – Pyrolysis - Biogas plants – Digesters – Biodiesel production – Ethanol production - Applications.		
Unit-V	OCEAN AND GEOTHERMAL ENERGY	(9)
Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications - Environmental impact.		
Total No of Periods to be Taught		45
TEXT BOOK:		
1	Fundamentals and Applications of Renewable Energy Indian Edition, by Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, cGraw Hill; First edition (10 December 2020), ISBN-10 : 9390385636	
2	Renewable Energy Sources and Emerging Technologies, by Kothari, Prentice Hall India Learning Private Limited; 2nd edition (1 January 2011), ISBN-10 : 8120344707.	


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REFERENCES:

1	Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012.
2	Rai.G.D., “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2014.
3	Sukhatme.S.P., “Solar Energy: Principles of Thermal Collection and Storage”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
4	Tiwari G.N., “Solar Energy – Fundamentals Design, Modelling and applications”, Alpha Science Intl Ltd, 2015.
5	Twidell, J.W. & Weir A., “Renewable Energy Resources”, EFNSpon Ltd., UK, 2015

COURSE OUTCOMES:

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

CO1:	Discuss the Indian and global energy scenario.
CO2:	Describe the various solar energy technologies and its applications.
CO3:	Explain the various wind energy technologies
CO4:	Explore the various bio-energy technologies.
CO5:	Discuss the ocean and geothermal technologies

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	2	3	2	2	1	1	2	1	2
CO2	3	2	2	1	1	1	3	1	1	1	2	2	1	2
CO3	3	2	3	1	2	1	3	1	1	1	1	1	1	2
CO4	2	2	2	1	2	1	3	1	1	1	2	2	2	2
CO5	2	1	2	1	2	1	3	1	1	1	1	2	1	2
Avg.	3	2	2	1	2	1	3	1	1	1	1	2	1	2

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


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Department	Mechanical	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMEOE2406	INTRODUCTION TO INDUSTRIAL ENGINEERING	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Understand the concepts productivity and productivity measurement approaches. - Understand the basic principles in facilities planning and plant location - Apply work study and ergonomic principles to design workplaces for the improvement of human performance - Impart knowledge to design and implement Statistical Process control in any industry - Recognize the concept of Production and Operations Management in creating and enhancing a firm's competitive advantages					
Unit-I	INTRODUCTION					(9)
Concepts of Industrial Engineering – History and development of Industrial Engineering – Roles of Industrial Engineer – Applications of Industrial Engineering – Production Management Vs Industrial Engineering – Production System – Input Output Model – Productivity – Factors affecting Productivity – Increasing Productivity of resources – Kinds of Productivity measures						
Unit-II	PLANT LOCATION AND LAYOUT					(9)
Factors affecting Plant location – course objectives of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Methods of Plant and Facility Layout – Storage Space requirements – Plant Layout procedure – Line Balancing methods.						
Unit-III	WORK SYSTEM DESIGN& ERGONOMICS					(9)
Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.						
Unit-IV	STATISTICAL QUALITY CONTROL					(9)
Definition and Concepts – Fundamentals – Control Charts for variables – Control Charts for attributes – Acceptance Sampling- O.C curve –Single sampling plan- Double sampling plan						
Unit-V	PRODUCTION PLANNING AND CONTROL					(9)
Forecasting – Qualitative and Quantitative forecasting techniques – Types of production – Process planning – Economic Batch Quantity– Loading – Scheduling and control of production – Dispatching–Progress contro						
Total No of Periods to be Taught		45				

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TEXT BOOK:

1	O.P.Khanna, 2010, Industrial Engineering and Management, Dhanpat Rai Publications.
2	Koontz.H.andWeihrich.H.,“EssentialsofManagement:AnInternationalPerspective”,8th Edition, Tata McGraw-Hill, New Delhi, 2010.

REFERENCES:

1	Ravi Shankar, 2009, Industrial Engineering and Management, Galgotia Publications & Private Limited.
2	Martand Telsang,2006, Industrial Engineering and Production Management, S. Chand and Company

COURSE OUTCOMES:

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

CO1:	Ability To define the concepts of productivity and productivity measurement approaches.
CO2:	Ability to evaluate appropriate location models for various facility types and design various facility layouts
CO3:	To conduct a method study and time study to improve the efficiency of the system.
CO4:	Ability to Control the quality of processes using control charts in manufacturing/service industries.
CO5:	Ability to define the Planning strategies and Material Requirement Plan.

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	-
CO2	2	2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	1	1	-	-	2	-	-	1	2	-	-
CO4	2	2	3	1	1	-	-	-	-	-	-	-	-	-
CO5	1	2	2	-	-	-	-	-	-	-	-	-	-	3
Avg.	2.2	2	2.5	1.3	1	-	-	2	-	-	1	2	1	3

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


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Department	Mechanical	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMEOE2407	FIBRE REINFORCED PLASTICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Understand the basic definition and unique properties of nanomaterials arising from size effects. - Explore various synthesis methods for fabricating nanomaterials using top-down and bottom-up approaches. - Study the types and properties of nanocomposites, and the role of interface, shape, and structure in determining their behavior. - Familiarize with classification schemes and characterization techniques such as spectroscopy, diffraction, thermal analysis, and surface area measurements. - Evaluate the diverse and emerging applications of nanomaterials in electronics, medicine, energy, coatings, and environmental technologies.					
Unit-I	INTRODUCTION					(9)
General definition and size effects–important nano structured materials and nano particles- importance of nano materials- Size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties of nanomaterials- surface area - band gap energy and applications. Photochemistry and Electrochemistry of nanomaterials –Ionic properties of nanomaterials- Nano catalysis						
Unit-II	SYNTHESIS OF NANOMATERIALS					(9)
Bottom up and Top-down approach for obtaining nano materials – Precipitation methods – sol gel technique – high energy ball milling, CVD and PVD methods, gas phase condensation, magnetron sputtering and laser deposition methods – laser ablation, sputtering.						
Unit-III	NANO COMPOSITES					(9)
Definition- importance of nanocomposites- nano composite materials-classification of composites- metal/metal oxides, metal-polymer- thermoplastic based, thermoset based and elastomer based- influence of size, shape and role of interface in composites applications.						
Unit-IV	NANO STRUCTURES AND CHARACTERIZATION TECHNIQUES					(9)
Classifications of nanomaterials - Zero dimensional, one-dimensional and two-dimensional nanostructures- Kinetics in nanostructured materials- multilayer thin films and superlattice- clusters of metals, semiconductors and nanocomposites. Spectroscopic techniques, Diffraction methods, thermal analysis method, BET analysis method.						
Unit-V	APPLICATIONS OF NANO MATERIALS					(9)
Overview of nanomaterials properties and their applications, nano painting, nano coating, nanomaterials for renewable energy, Molecular Electronics and Nanoelectronics – Nanobots- Biological Applications. Emerging technologies for environmental applications- Practice of nanoparticles for environmental remediation and water treatment.						
Total No of Periods to be Taught		45				


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TEXT BOOK:

1	Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmom, Burkhard Raguse, “ Nano Technology: Basic Science & Engineering Technology”, 2005, Overseas PressG.
2	Cao, “Nanostructures & Nanomaterials: Synthesis, Properties & Applications” Imperial College Press, 2004

REFERENCES:

1	R.H.J.Hannink & A.J.Hill, Nanostructure Control, Wood Head Publishing Ltd.,Cambridge, 2006.
2	C.N.R.Rao, A.Muller, A.K.Cheetham, The Chemistry of Nanomaterials: Synthesis, Properties and Applications Vol. I & II, 2nd edition, 2005, Wiley VCH Verlag Gibtl & Co
3	Ivor Brodie and Julius J.Muray, 'The physics of Micro/Nano – Fabrication', Springer International Edition, 2010

COURSE OUTCOMES:

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

CO1:	Understand the basic properties such as structural, physical, chemical properties of nanomaterials and their applications
CO2:	Able to acquire knowledge about the different types of nano material synthesis
CO3:	Describes about the shape, size, structure of composite nano materials and their interference
CO4:	Understand the different characterization techniques for nano materials
CO5:	Develop a deeper knowledge in the application of nano materials in different 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	3	2	3	3	-	-	-	1	1	-	1	1	3
CO2	2	3	1	3	3	-	-	-	1	1	-	2	1	3
CO3	2	2	2	3	3	1	1	-	1	1	-	2	1	3
CO4	2	2	1	3	3	1	1	1	1	-	1	1	1	3
CO5	2	2	1	3	3	1	1	1	1	-	1	2	1	3
Avg.	3	2	2	1	3	3	1	1	1	1	1	3	2	1

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


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Department	Mechanical	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMEOE2408	NANO TECHNOLOGY AND ITS APPLICATIONS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To introduce the basic concepts, structures, and kinetics of nanoparticles and nanostructured materials. - To provide knowledge of synthesis methods and characterization techniques for nanomaterials. - To understand the optical, electrical, and mechanical properties of nanomaterials and their measurement methods. - To explore different nanostructures and their applications in engineering, medicine, and materials science. - To explain the role of nanotechnology in electronics, sensors, diagnostics, environment, agriculture, and energy systems.					

Unit-I	INTRODUCTION TO NANOTECHNOLOGY	(9)
Basic Structure of Nanoparticles- Kinetics in Nanostructured Materials- Zero-dimensional, size and shape of nanoparticles; one-dimensional and two-dimensional nanostructures- clusters of metals and semiconductors, bio nano-particles.		
Unit-II	FABRICATION AND CHARACTERIZATION OF NANOMATERIALS	(9)
Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes); Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials.		
Unit-III	PROPERTIES AND MEASUREMENT OF NANOMATERIALS	(9)
Optical Properties: Absorption, Fluorescence, and Resonance; Methods for the measurement of nanomaterials; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging.		
Unit-IV	NANO STRUCTURES	(9)
Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots. Applications of nanostructures. Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc. Cells response to Nanostructures.		
Unit-V	APPLICATIONS OF NANOTECHNOLOGY	(9)
Nano electronics, Nano sensors, Nanotechnology in Diagnostics applications, Environmental and Agricultural Applications of nanotechnology, Nano technology for energy systems		
Total No of Periods to be Taught		45


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TEXT BOOK:

1	Springer Handbook of Nanotechnology by Bharat Bhushan 2004.(Unit I – V)
2	Encyclopedia of Nanotechnology - Hari Singh Nalwa 2004. (Unit I – V)

REFERENCES:

1	Nanomaterials, Nanotechnologies and Design: an Introduction to Engineers and Architects, D. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, 2009.
2	Handbook of Nanophase and Nanostructured Materials (in four volumes), Eds: Z.L. Wang, Y. Liu, Z. Zhang, Kluwer Academic/Plenum Publishers, 2003.
3	Handbook of Nanoceramics and their Based Nanodevices (Vol. 2) Edited by Tseung-Yuen Tseng and Hari Singh Nalwa, American Scientific Publishers.

COURSE OUTCOMES:

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

CO1:	Describe the fundamentals and structural characteristics of nanoparticles and nanostructures.
CO2:	Demonstrate knowledge of fabrication techniques and characterization tools for nanomaterials.
CO3:	Analyze the properties of nanomaterials using advanced measurement methods.
CO4:	Evaluate the applications of nanostructures in ceramics, drug delivery, magnetoresistance, and biological systems.
CO5:	Apply nanotechnology concepts to electronics, sensors, diagnostics, environmental, agricultural, and 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	1	2	2	1	2	1	1	1	1	3	2	2
CO2	3	3	2	3	3	2	2	1	2	2	2	3	2	2
CO3	3	3	2	3	3	2	2	1	2	2	2	3	2	2
CO4	3	3	3	3	3	2	3	2	2	2	2	2	3	2
CO5	3	3	3	3	3	3	3	2	2	2	2	2	3	3
Avg.	3	3	2.2	2.8	2.8	2	2.4	1.4	1.8	1.8	1.8	2.6	2.4	2.2

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


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