



THE KAVERY ENGINEERING COLLEGE



(An Autonomous Institution)

Mecheri, Salem - 636 453.

Approved by AICTE, New Delhi
Affiliated to Anna University

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE



UG
REGULATIONS
2024

Academic Year 2024-25 onwards

**AUTONOMOUS
CURRICULUM AND**

**SYLLABUS
I-VIII
SEMESTERS**



(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. TECH. ARTIFICIAL INTELLIGENCE & DATA SCIENCE

CHOICE BASED CREDIT SYSTEM

CURRICULUM FOR SEMESTER I TO VIII

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

VISION

- To promote innovative research and consultancy through effectual teaching and learning processes to develop emerging technology solutions for the benefits of industry and society.

MISSION

- Imparting quality value based technical education and produce technology professionals with innovative thoughts and inspiring leadership skills.
- Having rational thinking for design and development of cutting-edge products by engaging with industry stakeholders to fulfil the global demands and standards.
- Strengthening the core competence in the domain of Artificial Intelligence and Data Science.
- Enabling the graduates to adapt to the evolving technologies through strong fundamentals and lifelong.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Our Graduates will

- Utilize their proficiencies in the fundamental knowledge of basic sciences, mathematics, Artificial Intelligence, data science and statistics to build systems that require management and analysis of large volumes of data.
- Enhance their technical skills to pursue pioneering research in the field of AI and Data Science and to create disruptive and sustainable solutions for the welfare of ecosystems.
- Think logically, pursue lifelong learning and collaborate with an ethical attitude in a multidisciplinary team.

- Design and model AI based solutions to critical problem domains in the real world.
- Demonstrate innovative thinking and generate creative ideas to contribute effectively to economic development.

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.
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


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PROGRAM SPECIFIC OUTCOMES (PSOs)

Upon completion of the Artificial Intelligence and Data Science program, the student will be able to:

- Develop AI-based, domain-specific processes to support effective decision-making across sectors such as business, governance, and other critical domains.
- Extract actionable foresight, insight, and hindsight from data to solve complex business and engineering problems.
- Apply theoretical knowledge of AI and data analytics, along with practical industrial tools and techniques, to address and solve complex societal challenges.
- Demonstrate skills in data analytics, data visualization, knowledge acquisition, knowledge representation, and knowledge engineering to effectively manage and coordinate complex projects.
- Conduct fundamental research to meet critical societal needs using cutting-edge AI technologies.



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REGULATIONS - 2024

CHOICE BASED CREDIT SYSTEM

B. TECH. ARTIFICIAL INTELLIGENCE & DATA SCIENCE

CURRICULUM & SYLLABI FOR I TO VIII SEMESTERS

(For the students admitted 2024 onwards)

SEMESTER – I									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		C A	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									


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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
UPHT24202	Physics for Information Science	3	0	0	3	40	60	100	BSC
UBET24202	Basic Electrical and Electronics Engineering	3	0	0	3	40	60	100	ESC
UGET24201	Engineering Graphics	2	0	4	4	40	60	100	ESC
UADT24201	Data Structures Design	3	0	0	3	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
UADL24201	Data Structures Design Laboratory	0	0	4	2	60	40	100	PCC
UGEL24202	Communication Laboratory /Foreign Language \$	0	0	4	2	60	40	100	EEC
Total Credits to be earned					26				

\$ Skill Based Course


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SEMESTER – III									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory Course(s)									
UMAT24302	Discrete Mathematics	3	1	0	4	40	60	100	BSC
UADT24301	Artificial Intelligence	3	0	0	3	40	60	100	PCC
UCST24302	Object Oriented Programming	3	0	0	3	40	60	100	PCC
UCST24303	Foundation of Data Science	3	0	0	3	40	60	100	PCC
Theory with Practical Course(s)									
UADTL24301	Design and Analysis of Algorithms	3	0	2	4	50	50	100	PCC
UECTL24302	Digital Principles and Computer Organization	3	0	2	4	50	50	100	ESC
Practical / Employability Enhancement									
UADL24301	Artificial Intelligence Laboratory	0	0	4	2	60	40	100	PCC
UCSL24302	Object Oriented Programming Laboratory	0	0	3	1.5	60	40	100	PCC
UCSL24303	Data Science Laboratory	0	0	4	2	60	40	100	PCC
Mandatory Courses									
USD24301	Soft Skill 1	2	0	0	0	100	-	100	MC
Total Credits to be earned					26.5				


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SEMESTER – IV									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory Course(s)									
UMAT24402	Probability and Statistics	3	1	0	4	40	60	100	BSC
UADT24401	Machine Learning	3	0	0	3	40	60	100	PCC
UCST24401	Database Management Systems	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)									
UADTL24401	Operating Systems	3	0	2	4	50	50	100	PCC
UCSTL24501	Computer Networks	3	0	2	4	50	50	100	PCC
Practical / Employability Enhancement									
UADL24401	Machine Learning Laboratory	0	0	4	2	60	40	100	PCC
UCSL24401	Database Management Systems Laboratory	0	0	3	1.5	60	40	100	PCC
UIDL24001	Idea Laboratory	0	0	2	1	100	-	100	EEC
Mandatory Courses									
USD24401	Soft Skill 2	2	0	0	-	100	-	100	MC
Total Credits to be earned					24.5				

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


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SEMESTER – V

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory Course(s)									
UADT24501	Deep Learning	3	0	0	3	40	60	100	PCC
UADT24502	Data and Information Security	3	0	0	3	40	60	100	PCC
UCST24502	Distributed Computing	3	0	0	3	40	60	100	PCC
Theory with Practical Course(s)									
UCSPE2408	Big Data Analytics	2	0	2	3	50	50	100	PCC
	Professional Elective I	-	-	-	3	50	50	100	PEC
	Professional Elective II	-	-	-	3	50	50	100	PEC
Practical / Employability Enhancement									
UADL24501	Deep Learning Laboratory	0	0	4	2	60	40	100	PCC
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					21				


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SEMESTER – VI									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory Course(s)									
	Open Elective–I	3	0	0	3	40	60	100	OEC
Theory with Practical Course(s)									
UECTL24502	Embedded Systems and IoT	3	0	2	4	50	50	100	ESC
	Professional Elective III	-	-	-	3	50	50	100	PEC
	Professional Elective IV	-	-	-	3	50	50	100	PEC
	Professional Elective V	-	-	-	3	50	50	100	PEC
Practical / Employability Enhancement									
UADL24601	Mini Project	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					18				


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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
	Elective- Management	3	0	0	3	40	60	100	HSMC
	Open Elective–II	3	0	0	3	40	60	100	OEC
	Open Elective–III	3	0	0	3	40	60	100	OEC
Practical / Employability Enhancement									
USI24701	Summer Internship - II #	0	0	0	1	0	0	100	EEC
Total Credits to be earned					12				

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									
	Open Elective–IV	3	0	0	3	40	60	100	OEC
Theory with Practical									
	Professional Elective VI	-	-	-	3	50	50	100	PEC
Practical / Employability Enhancement									
UADL24801	Project Work / Internship	-	-	20	10	60	40	100	EEC
Total Credits to be earned					16				


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ELECTIVE – MANAGEMENT COURSES

S. NO.	Course Code	Course Title	Category	Periods/Week			Credit	Credits		
				L	T	P		CA	ESE	Total
1.	UGET24701	Principles of Management	HSMC	3	0	0	3	40	60	100
2.	UGET24702	Total Quality Management	HSMC	3	0	0	3	40	60	100
3.	UGET24703	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	40	60	100
4.	UGET24704	Human Resource Management	HSMC	3	0	0	3	40	60	100
5.	UGET24705	Knowledge Management	HSMC	3	0	0	3	40	60	100
6.	UGET24706	Industrial Management	HSMC	3	0	0	3	40	60	100

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


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PROFESSIONAL ELECTIVES (PEC)

Course Code	Course Subject	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	ESE	Total
STREAM-I VERTICALS FOR AIDS I									
UCSPE2409	Knowledge Engineering	PEC	2	0	2	3	50	50	100
UCSPE2402	Recommender Systems	PEC	2	0	2	3	50	50	100
UCSPE2441	Soft Computing	PEC	2	0	2	3	50	50	100
UCSPE2404	Text and Speech Analysis	PEC	2	0	2	3	50	50	100
UCSPE2405	Business Analytics	PEC	2	0	2	3	50	50	100
UCSPE2406	Image and Video Analytics	PEC	2	0	2	3	50	50	100
UCSPE2407	Computer Vision	PEC	2	0	2	3	50	50	100
STREAM-II FULL STACK DEVELOPMENT									
UCSPE2410	App Development	PEC	2	0	2	3	50	50	100
UCSPE2411	Cloud Services Management	PEC	2	0	2	3	50	50	100
UCSPE2412	UI and UX Design	PEC	2	0	2	3	50	50	100
UCSPE2413	Software Testing and Automation	PEC	2	0	2	3	50	50	100
UCSPE2414	Web Application Security	PEC	2	0	2	3	50	50	100
UCSPE2415	DevOps	PEC	2	0	2	3	50	50	100


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STREAM- III CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

UCSPE2417	Cloud Computing	PEC	2	0	2	3	50	50	100
UCSPE2418	Virtualization	PEC	2	0	2	3	50	50	100
UCSPE2419	Data Warehousing & Data Mining	PEC	2	0	2	3	50	50	100
UCSPE2420	Software Defined Networks	PEC	2	0	2	3	50	50	100
UCSPE2421	Stream Processing	PEC	2	0	2	3	50	50	100
UCSPE2422	Security and Privacy in Cloud	PEC	2	0	2	3	50	50	100

STREAM- IV CYBER SECURITY AND DATA PRIVACY

UCSPE2423	Ethical Hacking	PEC	2	0	2	3	50	50	100
UCSPE2424	Digital and Mobile Forensics	PEC	2	0	2	3	50	50	100
UCSPE2425	Social Network Security	PEC	2	0	2	3	50	50	100
UCSPE2426	Modern Cryptography	PEC	2	0	2	3	50	50	100
UCSPE2427	Engineering Secure Software Systems	PEC	2	0	2	3	50	50	100
UCSPE2428	Cryptocurrency and Blockchain Technologies	PEC	2	0	2	3	50	50	100
UCSPE2429	Network Security	PEC	2	0	2	3	50	50	100


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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 AI&DS Branch
(OPEN ELECTIVES – I, II & III)**

S.NO	Course Code	Course Title	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P		CA	ESE	Total
Agricultural Engineering										
1.	UAIOE2401	Introduction to Food processing	OEC	3	0	0	3	40	60	100
2.	UAIOE2402	Traditional Indian Foods	OEC	3	0	0	3	40	60	100
3.	UAIOE2403	Fundamentals of Food Engineering	OEC	3	0	0	3	40	60	100
4.	UAIOE2404	Remote Sensing Concepts	OEC	3	0	0	3	40	60	100
5.	UAIOE2405	Basics of Integrated Water Resources Management	OEC	3	0	0	3	40	60	100
Biomedical Engineering										
6.	UBMOE2401	Basics of Microbial Technology	OEC	3	0	0	3	40	60	100
7.	UBMOE2402	Radiological Equipment	OEC	3	0	0	3	40	60	100
8.	UBMOE2403	Fundamentals of Cell and Molecular Biology	OEC	3	0	0	3	40	60	100
9.	UBMOE2404	Human Physiology	OEC	3	0	0	3	40	60	100
10.	UBMOE2405	Lifestyle Diseases	OEC	3	0	0	3	40	60	100
11.	UBMOE2406	Pathology and Microbiology	OEC	3	0	0	3	40	60	100
12.	UBMOE2407	Medical Electronics	OEC	3	0	0	3	40	60	100
13.	UBMOE2408	Assist Devices	OEC	3	0	0	3	40	60	100


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S.NO	Course Code	Course Title	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P		CA	ESE	Total
Chemical Engineering										
14.	UCHOE2401	Nanomaterials and applications.	OEC	3	0	0	3	40	60	100
15.	UCHOE2402	Polymer Technology	OEC	3	0	0	3	40	60	100
16.	UCHOE2403	Enzyme engineering	OEC	3	0	0	3	40	60	100
17.	UCHOE2404	Bio Energy Resources	OEC	3	0	0	3	40	60	100
18.	UCHOE2405	Chemical Process Safety	OEC	3	0	0	3	40	60	100
Civil Engineering										
19.	UCEOE2401	Architectural Heritage of India	OEC	3	0	0	3	40	60	100
20.	UCEOE2402	Building Planning and Construction	OEC	3	0	0	3	40	60	100
21.	UCEOE2403	Elementary Civil Engineering	OEC	3	0	0	3	40	60	100
22.	UCEOE2404	Energy and Environment	OEC	3	0	0	3	40	60	100
23.	UCEOE2405	Global Warming and Climate Change	OEC	3	0	0	3	40	60	100
24.	UCEOE2406	Introduction to Disaster Management and Mitigation	OEC	3	0	0	3	40	60	100
Electronics and Communication Engineering										
25.	UECOE2401	Industrial Electronics	OEC	3	0	0	3	40	60	100
26.	UECOE2402	Image Processing and Computer Vision	OEC	3	0	0	3	40	60	100
27.	UECOE2403	4G/5G Communication Networks	OEC	3	0	0	3	40	60	100
28.	UECOE2404	Wireless Communication	OEC	3	0	0	3	40	60	100
29.	UECOE2405	Embedded and Real Time Systems	OEC	3	0	0	3	40	60	100
30.	UECOE2406	Robotics and its Industrial Application	OEC	3	0	0	3	40	60	100
31.	UECOE2407	Industrial IoT	OEC	3	0	0	3	40	60	100
32.	UECOE2408	Sensors and Transducers	OEC	3	0	0	3	40	60	100
33.	UECOE2409	Space Science	OEC	3	0	0	3	40	60	100


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S.NO	Course Code	Course Title	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P		CA	ESE	Total
Electrical and Electronic Engineering										
34.	UEEOE2401	Electrical safety	OEC	3	0	0	3	40	60	100
35.	UEEOE2402	Introduction to Electrical Machines	OEC	3	0	0	3	40	60	100
36.	UEEOE2403	Electric Energy Generation, Utilization and Conservation.	OEC	3	0	0	3	40	60	100
37.	UEEOE2404	Power Electronics and Drives	OEC	3	0	0	3	40	60	100
38.	UEEOE2405	Electrical Estimation and Costing	OEC	3	0	0	3	40	60	100
39.	UEEOE2406	Basics of Electrical Measurements and Instrumentation	OEC	3	0	0	3	40	60	100
40.	UEEOE2407	Introduction to Control Engineering	OEC	3	0	0	3	40	60	100
41.	UEEOE2408	Fundamentals of Electrical Drives and Control	OEC	3	0	0	3	40	60	100
42.	UEEOE2409	Energy Conservation and Management	OEC	3	0	0	3	40	60	100
43.	UEEOE2410	Automotive Electrical and Electronics Engineering	OEC	3	0	0	3	40	60	100
44.	UEEOE2411	Introduction to Embedded Systems	OEC	3	0	0	3	40	60	100
Mechanical Engineering										
45.	UMEOE2401	Reverse Engineering	OEC	2	0	2	3	50	50	100
46.	UMEOE2402	Non - Destructive Testing	OEC	2	0	2	3	50	50	100
47.	UMEOE2403	Additive Manufacturing Technology	OEC	2	0	2	3	50	50	100
48.	UMEOE2404	Energy Technology	OEC	3	0	0	3	40	60	100
49.	UMEOE2405	Renewable Energy Technologies	OEC	3	0	0	3	40	60	100
50.	UMEOE2406	Introduction to Industrial Engineering	OEC	3	0	0	3	40	60	100
51.	UMEOE2407	Fiber Reinforced Plastics	OEC	3	0	0	3	40	60	100
52.	UMEOE2408	NANO Technology and its Applications	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	4	3					5		12	7.22%
2.	BSC	12	4	4	6					26	15.66%
3.	ESC	5	8							13	7.83%
4.	PCC		9	22.5	17.5	14	4			67	40.36%
5.	PEC					6	9		3	18	10.84%
6.	OEC						3	6	6	12	7.23%
7.	EEC	1	2		1	1	2	1	10	18	10.84%
8.	MC					√	√				0%
TOTAL		22	26	26.5	24.5	21	18	12	16	166	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.

STREAM I Creative Media	STREAM II Emerging Technologies	STREAM III AI&DS
Augmented Reality / Virtual Reality	Multimedia Data Compression and Storage	Bio-Inspired Optimization Techniques
Multimedia and Animation	Robotic Process Automation	Game Theory
Video Creation and Editing	Neural Networks and Deep Learning	Cognitive Science
Digital marketing	Cyber Security	Ethics and AI
Visual Effects	Quantum Computing	Health Care Analytics
Game Development	3D Printing and Design	Optimization Techniques


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STREAM 1: CREATIVE MEDIA

S. NO.	Course Code	Course	Category	Periods/Week			C	Credits		
				L	T	P		CA	ESE	Total
1.	UCSPE2430	Augmented Reality/Virtual Reality	PEC	2	0	2	3	50	50	100
2.	UCSPE2431	Multimedia and Animation	PEC	2	0	2	3	50	50	100
3.	UCSPE2432	Video Creation and Editing	PEC	2	0	2	3	50	50	100
4.	UCSPE2433	Digital marketing	PEC	2	0	2	3	50	50	100
5.	UCSPE2434	Visual Effects	PEC	2	0	2	3	50	50	100
6.	UCSPE2435	Game Development	PEC	2	0	2	3	50	50	100

STREAM 2: EMERGING TECHNOLOGIES

S. NO.	Course Code	Course	Category	Periods/Week			C	Credits		
				L	T	P		CA	ESE	Total
1.	UCSPE2436	Multimedia Data Compression and Storage	PEC	2	0	2	3	50	50	100
2.	UCSPE2437	Robotic Process Automation	PEC	2	0	2	3	50	50	100
3.	UCSPE2403	Neural Networks and Deep Learning	PEC	2	0	2	3	50	50	100
4.	UCSPE2438	Cyber Security	PEC	2	0	2	3	50	50	100
5.	UCSPE2439	Quantum Computing	PEC	2	0	2	3	50	50	100
6.	UCSPE2440	3D Printing and Design	PEC	2	0	2	3	50	50	100


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STREAM 3: VERTICALS FOR AIDS

S. NO.	Course Code	Course	Category	Periods/Week			C	Credits		
				L	T	P		CA	ESE	Total
1.	UCSPE2442	Bio-Inspired Optimization Techniques	PEC	3	0	0	3	40	60	100
2.	UCSPE2443	Game Theory	PEC	2	0	2	3	50	50	100
3.	UCSPE2444	Cognitive Science	PEC	3	0	0	3	50	50	100
4.	UCSPE2445	Ethics and AI	PEC	2	0	2	3	50	50	100
5.	UCSPE2446	Health Care Analytics	PEC	2	0	2	3	50	50	100
6.	UCSPE2447	Optimization Techniques	PEC	2	0	2	3	50	50	100


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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


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(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	CATEGORY	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 Applications	PEC	3	0	0	3	3
5.	UCMG2405	Fintech Personal Finance and Payments	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 PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	UCMG2407	Foundations of Entrepreneurship	PEC	3	0	0	3	3
2.	UCMG2408	Team Building & Leadership Management for Business	PEC	3	0	0	3	3
3.	UCMG2409	Creativity & Innovation in Entrepreneurship	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 Ventures	PEC	3	0	0	3	3


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VERTICAL 3: PUBLIC ADMINISTRATION

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			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	PEC	3	0	0	3	3

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


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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	-	-	-

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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPHT24103	ENGINEERING PHYSICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To make the students effectively to achieve an understanding of mechanics. • To enable the students to gain knowledge of electromagnetic waves and its applications. • To introduce the basics of oscillations, optics and lasers. • Equipping the students to be successfully understand the importance of quantum physics. • To motivate the students towards the applications of quantum mechanics.					

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

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TEXT BOOK:

1	D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2	E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.

REFERENCES:

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

COURSE OUTCOMES:

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

CO1:	Understand the importance of mechanics.
CO2:	Express their knowledge in electromagnetic waves.
CO3:	Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
CO4:	Understand the importance of quantum physics.
CO5:	Comprehend and apply quantum mechanical principles towards the formation of energy bands.

Mapping of COs with POs and PSOs

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


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCHT24104	ENGINEERING CHEMISTRY	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To inculcate sound understanding of water quality parameters and water treatment techniques. • To impart knowledge on the basic principles and preparatory methods of nanomaterials. • To introduce the basic concepts and applications of phase rule and composites. • To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics. • To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.					

Unit-I	WATER AND ITS TREATMENT	(9)
Water: Sources and impurities, Water quality parameters: Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming & foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralisation and zeolite process.		
Unit-II	NANOCHEMISTRY	(9)
Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.		
Unit-III	PHASE RULE AND COMPOSITES	(9)
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.		

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Unit-IV	FUELS AND COMBUSTION	(9)
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon foot print.		
Unit-V	ENERGY SOURCES AND STORAGE DEVICES	(9)
Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles-working principles; Fuel cells: H ₂ -O ₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.		
Total No of Periods to be Taught		Total: 45 periods

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

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

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



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Mapping of COs with POs and PSOs

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

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


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPST24105	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand the basics of algorithmic problem solving. - To learn to solve problems using Python conditionals and loops. - To define Python functions and use function calls to solve problems. - To use Python data structures - lists, tuples, dictionaries to represent complex data. - To do input/output with files in Python.					

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

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

REFERENCES:	
1	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2	G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data,,Third Edition, MIT Press 2021

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

Mapping of COs with POs and PSOs														
Cos / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2	PSO 3
CO1	3	3	3	3	2	-	-	-	-	2	2	3	3	-
CO2	3	3	3	3	2	-	-	-	-	2	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	2	-	3	-	-
CO4	2	2	-	2	2	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	1	-	2	-	-
CO6	2	2	-	-	2	-	-	-	-	1	-	2	-	-
Avg.	2	3	3	3	2	-	-	-	-	2	2	3	3	-
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														

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

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

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



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

REFERENCES:	
1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB& ESCandRMRL–(in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
3	Historical Heritage of the Tamils (Dr.S.V.Subatamian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

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



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


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

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

அலகு 1	மொழி மற்றும் இலக்கியம்	(3)
இந்திய மொழிக்குடும்பங்கள் - திராவிடமொழிகள் - தமிழ் ஒரு செம்மொழி தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம். ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - 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 கல்வியியல்பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர் இல, சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல்துறை வெளியீடு)
4	பொருநை - ஆற்றங்கரை நாகரிகம், (தொல்லியல்துறை வெளியீடு)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

REFERENCES:

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB& ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)


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COURSE OUTCOMES:

பாடநெறியின் முடிவில் மாணவர்கள்

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

Mapping of COs with POs and PSOs

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

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



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Department	CSE	Programme Code & Name	Common to All
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Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPSL2413	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C	100
		0	0	4	2	
Course Objectives	- To understand the problem solving approaches. - To learn the basic programming constructs in Python. - To practice various computing strategies for Python-based solutions to real world problems. - To use Python data structures - lists, tuples, dictionaries. - To do input/output with files in Python.					

List of Exercises/Experiments			
1.	Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)		
2.	Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).		
3.	Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)		
4.	Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)		
5.	Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)		
6.	Implementing programs using Functions. (Factorial, largest number in a list, area of shape)		
7.	Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)		
8.	Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)		
9.	Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)		
10.	Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)		
11.	Exploring Pygame tool.		
12.	Developing a game activity using Pygame like bouncing ball, car race etc.		
<table> <tr> <td>Total No of Periods to be Taught</td><td>60 Periods</td></tr> </table>		Total No of Periods to be Taught	60 Periods
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	Python Programming Software	30
2	Personal Computer	

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	3	3	-
CO2	3	3	3	3	2	-	-	-	-	2	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	2	-	3	-	-
CO4	2	2	-	2	2	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	1	-	2	-	-
CO6	2	2	-	-	2	-	-	-	-	1	-	2	-	-
Avg.	2	3	3	3	2	-	-	-	-	2	2	3	3	-

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

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

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

PHYSICS LABORATORY : (Any Seven Experiments)

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

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.	
2. Simple harmonic oscillations of cantilever.	
3. Non-uniform bending - Determination of Young's modulus	
4. Uniform bending – Determination of Young's modulus	
5. Laser- Determination of the wave length of the laser using grating	
6. Air wedge - Determination of thickness of a thin sheet/wire	
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle b) Compact disc- Determination of width of the groove using laser.	
8 .Acoustic grating- Determination of velocity of ultrasonic waves in liquids.	
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids	
10. Post office box -Determination of Band gap of a semiconductor.	
11. Photoelectric effect.	
12. Michelson Interferometer.	
13. Melde's string experiment	
14. Experiment with lattice dynamics kit.	
Total No of Periods to be Taught	30 periods


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COURSE OUTCOMES:

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

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	1	1	-	-	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	-	-	-	-	-	-
CO3	3	2	3	1	1	-	-	-	-	-	-	-	-
CO4	3	3	2	1	1	-	-	-	-	-	-	-	-
CO5	3	2	3	1	1	-	-	-	-	-	-	-	-
Avg.	3	2.4	2.6	1	1								
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy													

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

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

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

Course Objectives	- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper. - To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions. - To demonstrate the analysis of metals and alloys. - To demonstrate the synthesis of nanoparticles
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List of Exercises/Experiments	
1	Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2.	Determination of types and amount of alkalinity in water sample. Split the first experiment into two
3.	Determination of total, temporary & permanent hardness of water by EDTA method.
4.	Determination of DO content of water sample by Winkler's method.
5.	Determination of chloride content of water sample by Argentometric method.
6.	Estimation of copper content of the given solution by Iodometry.
7.	Estimation of TDS of a water sample by gravimetry.
8.	Determination of strength of given hydrochloric acid using pH meter.
9.	Determination of strength of acids in a mixture of acids using conductivity meter.
10.	Conductometric titration of barium chloride against sodium sulphate (precipitation titration) .
11.	Estimation of iron content of the given solution using potentiometer
12.	Estimation of sodium /potassium present in water using flame photometer.
13.	Preparation of nanoparticles ($\text{TiO}_2/\text{ZnO}/\text{CuO}$) by Sol-Gel method
14.	Estimation of Nickel in steel.
15.	Proximate analysis of Coal
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	PSO 2	PSO 3
CO1	3	3	3	3	1	3	3	3	3	3	3	3	-	-
CO2	3	3	3	3	1	3	3	3	3	3	3	3	-	-
CO3	3	3	3	3	1	3	3	3	3	3	3	3	-	-
CO4	3	3	3	3	1	3	3	3	3	3	3	3	-	-
CO5	3	3	3	3	1	3	3	3	3	3	3	3	-	-
Avg.	3	3	3	3	1	3	3	3	3	3	3	3	-	-

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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UENT24201	PROFESSIONAL ENGLISH - II	L	T	P	C	100
		2	0	0	2	
Course Objectives	• To engage learners in meaningful language activities to improve their reading and writing skills • To learn various reading strategies and apply in comprehending documents in professional context • To help learners understand the purpose, audience, contexts of different types of writing • To develop analytical thinking skills for problem solving in communicative contexts • To demonstrate an understanding of job applications and interviews for internship and placements					

Unit-I	MAKING COMPARISONS	(6)
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases		
Unit-II	EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING	(6)
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds		
Unit-III	PROBLEM SOLVING	(6)
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences.		
Unit-IV	REPORTING OF EVENTS AND RESEARCH	(6)
Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions		
Unit-V	THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY	(6)
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses		
Total No of Periods to be Taught		30 Periods


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TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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	Common to 104 –B.E CSE 205 – B.TECH IT 243 – AI&DS
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UPHT24202	PHYSICS FOR INFORMATION SCIENCE	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To make the students understand the importance in studying electrical properties of materials. • To make the students understand the importance in studying electrical properties of materials. • To instill knowledge on magnetic properties of materials. • 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, ensuing nano device applications and quantum computing.					

Unit-I	ELECTRICAL PROPERTIES OF MATERIALS	(9)
Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – 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.		
Unit-II	SEMICONDUCTOR 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 – variation of Fermi level with temperature and impurity concentration – Carrier transport in Semiconductor: random motion, drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode.		
Unit-III	MAGNETIC PROPERTIES OF MATERIALS	(9)
Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility - Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples and uses— Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor).		
Unit-IV	OPTICAL PROPERTIES OF MATERIALS	(9)
Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode – solar cell - LED – Organic LED – Laser diodes – Optical data storage techniques.		



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Unit-V	NANODEVICES AND QUANTUM COMPUTING	(9)
Introduction - quantum confinement – quantum structures: quantum wells, wires and dots — band gap of nanomaterials. Tunneling – Single electron phenomena: Coulomb blockade - resonant-tunneling diode – single electron transistor – quantum cellular automata - Quantum system for information processing - quantum states – classical bits – quantum bits or qubits –CNOT gate - multiple qubits – Bloch sphere – quantum gates – advantage of quantum computing over classical computing.		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	Jasprit Singh, “Semiconductor Devices: Basic Principles”, Wiley (Indian Edition), 2007.
2	S.O. Kasap. Principles of Electronic Materials and Devices, McGraw-Hill Education (Indian Edition), 2020.

REFERENCES:	
1	Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
2	Y.B.Band and Y.Avishai, Quantum Mechanics with Applications to Nanotechnology and Information Science, Academic Press, 2013.
3	V.V.Mitin, V.A. Kochelap and M.A.Stroscio, Introduction to Nanoelectronics, Cambridge Univ.Press, 2008.

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Gain knowledge on classical and quantum electron theories, and energy band structures
CO2:	Acquire knowledge on basics of semiconductor physics and its applications in various devices
CO3:	Get knowledge on magnetic properties of materials and their applications in data storage,
CO4:	Have the necessary understanding on the functioning of optical materials for optoelectronics
CO5:	Understand the basics of quantum structures and their applications and basics of quantum computing

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	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	1	2	1	1	-	-	-	-	-	-	-
CO4	3	-	2	1	3	-	1	-	-	-	-	-	-	-
CO5	3	2	2	2	2	1	2	-	-	-	-	-	-	-
Avg.	3	1.3	2	1.3	2.3	1	1.3	-	-	-	-	-	-	-
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy														

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Department	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
UBET24202	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To introduce the basics of electric circuits and analysis • To impart knowledge in the basics of working principles and application of electrical machines • To introduce analog devices and their characteristics • To educate on the fundamental concepts of digital electronics • To introduce the functional elements and working of measuring instruments.					

Unit-I	ELECTRICAL CIRCUITS	(9)
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)		
Unit-II	ELECTRICAL MACHINES	(9)
Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.		
Unit-III	ANALOG ELECTRONICS	(9)
Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon & Germanium – PN Junction Diodes, Zener Diode – Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters		
Unit-IV	DIGITAL ELECTRONICS	(9)
Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only). Functional elements of an instrument, Standards and calibration, Operating Principle		
Unit-V	MEASUREMENTS AND INSTRUMENTATION	(9)
Functional elements of an instrument, Standards and calibration, Operating Principle, types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers -CT and PT, DSO- Block diagram- Data acquisition		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
2	S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.

REFERENCES:

1	Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2	Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
3	Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4	Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.

COURSE OUTCOMES:

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

CO1:	Compute the electric circuit parameters for simple problems
CO2:	Explain the working principle and applications of electrical machines
CO3:	Analyze the characteristics of analog electronic devices
CO4:	Explain the basic concepts of digital electronics
CO5:	Explain the operating principles of measuring instruments

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	-	-	-	2	-	-	2
CO2	2	2	1	-	-	-	1	-	-	-	2	-	1	2
CO3	2	1	1	-	-	-	1	-	-	-	2	-	-	2
CO4	2	2	1	-	-	-	1	-	-	-	2	-	-	2
CO5	2	2	1	-	-	-	1	-	-	-	2	-	-	2
Avg.	2	1.8	1	-	-	-	1	-	-	-	2	-	-	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
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	Artificial Intelligence and Data Science	Programme Code & Name	243 - AI&DS
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Semester - II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADT24201	Data Structures Design	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand the concepts of ADTs - To design linear data structures–lists, stacks, and queues - To understand sorting, searching and hashing algorithms - To apply Tree Structures - To apply Graph structures.					
Unit-I	ABSTRACT DATA TYPES					(9)
Abstract Data Types (ADTs) – ADTs and classes– introduction to OOP – classes in Python – inheritance – name spaces – shallow and deep copying - Introduction to analysis of algorithms – asymptotic notations – recursion – analyzing recursive algorithms.						
Unit-II	LINEAR STRUCTURES					(9)
List ADT– array-based implementations– linked list implementations– singly linked lists– circularly linked lists– doubly linked lists – applications of lists – Stack ADT – Queue ADT – double ended queues.						
Unit-III	SORTING AND SEARCHING					(9)
Bubble sort– selection sort– insertion sort– merge sort– quick sort– linear search – binary search – hashing – hash functions –collision handling– load factors, rehashing, and efficiency.						
Unit-IV	TREE STRUCTURES					(9)
Tree ADT – Binary Tree ADT – tree traversals –binary search trees – AVL trees – heaps – multi-way search trees.						
Unit-V	GRAPH STRUCTURES					(9)
Graph ADT–representations of graph–graph traversals–DAG–topological ordering–shortest paths– minimum Spanning trees.						
Total No of Periods to be taught		TOTAL: 45 Periods				

TEXT BOOK:

1	Michael T. Goodrich, Roberto Tamassia, and Michael H. Gold wasser, “Data Structures and Algorithms in Python” (An Indian Adaptation), Wiley, 2021.
2	Lee, Kent D., Hubbard, Steve, “Data Structures and Algorithm swith Python ”Springer Edition 2015.
3	Narasimha Karumanchi, “Data Structures and Algorithmic Thinking with Python” Career monk, 2015.

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REFERENCES:

1	Rance D.Necaise, "Data Structures and Algorithms Using Python", JohnWiley&Sons, 2011.
2	Thomas H. Carmen, Charles E. Leiserson, Ronald L. Rivets, and Clifford Stein, "Introduction to Algorithms", Third Edition, PHILearning, 2010.
3	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education, 2014.

COURSE OUTCOMES:

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

CO1:	Explain abstract data types.
CO2:	Design, implement and analyze linear data structures, such as lists, queues, and stacks, According to the needs of different applications
CO3:	Design, implement, and analyze efficient structures to meet requirements such as searching, indexing, and sorting
CO4:	Design, implement, and analyze efficient tree structures to meet requirements such as searching, indexing, and sorting
CO5:	Model problems as graph problems and implement efficient graph algorithms to solve them.

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

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

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Department		Programme Code & Name	
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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 Techology Of Tamils • To Compare The Design And Constructive Technology Of Cheras, Cholas, Pallavas And Nayakkars • To Gain Knowledge In Various Manufacturing Technology Of Tamils • To Analyse The Agriculture And Fishery Knowledge Of Tamils • To Learn About Scientific Tamils And Its And Use In Online Platforms					

UNIT 1	WEAVING AND CERAMIC TECHNOLOGY	(3)
Weaving Industry during Sangam Age –Ceramic technology – Black and Red Ware Potteries (BRW) –Graffition Potteries.		
UNIT 2	DESIGN AND CONSTRUCTION TECHNOLOGY	(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	MANUFACTURING TECHNOLOGY	(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	AGRICULTURE AND IRRIGATION TECHNOLOGY	(3)
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompou 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	SCIENTIFIC TAMIL & TAMIL COMPUTING	(3)
Development of Scientific Tamil - Tamil computing– Digitalization of Tamil Books– Development of Tamil Software–Tamil Virtual Academy–Tamil Digital Library–Online Tamil Dictionaries– Sorkuvai Project.		
Total No of Periods to be Taught		Total: 15 periods


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TEXTBOOK:

1	தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2	கணினித்தமிழ் - முளனவர் இல, சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருளை ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)

REFERENCES:

1	Social Life of Tamils(Dr.K.K.Pillay)A joint publication of TNTB& ESC and RMRL–(in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

COURSE OUTCOMES:

பாட நெறியின் 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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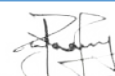
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Mapping of COs with POs and PSOs

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

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


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Department	Programme Code s Name
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Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UTAT24201	தமிழரும் தொழில்நுட்பமும்	L	T	P	C	100
		1	0	0	1	
பாடநெறி நோக்கங்கள்	• நெசவு மற்றும் பாணை தொழில்நுட்பத்தை புரிந்து கொள்ளல் • 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	நெசவு மற்றும் பாணை தொழில்நுட்பம்	(3)
சங்ககாலத்தில் நெசவுத்தொழில், பாணை தொழில்நுட்பம், கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களின் கீறல் குறியீடுகள்		
அலகு 2	வடிவமைப்பு மற்றும் கட்டிட தொழில்நுட்பம்	(3)
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமான பொருட்களும், வீட்டுப் பொருட்களில் வடிவமைப்பும். சங்க காலத்தில் நடுக்கல்லும் சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் மாமல்லபுரம் சிற்பங்களும், கோவில்களும் சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழி பாட்டுத் தலங்கள், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் செட்டிநாடு வீடுகள் பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ- சார்செனிக் கட்டிடக்கலை.		
அலகு 3	உற்பத்தி தொழில்நுட்பம்	(3)
கப்பல் கட்டும் கலை உலோகவியல் - இரும்பு தொழிற்சாலை இரும்பை உருக்குதல், எஃகு வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் மணி உருவாக்கும் தொழிற்சாலைகள் கல்மணிகள். கண்ணாடி மணிகள் - சங்கு மணிகள் சுடுமண் மணிகள் எலும்புத் துண்டுகள் தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.		

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அலகு 4	வேளாண்மை மற்றும் நீர் பாசனத் தொழில்நுட்பம்	(3)
அணை, ஏரி, குளங்கள், மதகு சோழர்கால குழுவித் 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 கணிதத் தமிழ்	(3)
அறிவியல் தமிழின் வளர்ச்சி கணிதத்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின் பதிப்பு 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

TEXTBOOK:

1	தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2	கணினித்தமிழ் - முளனவர் இல, சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருளை ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)

REFERENCES:

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

பாட நெறியின் 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

Mapping of COs with POs and PSOs

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

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


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGEL24201	ENGINEERING PRACTICES LABORATORY	L	T	P	C	100
		0	0	4	2	
Course Objectives	• Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common house hold wood work. • Wiring various electrical joints in common household electrical wire work. • Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work. • Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.					

GROUP – A (CIVIL & ELECTRICAL)	
PART I: CIVIL ENGINEERING PRACTICES	15
PLUMBING WORK: a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household. b) Preparing plumbing line sketches. c) Laying pipe connection to the suction side of a pump d) Laying pipe connection to the delivery side of a pump. e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances. WOOD WORK: a) Sawing, b) Planning and c) Making joints like T-Joint Mortise joint and Tenon joint and Dovetail joint. Wood Work Study: a) Studying joints in door panels and wooden furniture b) Studying common industrial trusses using models.	
PART II: ELECTRICAL ENGINEERING PRACTICES	15
a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket b) Staircase wiring c) Fluorescent Lamp wiring with introduction to CFL and LED types. d) Energy meter wiring and related calculations/ calibration e) Study of Iron Box wiring and assembly f) Study of Fan Regulator (Resistor type and Electronic type using Diac /Triac /quadrac) g) Study of emergency lamp wiring/Water heater	
GROUP – B (MECHANICAL AND ELECTRONICS)	
PART III MECHANICAL ENGINEERING PRACTICES	15

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WELDING WORK: a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding. b) Practicing gas welding. BASIC MACHINING WORK: a) (simple) Turning. b) (simple) Drilling. c) (simple) Tapping. ASSEMBLY WORK: a) Assembling a centrifugal pump. b) Assembling a household mixer. c) Assembling an air conditioner. SHEET METAL WORK: a) Making of a square tray FOUNDRY WORK: a) Demonstrating basic foundry operations.	
PART IV: ELECTRONIC ENGINEERING PRACTICES	15
SOLDERING WORK: a) Soldering simple electronic circuits and checking continuity. ELECTRONIC ASSEMBLY AND TESTING WORK: a) Assembling and testing electronic components on a small PCB ELECTRONIC EQUIPMENT STUDY: a) Study an elements of smart phone. b) Assembly and dismantle of LED TV. c) Assembly and dismantle of computer/ laptop	
Total No of Periods to be Taught	60 Periods

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


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Mapping of COs with POs and PSOs

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

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


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Department	Artificial Intelligence and Data Science	Programme Code & Name	243 - AI&DS
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Semester - II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADL24201	Data Structures Design Laboratory	L	T	P	C	100
		0	0	4	2	
Course Objectives	• To implement ADTs in Python. • To design and implement linear data structures–lists, stacks, and queues. • To implement sorting, searching and hashing algorithms, • To solve problems using tree and graph structures					

List of Exercises/Experiments	
1. Implement simple ADTs as Python classes	
2. Implementer cursive algorithms in Python.	
3. Implement List ADT using Python arrays.	
4. Linked list implementations of List.	
5. Implementation of Stack and Queue ADTs.	
6. Applications of List, Stack and Queue ADTs.	
7. Implementation of sorting and searching algorithms.	
8. Implementation of Hash tables.	
9. Tree representation and traversal algorithms.	
10. Implementation of Binary Search Trees.	
11. Implementation of Heaps.	
12. Graph representation and Traversal algorithms.	
13. Implementation of single source shortest path algorithm.	
14. Implementation of minimum spanning tree algorithms.	
Total No of Periods to be Taught	Total: 60 periods

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COURSE OUTCOMES:

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

CO1:	Explain abstract data types.
CO2:	Design, implement and analyse linear data structures, such as lists, queues, and stacks, according to the needs of different applications.
CO3:	Design, implement, and analyse efficient structures to meet requirements such as searching, indexing, and sorting.
CO4:	Design, implement, and analyse efficient tree structures to meet requirements such as searching, indexing, and sorting.
CO5:	Model problems as graph problems and implement efficient graph algorithms to solve them.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	ANACONDA JUPITER SOFTWARE	30
2	WINDOWS 10, I7 PROCESSOR, 8 GB RAM	

Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	1	2	2	3	1	-	-	2	-	2	1	1	-	-
CO2	2	3	2	2	2	-	-	2	-	2	2	3	2	-
CO3	2	2	3	2	3	-	-	3	-	2	2	3	2	1
CO4	2	2	3	2	3	-	-	3	-	2	2	3	2	1
CO5	3	3	3	3	1	-	-	3	-	2	2	3	2	1
Avg.	2	2.4	2.6	2.6	2	-	-	2.6	-	2	1.8	2.6	1.8	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	S&H	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMAT24302	Discrete Mathematics	L	T	P	C	100
		3	1	0	4	
Course Objectives	• To extend student’s logical and mathematical maturity and ability to deal with abstraction • To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems. • To understand the basic concepts of combinatorics and graph theory. • To familiarize the applications of algebraic structures. • To understand the concepts and significance of lattices and boolean algebra which are widely used in computer science and engineering.					

Unit-I	LOGIC AND PROOFS	(9+3)
Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.		
Unit-II	COMBINATORICS	(9+3)
Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.		
Unit-III	GRAPHS	(9+3)
Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths		
Unit-IV	ALGEBRAIC STRUCTURES	(9+3)
Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields		

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Unit-V	LATTICES AND BOOLEAN ALGEBRA	(9+3)
Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra – Sub Boolean Algebra – Boolean Homomorphism		
Total No of Periods to be Taught		60 Periods

TEXT BOOK:	
1	Rosen. K.H., "Discrete Mathematics and its Applications", 7 th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017
2	Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30 th Reprint, 2011.

REFERENCES:	
1	Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5 th Edition, Pearson Education Asia, Delhi, 2013
2	Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3	Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3 rd Edition, 2010

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Have knowledge of the concepts needed to test the logic of a program.
CO2:	Have an understanding in identifying structures on many levels
CO3:	Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science
CO4:	Be aware of the counting principles
CO5:	Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.



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Mapping of COs with POs and PSOs

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

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


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Department	Artificial Intelligence & Data Science	Programme Code & Name	243 – AI&DS
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADT24301	Artificial Intelligence	L	T	P	C	100
		3	0	0	3	
Course Objectives	• Learn the basic AI approaches • Develop problem solving agents • Perform logical and probabilistic reasoning					

Unit-I	INTELLIGENT AGENTS	(9)
Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.		
Unit-II	PROBLEM SOLVING	(9)
Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments.		
Unit-III	GAME PLAYING AND CSP	(9)
Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.		
Unit-IV	LOGICAL REASONING	(9)
Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.		
Unit-V	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.		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
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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.
5	http://nptel.ac.in/

COURSE OUTCOMES:

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

CO1:	Explain intelligent agent frameworks
CO2:	Apply problem solving techniques
CO3:	Apply game playing and CSP techniques
CO4:	Perform logical reasoning
CO5:	Perform probabilistic reasoning under uncertainty

Mapping of COs with POs and PSOs

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCST24302	Object Oriented Programming	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand Object Oriented Programming concepts and basics of Java programming language - To know the principles of packages, inheritance and interfaces - To develop a java application with threads and generics classes - To define exceptions and use I/O streams To design and build Graphical User Interface Application using JAVA FX					

UNIT – I	INTRODUCTION TO OOP AND JAVA	(9)
Overview of OOP – Object oriented programming paradigms – Features of Object-Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments		
Unit-II	INHERITANCE, PACKAGES AND INTERFACES	(9)
Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics–Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces		
UNIT – III	EXCEPTION HANDLING AND MULTITHREADING	(9)
Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java’s Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.		
Unit-IV	I/O, GENERICS, STRING HANDLING	(9)
I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.		
Unit-V	JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS	(9)
JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, Toggle Button – Radio Buttons – List View – Combo Box – Choice Box – Text Controls – Scroll Pane.		

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Layouts – Flow Pane – H Box and V Box – Border Pane – Stack Pane – Grid Pane. Menus – Basics – Menu – Menu bars – Menu Item

Total No of Periods to be Taught

45 Periods

TEXT BOOK:

1	Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, New Delhi, 2019
2	Herbert Schildt, “Introducing JavaFX 8 Programming”, 1st Edition, McGraw Hill Education, New Delhi, 2015

REFERENCES:

1	Cay S. Horstmann, “Core Java Fundamentals”, Volume 1, 11th Edition, Prentice Hall, 2018.
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COURSE OUTCOMES:

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

CO1:	Apply the concepts of classes and objects to solve simple problems.
CO2:	Develop programs using inheritance, packages and interfaces.
CO3:	Make use of exception handling mechanisms and multithreaded model to solve real world problems.
CO4:	Build Java applications with I/O packages, string classes, Collections and generics concepts.
CO5:	Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications.

Mapping of COs with POs and PSOs

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

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCST24303	Foundations of Data Science	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand the data science fundamentals and process. - To learn to describe the data for the data science process. - To learn to describe the relationship between data. - To utilize the Python libraries for Data Wrangling. - To present and interpret data using visualization libraries in Python					

Unit-I	INTRODUCTION	(9)
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	DESCRIBING DATA	(9)
Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores		
Unit-III	DESCRIBING RELATIONSHIPS	(9)
Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r^2 –multiple regression equations –regression towards the mean		
Unit-IV	PYTHON LIBRARIES FOR DATA WRANGLING	(9)
Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables		
Unit-V	DATA VISUALIZATION	(9)
Importing Matplotlib – Line plots – 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.		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I)
2	Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. (Units II and III)
3	Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Units IV and V)

REFERENCES:

1	Alen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014
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COURSE OUTCOMES:

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

CO1:	Define the data science process
CO2:	Understand different types of data description for data science process
CO3:	Gain knowledge on relationships between data
CO4:	Use the Python Libraries for Data Wrangling
CO5:	Apply visualization Libraries in Python to interpret and explore data

Mapping of COs with POs and PSOs

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

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Department	Artificial Intelligence and Data Science	Programme Code & Name	243 - AI&DS
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADTL24301	Design and Analysis of Algorithms	L	T	P	C	100
		3	0	2	4	
Course Objectives	- To critically analyses the efficiency of alternative algorithmic solutions for the same problem - To illustrate brute force and divide and conquer design techniques. - To explain dynamic programming and greedy techniques for solving various problems. - To apply iterative improvement technique to solve optimization problems - To examine the limitations of algorithmic power and handling it in different problems.					

Unit-I	INTRODUCTION	(8)
Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types –Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework - Asymptotic Notations and their properties – Empirical analysis - Mathematical analysis of Recursive and Non- recursive algorithms – Visualization.		
Unit-II	BRUTE FORCE AND DIVIDE AND CONQUER	(10)
Brute Force – String Matching - Exhaustive Search - Traveling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Multiplication of Large Integers and Strassen's Matrix Multiplication – Closest-Pair and Convex - Hull Problems. Decrease and Conquer: - Topological Sorting – Transform and Conquer: Pre-sorting – Heaps and Heap Sort.		
Unit-III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	(10)
Dynamic programming – Principle of optimality - Coin changing problem – Warshall's and Floyd's algorithms – Optimal Binary Search Trees - Multi stage graph - Knapsack Problem and Memory functions. Greedy Technique – Dijkstra's algorithm - Huffman Trees and codes - 0/1 Knapsack problem.		
Unit-IV	ITERATIVE IMPROVEMENT	(8)
The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable marriage Problem.		
Unit-V	LIMITATIONS OF ALGORITHM POWER	(9)
Lower - Bound Arguments - P, NP, NP- Complete and NP Hard Problems. Backtracking – N- Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Traveling Salesman Problem - Approximation Algorithms for NP-Hard Problems – Traveling Salesman problem – Knapsack problem.		
Total No of Periods to be Taught		45 Periods



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TEXT BOOK:

1	Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.
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REFERENCES:

1	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.
2	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
3	S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
4	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, Reprint 2006.

List of Exercises / Experiments

1.	Implement recursive and non-recursive algorithms and study the order of growth from $\log_2 n$ to $n!$.		
2.	Divide and Conquer - Strassen's Matrix Multiplication.		
3.	Decrease and Conquer - Topological Sorting		
4.	Transform and Conquer - Heap Sort		
5.	Dynamic programming - Coin change Problem, Warshall's and Floyd's algorithms, Knapsack Problem		
6.	Greedy Technique – Dijkstra's algorithm, Huffman Trees and codes.		
7.	Iterative improvement - Simplex Method.		
8.	Backtracking – N-Queen problem, Subset Sum Problem.		
9.	Branch and Bound - Assignment problem, Traveling Salesman Problem.		
<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:	Analyse the efficiency of recursive and non-recursive algorithm mathematically.
CO2:	Analyse the efficiency of brute force, divide and conquer, decrease and conquer, Transform and conquer algorithmic techniques
CO3:	Implement and analyse the problems using dynamic programming and greedy algorithmic techniques
CO4:	Solve the problems using iterative improvement techniques for optimization.
CO5:	Compute the limitations of algorithmic power and solve the problems using backtracking and branch and bound techniques.

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LIST OF EQUIPMENT 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	IDE/Compiler: Turbo C / GCC Compiler	30

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

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Department	Electronics and Communication Engineering	Programme Code & Name	Common to 104–CSE, 205–IT, 243–AI&DS
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECTL24302	Digital Principles and Computer Organization	L	T	P	C	100
		3	0	2	4	
Course Objectives	- To analyze and design combinational circuits. - To analyze and design sequential circuits - To understand the basic structure and operation of a digital computer. - To study the design of data path unit, control unit for processor and to familiarize with the hazards. - To understand the concept of various memories and I/O interfacing.					

Unit-I	COMBINATIONAL LOGIC	(9)
Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers		
Unit-II	SYNCHRONOUS SEQUENTIAL LOGIC	(9)
Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF– Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.		
Unit-III	COMPUTER FUNDAMENTALS	(9)
Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction –Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.		
Unit-IV	PROCESSOR	(9)
Instruction Execution – Building a Data Path — Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.		
Unit-V	MEMORY AND I/O	(9)
Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O –USB		
Total No of Periods to be Taught		45 Periods

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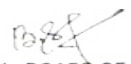


List of Exercises / Experiments	
1.	Verification of Boolean theorems using logic gates.
2.	Design and implementation of combinational circuits using gates for arbitrary functions.
3.	Implementation of 4-bit binary adder/subtractor circuits.
4.	Implementation of code converters.
5.	Implementation of BCD adder, encoder and decoder circuits
6.	Implementation of functions using Multiplexers.
7.	Implementation of the synchronous counters
8.	Implementation of a Universal Shift register.
6.	Simulator based study of Computer Architecture
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	75 Periods

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

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 EQUIPMENT 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 / 7461 / 555 / 7464 / 7447 / 74180 / 7485 / 7473 / 74138 / 7411 / 7474	50
3.	Bread Boards	15


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COURSE OUTCOMES:

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

CO1:	Design various combinational digital circuits using logic gates
CO2:	Design sequential circuits and analyze the design procedures
CO3:	State the fundamentals of computer systems and analyze the execution of an instruction
CO4:	Analyze different types of control design and identify hazards
CO5:	Identify the characteristics of various memory systems and I/O 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	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	Artificial Intelligence and Data Science	Programme Code & Name	243 - AI&DS
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADL24301	Artificial Intelligence Laboratory	L	T	P	C	100
		0	0	4	2	
Course Objectives	- To design and implement search strategies - To implement game playing techniques - To implement CSP techniques - To develop systems with logical reasoning - To develop systems with probabilistic reasoning					
List of Exercises / Experiments						
1. Implement of Uninformed search algorithms (BFS, DFS)						
2.Implement Minimax algorithm for game playing (Alpha-Beta pruning)						
3.Implement basic search strategies – 8-Puzzle, 8 - Queens problem, Cryptarithmic						
4.Implement A* and memory bounded A* algorithms.						
5.Solve constraint satisfaction problems						
6.Implement propositional model checking algorithms						
7.Implement forward chaining, backward chaining, and resolution strategies						
8.Build naïve Bayes models						
9.Implement of Water jug problem.						
10.Implement the Monte Carlo tree search algorithm.						
11.Implement Bayesian networks and perform inferences						
12.Mini-Project						
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:	Design and implement search strategies
CO2:	Implement game playing and CSP techniques
CO3:	Develop logical reasoning systems
CO4:	Develop probabilistic reasoning systems
CO5:	Develop a mini-project using all concepts.

LIST OF EQUIPMENT 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	Python, Numpy, Scipy, Matplotlib, Pandas, seaborn	30
4	Python3.9 and above	30

Mapping of COs with POs and PSOs

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

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 121-BME, 205 – IT, 243 – AI&DS
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSL24302	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C	100
		0	0	3	1.5	
Course Objectives	- To build software development skills using java programming for real-world applications. - To understand and apply the concepts of classes, packages, interfaces, inheritance, exception handling and file processing. - To develop applications using generic programming and event handling					

List of Exercises/Experiments	
1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)	
2. Develop stack and queue data structures using classes and objects.	
3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate Pay slips for the employees with their gross and net salary	
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape	
5. Solve the above problem using an interface	
6. Implement exception handling and creation of user defined exceptions.	
7. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of The number.	
8. Write a program to perform file operations.	
9. Develop applications to demonstrate the features of generics classes.	
10. Develop applications using JavaFX controls, layouts and menus.	
11. Develop a mini project for any application using Java concepts.	
Total No of Periods to be Taught	45 Periods

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	INTEL based desktop PC with min.4GBRAM and 500GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	30
2	Windows 7 or 10 or higher operating system / Linux Ubuntu 20 or higher	
3	Any Version of Java Programming Software	

COURSE OUTCOMES:

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

CO1:	Design and develop java programs using object-oriented programming concepts.
CO2:	Develop simple applications using object-oriented concepts such as package, exceptions.
CO3:	Implement multithreading, and generics concepts.
CO4:	Create GUIs and event driven programming applications for real world problems.
CO5:	Implement and deploy web applications using Java.

Mapping of COs with POs and PSOs

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

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT 243 – AI&DS
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Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSL24303	DATA SCIENCE LABORATORY	L	T	P	C	100
		0	0	4	2	
Course Objectives	- To understand the python libraries for data science - To understand the basic Statistical and Probability measures for data science. - To learn descriptive analytics on the benchmark data sets. - To apply correlation and regression analytics on standard data sets. - To present and interpret data using visualization packages in Python					

List of Exercises/Experiments	
1. Download, install and explore the features of NumPy, SciPy, Jupiter, Stats models and Pandas packages.	
2. Working with NumPy arrays	
3. Working with Pandas data frames	
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.	
5. Use the diabetes data set from UCI and Pima Indians Diabetes 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 modeling c. Multiple Regression analysis d. Also compare the results of the above analysis for the two data sets.	
6. Apply and explore various plotting functions on UCI data sets. a. Normal curves b. Density and contour plots c. Correlation and scatter plots d. Histograms e. Three-dimensional plotting	
7. Visualizing Geographic Data with Base map	
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:	Make use of the python libraries for data science
CO2:	Make use of the basic Statistical and Probability measures for data science
CO3:	Perform descriptive analytics on the benchmark data sets
CO4:	Perform correlation and regression analytics on standard data sets
CO5:	Present and interpret data using visualization packages in Python.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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

Mapping of COs with POs and PSOs

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

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


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

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


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TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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Department	S&H	Programme Code & Name	243 - AI&DS
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMAT24402	Probability and Statistics	L	T	P	C	100
		3	1	0	4	
Course Objectives	• This course aims at providing the required skill to apply the statistical tools in engineering problems. • To introduce the basic concepts of probability and random variables. • To introduce the basic concepts of two-dimensional random variables. • 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 classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.					

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	ESTIMATION THEORY	9+3
Unbiased estimators - Efficiency - Consistency - Sufficiency - Robustness - Method of moments - Method of maximum Likelihood - Interval estimation of Means - Differences between means, variations and ratio of two variances		
UNIT – IV	NON- PARAMETRIC TESTS	9+3
Introduction - The Sign test - The Signed - Rank test - Rank - sum tests - The U test - The H test - Tests based on Runs - Test of randomness - The Kolmogorov Tests.		
UNIT – V	STATISTICAL QUALITY CONTROL	9+3
Control charts for measurements ($\bar{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.		
Total No of Periods to be Taught		60 Periods

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TEXT BOOK:

1	Johnson. R.A., Miller. I.R and Freund . J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
2	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata Mc Graw Hill, 4th Edition, 2007. .
3	John E. Freund, "Mathematical Statistics", Prentice Hall, 5th Edition, 1992

REFERENCES:

1	Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3	Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5thEdition, Elsevier, 2014
4	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
5	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2010.

COURSE OUTCOMES:

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

CO1:	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
CO2:	Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
CO3:	Apply the concept of testing of hypothesis for small and large samples in real life problems
CO4:	Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
CO5:	Have the notion of sampling distributions and statistical techniques used in engineering and management problems. Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.


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Mapping of COs with POs and PSOs

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

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


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Department	Artificial Intelligence and Data Science	Programme Code & Name	243 - AI&DS
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADT24401	Machine Learning	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To understand the basic concepts of machine learning. • To understand and build supervised learning models. • To understand and build unsupervised learning models. • To evaluate the algorithms based on corresponding metrics identified					

Unit-I	INTRODUCTION TO MACHINE LEARNING	(9)
Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik- Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.		
Unit-II	SUPERVISED LEARNING	(9)
Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naïve Bayes, Maximum margin classifier–Support vector machine, Decision Tree, Random Forests		
Unit-III	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-IV	NEURAL NETWORKS	(9)
Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks–Unit saturation (aka the vanishing gradient problem)–ReLU, hyper parameter tuning, batch normalization, regularization, dropout		
Unit-V	DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS	(9)
Guidelines for machine learning experiments, Cross Validation (CV) and resampling- K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms–ttest, McNemar’s test, K-fold CV paired ttest		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	Ethem Alpaydin, “Introduction to Machine Learning”, MITPress, FourthEdition, 2020.
2	Stephen Marsland, “Machine Learning: An Algorithmic Perspective, “Second Edition”, CRCPress,2014.

REFERENCES:

1	Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
2	Tom Mitchell, “Machine Learning”, McGrawHill, 3 rd Edition,1997.
3	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, Second Edition, MITPress, 2018.
4	IanGoodfellow, YoshuaBengio, AaronCourville, “Deep Learning”, MIT Press,2016
5	Sebastain Raschka, VahidMirjalili, “Python Machine Learning”, Packt publishing, 3 rd Edition,2019.

COURSE OUTCOMES:

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

CO1:	Explain the basic concepts of machine learning.
CO2:	Construct supervised learning models.
CO3:	Construct unsupervised learning algorithms.
CO4:	Evaluate and compare different models
CO5:	Build the graph-based learning models for standard data sets.

Mapping of COs with POs and PSOs

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

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCST24401	Database Management Systems	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To learn the fundamentals of data models, relational algebra and SQL • To represent a database system using ER diagrams and to learn normalization techniques • To understand the fundamental concepts of transaction, concurrency and recovery processing • To understand the internal storage structures using different file and indexing techniques which will help in physical DB design • To have an introductory knowledge about the Distributed databases, NOSQL and database security					
Unit-I	RELATIONAL DATABASES					(9)
Purpose of Database System– Views of data – Data Models– Database System Architecture –Introduction to Relational databases–Relational Model–Keys–Relational Algebra–SQL fundamentals–Advanced SQL features– Embedded SQL– Dynamic SQL						
Unit-II	DATABASE DESIGN					(9)
Entity-Relationship model–E-R Diagrams–Enhanced-ER Model–ER-to-Relational Mapping–Functional Dependencies–Non-loss Decomposition–First, Second, Third Normal Forms, Dependency Preservation– Boyce/Codd Normal Form–Multi-valued Dependencies and Fourth Normal Form– Join Dependencies and Fifth Normal Form						
Unit-III	TRANSACTIONS					(9)
Transaction Concepts–ACID Properties–Schedules– Serializability–Transaction supporting SQL–Need For Concurrency –Concurrency control–Two Phase Locking–Timestamp–Multi version–Validation and Snapshot isolation–Multiple Granularity locking–Deadlock Handling–Recovery Concepts–Recovery based on deferred and immediate update – Shadow paging– ARIES Algorithm						

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Unit-IV	IMPLEMENTATION TECHNIQUES	(9)
RAID–File Organization–Organization of Records in Files–Data dictionary Storage–Column Oriented Storage–Indexing and Hashing–Ordered Indices– B+ tree Index Files– B tree Index Files–Static Hashing– Dynamic Hashing–Query Processing Overview–Algorithms for Selection, Sorting and join operations– Query optimization using Heuristics–Cost Estimation		
Unit-V	ADVANCED TOPICS	(9)
Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization–NOSQL Databases: Introduction–CAP Theorem–Document Based systems–Key value Stores–Column Based Systems–Graph Databases. Database Security: Security issues–Access control based on privileges– Role Based access control–SQL Injection–Statistical Data base security–Flow control–Encryption and Public Key infra structures– Challenges		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:

1	Abraham Silberschatz, HenryF. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGrawHill, 2020
2	Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017

REFERENCES:

1	C. J. Date, A. Kannan, Swaminathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006
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COURSE OUTCOMES:

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

CO1:	Construct SQL Queries using relational algebra.
CO2:	Design database using ER model and normalize the database.
CO3:	Construct queries to handle transaction processing and maintain consistency of the database.
CO4:	Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database.
CO5:	Appraise how advanced databases differ from Relational Databases and find a suitable database for the given requirement.

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


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Department	S&H	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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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.						


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Unit-III	RENEWABLE SOURCES OF ENERGY	(6)
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy		
Unit-IV	SUSTAINABILITY AND MANAGEMENT	(6)
Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study		
Unit-V	SUSTAINABILITY PRACTICES	(6)
Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cyclescarbon 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.


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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.

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	PSO 1	PSO 2	PSO 3
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	Artificial Intelligence and Data Science	Programme Code & Name	243 - AI&DS
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Semester 04

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADTL24401	Operating Systems	L	T	P	C	100
		3	0	2	4	
Course Objectives	• To understand the basics and functions of operating systems. • To understand Processes and Threads • To analyze Scheduling algorithms and process synchronization. • To understand the concept of Deadlocks. • To analyze various memory management schemes. • To be familiar with I/O management and File systems. • To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.					

Unit-I	INTRODUCTION	(7)
Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation- Structuring methods.		
Unit-II	PROCESS MANAGEMENT	(11)
Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads –Multithread Models –Threading issues; Process Synchronization-The critical-section problem-Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization -Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.		
Unit-III	MEMORY MANAGEMENT	(10)
Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write – Page Replacement-Allocation of Frames–Thrashing.		

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Unit-IV	STORAGE MANAGEMENT	(10)
Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface -File concept- Access methods - Directory Structure -Directory organization -File system mounting - File Sharing and Protection; File System Implementation - File System Structure -Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.		
Unit-V	VIRTUAL MACHINES AND MOBILEOS	(7)
Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS – iOS and Android.		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2018.
2	Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 4thEdition, New Delhi, 2016.
REFERENCES:	
1	Ramaz Elmasri, A. GilCarrick, David Levine, “Operating Systems–A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2	William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3	AchyutS. Godbole, AtulKahate, “Operating Systems”, McGrawHill Education, 2016.

List of Exercises / Experiments
1. Installation of Operating system: Windows/ Linux.
2. Illustrate UNIX commands and Shell Programming.
3. Process Management using System Calls: Fork, Exec, Getpid, Exit, Wait, Close.
4. Write C programs to implement the various CPU Scheduling Algorithms.
5. Illustrate the inter process communication strategy.
6. Implement mutual exclusion by Semaphores.
7. Write a C program to avoid Deadlock using Banker's Algorithm.
8. Write a C program to Implement Deadlock Detection Algorithm.
9. Write C program to implement Threading.
10. Implement the paging Technique using C program Write C programs to implement the following Memory Allocation Methods a. First Fit b. Worst Fit c. Best Fit

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Write C programs to implement the various Page Replacement Algorithms Write C programs to Implement the various File Organization Techniques Implement the following File Allocation Strategies using C programs a. Sequential b. Indexed c. Linked Write C programs for the implementation of various disk scheduling algorithms	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

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

CO1:	Analyze various scheduling algorithms and process synchronization.
CO2:	Explain deadlock, prevention and avoidance algorithms.
CO3:	Compare and contrast various memory management schemes.
CO4:	Explain the functionality of file systems I/O systems, and Virtualization
CO5:	Compare iOS and Android Operating Systems.

LIST OF EQUIPMENT 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	Python , Numpy, Scipy ,Matplotlib, Pandas, seaborn, statmodels	30

Mapping of COs with POs and PSOs

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

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSTL24501	COMPUTER NETWORKS	L	T	P	C	100
		3	0	2	4	
Course Objectives	• To understand the concept of layering in networks • To know the functions of protocols of each layer of TCP/IP protocol suite. • To visualize the end-to-end flow of information. • To learn the functions of network layer and the various routing protocols • To familiarize the functions and protocols of the Transport layer					

Unit-I	INTRODUCTION AND APPLICATION LAYER	(10)
Data Communication - Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Introduction to Sockets - Application Layer protocols: HTTP – FTP – Email protocols (SMTP - POP3 - IMAP - MIME) – DNS – SNMP		
Unit-II	TRANSPORT LAYER	(9)
Introduction - Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control - Congestion Control - Congestion avoidance (DECbit, RED) – SCTP – Quality of Service		
Unit-III	NETWORK LAYER	(7)
Switching : Packet Switching - Internet protocol - IPV4 – IP Addressing – Subnetting - IPV6, ARP, RARP, ICMP, DHCP		
Unit-IV	ROUTING	(7)
Routing and protocols: Unicast routing - Distance Vector Routing - RIP - Link State Routing – OSPF – Path-vector routing - BGP - Multicast Routing: DVMRP – PIM.		
Unit-V	DATA LINK AND PHYSICAL LAYERS	(12)
Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC – PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) - Physical Layer: Data and Signals - Performance – Transmission media- Switching – Circuit Switching		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.
2	Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022.


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REFERENCES:

1	Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012
2	William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3	Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4	Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill, 2012.

List of Exercises/Experiments

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.	
2. Write a HTTP web client program to download a web page using TCP sockets	
3. Applications using TCP sockets like: a) Echo client and echo server b) Chat	
4. Simulation of DNS using UDP sockets	
5. Use a tool like Wireshark to capture packets and examine the packets	
6. Write a code simulating ARP /RARP protocols.	
7. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.	
8. Study of TCP/UDP performance using Simulation tool.	
9. Simulation of Distance Vector/ Link State Routing algorithm.	
10. Simulation of an error correction code (like CRC)	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	75 Periods

LIST OF EQUIPMENT 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	Java Programming and Simulation Software	30


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COURSE OUTCOMES:

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

CO1:	Explain the basic layers and its functions in computer networks.
CO2:	Understand the basics of how data flows from one node to another.
CO3:	Analyze routing algorithms
CO4:	Describe protocols for various functions in the network
CO5:	Analyze the working of various application layer protocols.

Mapping of COs with POs and PSOs

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

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


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Department	Artificial Intelligence and Data Science	Programme Code & Name	243 - AI&DS
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADL24401	Machine Learning Laboratory	L	T	P	C	100
		0	0	4	2	
Course Objectives	• To understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis. • To learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance. • To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance. • To build the graph-based learning models for standard data sets. • To compare the performance of different ML algorithms and select the suitable one based on the application.					

List of Exercises / Experiments

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate datasets.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set to read a .CSV file and compute the accuracy with a few test datasets.
5. Implement naïve Bayesian Classifier model to classify a set of documents and measure the accuracy, precision, and recall.
6. Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms.
8. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

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9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select an appropriate data set for your experiment and draw graphs.

Total No of Periods to be Taught

60 Periods

COURSE OUTCOMES:

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

CO1:	Apply suitable algorithms for selecting the appropriate features for analysis.
CO2:	Implement supervised machine learning algorithms on standard datasets and evaluate the performance.
CO3:	Apply unsupervised machine learning algorithms on standard datasets and evaluate the performance.
CO4:	Build the graph-based learning models for standard data sets.
CO5:	Assess and compare the performance of different ML algorithms and select the suitable one based on the application

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	The programs can be implemented in either Python or R.	30
2	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3	Dev C++ / Eclipse CDT / Code Blocks / CodeLite / equivalent open-source IDE	30
4	Python , Numpy, Scipy, Matplotlib, Pandas, seaborn, statsmodels Python3.9 and above, Anaconda Distribution	30

Mapping of COs with POs and PSOs

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

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSL24401	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C	100
		0	0	3	1.5	
Course Objectives	• To learn and implement important commands in SQL. • To learn the usage of nested and joint queries • To understand functions, procedures and procedural extensions of databases • To understand design and implementation of typical database applications • To be familiar with the use of a front-end tool for GUI based application development					

List of Exercises/Experiments

1. Create a database table, add constraints(primary key, unique, check, not null),insert rows, update and delete rows using SQL DDL and DML commands
2. Create a set of tables, add foreign key constraints and in corporate referential integrity.
3. Query the database tables using different 'where' clause conditions and also implement aggregate functions
4. Query the database tables and explore sub queries and simple join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete and update operations in a database table.
9. Create View and index for database tables with a large number of records.
10. Create an XML database and validate it using XML schema
11. Create Document, column and graph-based data using NOSQL database tools.
12. Develop a simple GUI based database application and incorporate all the above-mentioned features


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13. Case Study using any of the real life database applications from the following list

- Inventory Management for a EMart Grocery Shop
- Society Financial Management
- Cop Friendly App – Eseva
- Property Management – eMall
- Star Small and Medium Banking and Finance

- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
- Apply Normalization rules in designing the tables in scope.
- Prepared applicable views, triggers (for auditing purposes), and functions for enabling enterprise grade features.
- Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
- Ability to showcase ACID Properties with sample queries with appropriate settings

Total No of Periods to be Taught

45 Periods

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	INTELbaseddesktopPCwithmin.8GBRAMand500GB HDD, 17 or higher TFT Monitor, Keyboard and mouse	30
2	Windows 10or higher operating system / Linux Ubuntu 20 or higher	
3	Any Version of Database Software	

COURSE OUTCOMES:

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

CO1:	Create databases with different types of key constraints.
CO2:	Construct simple and complex SQL queries using DML and DCL commands.
CO3:	Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.
CO4:	Create an XML database and validate with meta-data (XML schema).
CO5:	Create and manipulate data using NOSQL database.


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Mapping of COs with POs and PSOs

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

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

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


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TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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


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Department	Artificial Intelligence and Data Science	Programme Code & Name	243 - AI&DS
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADT24501	Deep Learning	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To understand and need and principles of deep neural networks • To understand CNN and RNN architectures of deep neural networks • To comprehend advanced deep learning model • To learn the evaluation metrics for deep learning models					

Unit-I	DEEP NETWORKS BASICS	(9)
Linear Algebra: Scalars -- Vectors -- Matrices and tensors; Probability Distributions -- Gradient-based Optimization-- Machine Learning Basics: Capacity—Over fitting and under fitting--Hyperparameters and validation sets -- Estimators -- Bias and variance -- Stochastic gradient descent--Challenges motivating deep learning; Deep Networks: Deep feed forward networks; Regularization-- Optimization.		
Unit-II	CONVOLUTIONAL NEURAL NETWORKS	(9)
Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided -- Tiled -- Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions -- Loss Functions -- Regularization -- Optimizers --Gradient Computation.		
Unit-III	RECURRENT NEURAL NETWORKS	(9)
Unfolding Graphs -- RNN Design Patterns: Acceptor -- Encoder --Transducer; Gradient Computation -- Sequence Modeling Conditioned on Contexts -- Bidirectional RNN -- Sequence to Sequence RNN -- Deep Recurrent Networks -- Recursive Neural Networks -- Long Term Dependencies; Leaky Units: Skip connections and dropouts; Gated Architecture: LSTM.		
Unit-IV	MODEL EVALUATION	(9)
Performance metrics -- Baseline Models -- Hyperparameters: Manual Hyperparameter -- Automatic Hyperparameter -- Grid search -- Random search -- Debugging strategies.'		
Unit-V	AUTO ENCODERS AND GENERATIVE MODELS	(9)
Auto encoders: Under complete auto encoders -- Regularized autoencoders -- Stochastic encoders and decoders -- Learning with autoencoders; Deep Generative Models: Variational autoencoders -- Generative adversarial networks		
Total No of Periods to be Taught	45 Periods	

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TEXT BOOK:

1	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2	Andrew Glassner, "Deep Learning: A Visual Approach", No Starch Press, 2021.

REFERENCES:

1	Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, "A Guide to Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool Publishers, 2018.
2	Yoav Goldberg, "Neural Network Methods for Natural Language Processing", Synthesis Lectures on Human Language Technologies, Morgan & Claypool Publishers, 2017.
3	Francois Chollet, "Deep Learning with Python", Manning Publications Co, 2018.

COURSE OUTCOMES:

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

CO1:	Explain the basics in deep neural networks
CO2:	Apply Convolution Neural Network for image processing
CO3:	Apply Recurrent Neural Network and its variants for text analysis
CO4:	Apply model evaluation for various applications
CO5:	Apply autoencoders and generative models for suitable applications

Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	-	-	-	2	1	1	2	3	3	3
CO2	2	2	2	3	-	-	-	1	2	2	3	1	1	3
CO3	3	3	3	3	-	-	-	2	1	1	2	2	1	3
CO4	3	3	1	1	-	-	-	1	1	1	3	2	1	1
CO5	3	2	2	3	-	-	-	2	2	2	2	2	3	3
Avg.	2.8	2.4	2.4	2.2	-	-	-	1.6	2.4	1.4	2.4	2	1.8	2.6

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

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Department	Artificial Intelligence and Data Science	Programme Code & Name	243 - AI&DS
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADT24502	Data and Information Security	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To understand the basics of Information Security • To know the legal, ethical and professional issues in Information Security • To equip the students’ knowledge on digital signature, email security and web security					

Unit-I	INTRODUCTION	(9)
History, what is Information Security? Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.		
Unit-II	SECURITY INVESTIGATION	(9)
Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.		
Unit-III	DIGITAL SIGNATURE AND AUTHENTICATION	(9)
Digital Signature and Authentication Schemes: Digital Signature-Digital Signature Schemes and their Variants-Digital Signature Standards-Authentication: Overview- Requirements Protocols - Applications - Kerberos - X.509 Directory Services.		
Unit-IV	E-MAIL AND IP SECURITY	(9)
E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPSec Modes – Security association - Key management.		
Unit-V	WEB SECURITY	(9)
Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL secure communication- Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing.		
Total No of Periods to be Taught		45 Periods

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TEXT BOOK:

1	Michael E Whitman and Herbert J Mattord, "Principles of Information Security, Course Technology, 6th Edition, 2017.
2	Stallings William. Cryptography and Network Security: Principles and Practice, Seventh Edition, Pearson Education, 2017.

REFERENCES:

1	Harold F. Tipton, Micki Krause Nozaki,, "Information Security Management Handbook, Volume 6, 6th Edition, 2016.
2	Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", McGraw- Hill, Seventh Edition, 2012.
3	Matt Bishop, "Computer Security Art and Science, Addison Wesley Reprint Edition, 2015.

COURSE OUTCOMES:

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

CO1:	Understand the basics of data and information security
CO2:	Understand the legal, ethical and professional issues in information security
CO3:	Understand the various authentication schemes to simulate different applications.
CO4:	Understand various security practices and system security standards
CO5:	Understand the Web security protocols for E-Commerce applications

Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	1	-	-	-	-	1	3	1	3	1	1
CO2	1	3	3	3	2	-	-	-	1	2	2	1	2	2
CO3	2	3	3	3	1	-	-	-	1	3	1	1	2	1
CO4	3	3	1	1	1	-	-	-	3	1	1	2	3	3
CO5	3	2	2	3	2	-	-	-	1	2	1	2	2	1
Avg.	2.4	2.6	2.4	2.2	1.5	-	-	-	1.4	2.2	1.2	1.8	2	1.6

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCST24502	Distributed Computing	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To introduce the computation and communication models of distributed systems - To illustrate the issues of synchronization and collection of information in distributed systems - To describe distributed mutual exclusion and distributed deadlock detection techniques - To elucidate agreement protocols and fault tolerance mechanisms in distributed systems - To explain the cloud computing models and the underlying concepts					

Unit-I	INTRODUCTION	(9)
Introduction: Definition-Relation to Computer System Components–Motivation–Message-Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.		
Unit-II	LOGICAL TIME AND GLOBAL STATE	(9)
Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction–System Model and Definitions–Snapshot Algorithms for FIFO Channels.		
Unit-III	DISTRIBUTED MUTEX AND DEADLOCK	(9)
Distributed Mutual exclusion Algorithms: Introduction–Preliminaries–Lamport’s algorithm–Ricart-Agrawala’s Algorithm — Token-Based Algorithms – Suzuki-Kasami’s Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model		

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Unit-IV	CONSENSUS AND RECOVERY	(9)
Consensus and Agreement Algorithms: Problem Definition–Overview of Results–Agreement Failure-Free System(Synchronous and Asynchronous) –Agreement in Synchronous Systems with Failures; Check pointing and Rollback Recovery: Introduction–Background and Definitions–Issues inFailureRecovery–Checkpoint-basedRecovery–CoordinatedCheckpointing Algorithm- -Algorithm for Asynchronous Checkpointing and Recovery		
Unit-V	CLOUD COMPUTING	(9)
Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services.Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services.		
Total No of Periods to be Taught		45 Periods

TEXT BOOK:	
1	Kshemkalyani Ajay D, Mukesh Singhal, “Distributed Computing: Principles, Algorithms and Systems”, Cambridge Press, 2011.
2	Mukesh Singhal, Niranjan G Shivaratri, “Advanced Concepts in Operating systems”, McGraw Hill Publishers, 1994.

REFERENCES:	
1	George Coulouris, Jean Dollimore, Time Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
2	Pradeep L Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.
3	Tanenbaum A S, Van Steen M, “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
4	Liu M L, “Distributed Computing: Principles and Applications”, Pearson Education, 2004.
5	Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, 2003.
6	Arshdeep Bagga, Vijay Madiseti, “ Cloud Computing: A Hands-On Approach”, Universities Press, 2014.


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COURSE OUTCOMES:

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

CO1:	Explain the foundations of distributed systems.
CO2:	Solve synchronization and state consistency problems
CO3:	User source sharing techniques in distributed systems
CO4:	Apply working model of consensus and reliability of distributed systems.
CO5:	Explain the fundamentals of cloud computing.

Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	2	2	3	3	1	-	-	-	2	1	3	3	2	1
CO2	1	3	2	1	2	-	-	-	2	2	2	2	1	3
CO3	2	2	1	3	3	-	-	-	3	2	1	1	1	2
CO4	1	2	2	3	1	-	-	-	3	3	2	1	3	1
CO5	3	3	1	2	3	-	-	-	3	3	3	1	3	2
Avg.	1.8	2.4	1.8	2.4	2	-	-	-	2.6	2.2	2.2	1.6	2	1.8

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Semester V

Course Code	Course Name	Hours / Week			Credit	Maximum Marks
UCSPE2408	Big Data Analytics	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To understand big data. • To learn and use NoSQL big data management. • To learn mapreduce analytics using Hadoop and related tools. • To work with map, reduce applications • To understand the usage of Hadoop related tools for Big Data Analytics					

Unit-I	UNDERSTANDING BIG DATA	(6)
Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open– source technologies– cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics		
Unit-II	NOSQL DATA MANAGEMENT	(6)
Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients.		
Unit-III	MAP REDUCE APPLICATIONS	(6)
MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.		
Unit-IV	BASICS OF HADOOP	(6)
Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration		

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Unit-V	HADOOP RELATED TOOLS	(6)
Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model– Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:	
1	Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2	Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3	Sadalage, Pramod J. "NoSQL distilled", 2013

REFERENCES:	
1	E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2	Lars George, "HBase: The Definitive Guide", O'Reilley, 2011
3	Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
4	Alan Gates, "Programming Pig", O'Reilley, 2011

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:	Describe big data and use cases from selected business domains
CO2:	Explain NoSQL big data management.
CO3:	Install, configure, and run Hadoop and HDFS.
CO4:	Perform map-reduce analytics using Hadoop.
CO5:	Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

LIST OF EQUIPMENT 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	Python, OpenCV, PyTorch, Google Cloud (Vision AI, AutoML)	30
4	AWS (EC2, S3, Rekognition), Microsoft Azure	30

Mapping of COs with POs and PSOs

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

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

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Department	Artificial Intelligence and Data Science	Programme Code & Name	243 - AI&DS
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADL24501	Deep Learning Laboratory	L	T	P	C	100
		0	0	4	2	
Course Objectives	• To understand the tools and techniques to implement deep neural networks • To apply different deep learning architectures for solving problems • To implement generative models for suitable applications • To learn to build and validate different models					

List of Exercises / Experiments	
1.Solving XOR problem using DNN	
2. Character recognition using CNN	
3.Face recognition using CNN	
4.Language modeling using RNN	
5.Sentiment analysis using LSTM	
6.Parts of speech tagging using Sequence to Sequence architecture	
7.Machine Translation using Encoder-Decoder model	
8.Image augmentation using GANs	
9.Mini-project on real world applications	
Total No of Periods to be Taught	60 Periods

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Apply Convolution Neural Network for image processing
CO2:	Apply Recurrent Neural Network and its variants for text analysis
CO3:	Use resource sharing techniques in analysis
CO4:	Apply generative models for data augmentation
CO5:	Develop real-world solutions using suitable deep neural networks

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	The programs can be implemented in either Python or R.	30
2	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3	Dev C++ / Eclipse CDT / Code Blocks / CodeLite / equivalent open-source IDE	30
4	Python , Numpy, Scipy, Matplotlib, Pandas, seaborn, statsmodels Python3.9 and above, Anaconda Distribution	30

Mapping of COs with POs and PSOs														
COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	1	-	-	-	3	2	3	3	3	2
CO2	1	3	2	2	2	-	-	-	3	2	2	1	3	1
CO3	3	2	1	2	1	-	-	-	2	3	1	2	3	3
CO4	3	3	1	2	1	-	-	-	1	3	2	3	2	2
CO5	3	3	3	3	2	-	-	-	1	2	3	3	3	2
Avg.	2.6	2.6	1.6	2	1.4	-	-	-	2	2.4	2.2	2.4	2.8	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														

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Department	AI&DS	Programme Code s Name	Common to All
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
USI24501	Summer Internship – I *	L	T	P	C	100
		0	0	0	1	
Course Objectives	• Get connected with Industry/laboratory/research institute • Get practical knowledge on production process in the industry and develop skills to solve related problems • Develop skills to carry out research in the research institutes/laboratories					

List of Exercises/Experiments

The students individually undergo training in reputed firms/ research institutes /laboratories of the specified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.

Total No of Periods to be Taught	2 WEEKS
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COURSE OUTCOMES:

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

CO1:	Plant layout, machinery, organizational structure and production processes in the firm or research facilities in the laboratory/research institute.
CO2:	Analysis of industrial/research problems and their solutions.
CO3:	Documenting of material specifications, machine and process parameters, testing parameters and results.
CO4:	Preparing of Technical report and presentation.

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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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TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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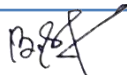


Department	ECE	Programme Code s Name	Common to 104 – CSE, 205 – IT 243 – AIsDS
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECTL24502	EMBEDDED SYSTEMS AND IOT	L	T	P	C	100
		3	0	2	4	
Course Objectives	- To learn the internal architecture and programming of an embedded processor. - To introduce interfacing I/O devices to the processor. - To introduce the evolution of the Internet of Things (IoT). - To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform. - To apply the concept of Internet of Things in real world scenario.					

Unit-I	8-BIT EMBEDDED PROCESSOR	(G)
8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.		
Unit-II	EMBEDDED C PROGRAMMING	(G)
Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.		
Unit-III	IOT AND ARDUINO PROGRAMMING	(G)
Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input / Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.		
Unit-IV	IOT COMMUNICATION AND OPEN PLATFORMS	(G)
IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.		
Unit-V	APPLICATIONS DEVELOPMENT	(G)
Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.		
Total No of Periods to be Taught		45 Periods


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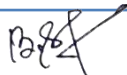
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List of Exercises/Experiments	
1. Write 8051 Assembly Language experiments using simulator.	
2. Test data transfer between registers and memory.	
3. Perform ALU operations.	
4. Write Basic and arithmetic Programs Using Embedded C.	
5. Introduction to Arduino platform and programming	
6. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)	
7. Introduction to Raspberry PI platform and python programming	
8. Interfacing sensors with Raspberry PI	
9. Communicate between Arduino and Raspberry PI using any wireless medium	
10. Setup a cloud platform to log the data	
11. Log Data using Raspberry PI and upload to the cloud platform	
12. Design an IOT based system	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (TsL)	75 Periods

TEXT BOOK:	
1	Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014
2	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.

REFERENCES:	
1.	Michael J. Pont, "Embedded C", Pearson Education, 2007.
2.	Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
3.	Andrew N Sloss, D. Symes, C. Wright, "Arm System Developer's Guide", Morgan Kauffman/ Elsevier, 2006.


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LIST OF EQUIPMENT 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

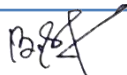
COURSE OUTCOMES:

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

CO1:	Explain the architecture of embedded processors.
CO2:	Write embedded C programs.
CO3:	Design simple embedded applications.
CO4:	Compare the communication models in IOT
CO5:	Design IoT applications using Arduino/Raspberry Pi /open platform.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO6	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	1	2	3	3	2	1	3
CO2	2	1	3	2	2	-	-	1	2	2	3	3	1	3
CO3	3	1	3	3	1	-	-	1	2	1	1	1	3	3
CO4	3	2	3	2	1	-	-	1	2	2	3	2	2	1
CO5	2	3	3	2	2	-	-	1	3	3	2	3	1	3
Avg.	2.6	2	3	2.4	1.5	-	-	1	2.2	2.2	2.4	2.2	1.6	2.6
1 – Slight, 2 – Moderate, 3 –Substantial, BT – Bloom’s Taxonomy														


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Department	AI&DS	Programme Code Name	243 & AI&DS
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Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADL24601	MINI PROJECT	L	T	P	C	100
		0	0	4	2	
Course Objectives	• The primary aim of a mini-project course is to equip students with practical experience by applying theoretical knowledge to real-world scenarios. • This hands-on approach enhances analytical and problem-solving skills, fosters teamwork, and develops project management abilities. • Ultimately, these projects serve as a crucial bridge connecting academic learning with professional practice, better preparing students for more complex challenges in their future careers. • The purpose of the mini-project is to allow you to explore the breadth of research that is being performed within the college					

List of Exercises/Experiments:

The student shall carry out a 'mini project work in the sixth semester. This Mini project work carries 2 credits. The student is given an option to carry out this mini project work either in the college or in an industry or in a research laboratory or in a higher learning institution. The students shall individually / or as group work on a specific topic approved by the Department. The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. The project work will be carried out under supervision of a project guide from the department. In case of student carrying out the project work outside the college, an external guide from the relevant organization shall be assigned in addition to the internal guide from the department. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

Total No of Periods	60 Periods
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COURSE OUTCOMES:

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

CO1:	Apply class room theory by collecting literature pertaining to the purpose project
CO2:	Demonstrate the ability to work in teams
CO3:	Write technical documents and make oral presentations related to the work completed.
CO4:	Manage a project within a stipulated time period
CO5:	Apply professional ethics and responsibilities.


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Mapping of COs with POs and PSOs

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

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


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Department	Mechanical	Programme Code s Name	Common to All
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Semester VI

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

Unit-I	RATIO AND PROPORTION, PIPES AND CISTERNS	(6)
Introductions - Pipes s Outlet Problem - Problem on Ratio s Proportion.		
Unit-II	SIMPLE INTEREST AND COMPOUND INTEREST s SPEAKING ACTIVITY	(6)
Introduction-Simple Interest-Compound Interest-Different Rules-Present worth.		
Unit-III	BOAT AND STREAM, CALENDAR s LOGICAL ARRANGEMENT OF WORDS	(6)
Introduction-Upstream s 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 s CONCLUSION	(6)
Introduction – Alligation -Mean Price-Rule of Allegation-Problem on Mixture Introduction to Statement and Conclusion –Exercise for Statement and Conclusion.		
Total No of Periods to be Taught		30


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TEXT BOOK:

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

REFERENCES:

1	R.S. Aggarwal, "Quantitative Aptitude", Seventh edition, S.Chand Publication.
2	http://www.mastguru.com/arithmatic-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	PO6	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

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


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Department	AI&DS	Programme Code & Name	243 – AI&DS
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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	AI&DS	Programme Code s Name	Common to All
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Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
USI24701	Summer Internship - II #	L	T	P	C	100
		0	0	0	1	
Course Objectives	• Get connected with Industry/laboratory/research institute • Get practical knowledge on production process in the industry and develop skills to solve related problems • Develop skills to carry out research in the research institutes/laboratories					

List of Exercises/Experiments

The students individually undergo training in reputed firms/ research institutes /laboratories of the specified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.

Total No of Periods to be Taught	2 WEEKS
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COURSE OUTCOMES:

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

CO1:	Plant layout, machinery, organizational structure and production processes in the firm or research facilities in the laboratory/research institute.
CO2:	Analysis of industrial/research problems and their solutions.
CO3:	Documenting of material specifications, machine and process parameters, testing parameters and results.
CO4:	Preparing of Technical report and presentation.

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Department	AI&DS	Programme Code s Name	243 – AI&DS
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Semester VIII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UADL24801	PROJECT WORK/INTERNSHIP	L	T	P	C	100
		0	0	20	10	
Course Objectives	To enable the students to - To train the students for gaining domain knowledge, and technical skills to solve potential business/research problems - Gather requirements and Design suitable software solutions and evaluate alternatives - To work in small teams and understand the processes and practices in the industry. - Implement, Test and deploy solutions for target platforms - Preparing project reports and presentation					

The students shall individually / or as group work on business/research domains and related problems approved by the Department / organization that offered the internship / project.

The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by 106 the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

Total No of Periods to be Taught	300 Periods
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COURSE OUTCOMES:

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

CO1:	Gain Domain knowledge and technical skill set required for solving industry/research problems
CO2:	Provide solution architecture, module level designs, algorithms
CO3:	Implement, test and deploy the solution for the target platform
CO4:	Prepare detailed technical report, demonstrate and present the work
CO5:	Gain Domain knowledge and technical skill set required for solving industry/research problems

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Department	MBA	Programme Code & Name	COMMON TO ALL
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Semester

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

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

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TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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

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Department	MBA	Programme Code & Name	COMMON TO ALL
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Semester

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

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

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

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

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

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

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Department	MBA	Programme Code & Name	COMMON TO ALL
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGET24703	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	L	T	P	C	100
		3	0	0	3	

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

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TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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

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Department	MBA	Programme Code & Name			COMMON TO ALL	
Semester						
Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UGET24704	HUMAN RESOURCE MANAGEMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To provide knowledge about management issues related to staffing, - To provide knowledge about management issues related to training, - To provide knowledge about management issues related to performance - To provide knowledge about management issues related to compensation - To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements.					
Unit-I	INTRODUCTION TO HUMAN RESOURCE MANAGEMENT					(9)
The importance of human resources– Objective of Human Resource Management-Human resource policies - Role of human resource manager.						
Unit-II	HUMAN RESOURCE PLANNING					(9)
Importance of Human Resource Planning – Internal and External sources of Human Resources - Recruitment - Selection – Socialization.						
Unit-III	TRAININGAND EXECUTIVE DEVELOPMENT					(9)
Types of training and Executive development methods–purpose–benefits.						
Unit-IV	EMPLOYEE COMPENSATION					(9)
Compensationplan–Reward–Motivation–CareerDevelopment-Mentor–Protege relationships.						
Unit-V	PERFORMANCE EVALUATION AND CONTROL					(9)
Performance evaluation – Feedback - The control process – Importance –Methods – grievances – Causes – Redressal methods.						
Total No of Periods to be Taught					45 periods	

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

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REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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

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

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TEXT BOOK:

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

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

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

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

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1					1									
CO2					2								1	
CO3					2									2
CO4				1	1				1					1
CO5				1	1				1					1
Avg.				1	1.4				1				1	1.3

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

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Department	MBA	Programme Code & Name	COMMON TO ALL
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Semester

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

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

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

Total No of Periods to be Taught

45 periods

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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Mapping of COs with POs and PSOs

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

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

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

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

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


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

Total No of Periods to be Taught

Total : 30 Periods

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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


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Mapping of COs with POs and PSOs

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

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

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

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

COURSE CONTENTS

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


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

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

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


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Mapping of COs with POs and PSOs

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

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

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

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

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


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COURSE OUTCOMES:

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

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

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

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

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


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Mapping of COs with POs and PSOs

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

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


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

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

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


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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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


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

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

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

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TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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

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

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


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

Total No of Periods to be Taught

Total: 30 periods

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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


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Mapping of COs with POs and PSOs

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

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

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

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

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


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

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

Prevention of illness with our traditional system of medicine

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

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

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

Immunity - Types and importance - Ways to develop immunity

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

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

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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


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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 – CSE 205 – IT 243 - AI&DS
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Course Code	Course Name	Hours / Week			Credit	Maximum Marks
UCSPE2409	Knowledge Engineering	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To understand the basics of Knowledge Engineering. • To discuss methodologies and modeling for Agent Design and Development. • To design and develop ontologies. • To apply reasoning with ontologies and rules. • To understand learning and rule learning					

Unit-I	REASONING UNDER UNCERTAINTY	(6)
Introduction–Abductive reasoning–Probabilistic reasoning: Enumerative Probabilities– Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods – Evidence based reasoning–Intelligent Agent – Mixed – Initiative Reasoning– Knowledge Engineering.		
Unit-II	METHODOLOGY AND MODELING	(6)
Conventional Design and Development – Development tools and Reusable Ontologies Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry- driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment –Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios		
Unit-III	ONTOLOGIES –DESIGN AND DEVELOPMENT	(6)
Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation–Transitivity–Inheritance–Concepts as Feature Values–Ontology Matching. Design and Development Methodologies–Steps in Ontology Development-Domain Understanding and Concept Elicitation–Modelling-based Ontology Specification.		


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Unit-IV	REASONING WITH ON TOLOGIES AND RULES	(6)
Production System Architecture–Complex Ontology-based Concepts–Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching–Partially Learned Knowledge–Reasoning with Partially Learned Knowledge.		

Unit-V	LEARNING AND RULE LEARNING	(6)
Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement–Overview– Rule Generation and Analysis–Hypothesis Learning.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Gheorghe Tecuci, Dorine Marco, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit1–Chapter 1/Unit 2 –Chapter 3,4/Unit 3– Chapter5,6/Unit4-7, Unit5 –Chapter 8,9)
2	Expert Systems: Principles and Programming" by Joseph C. Giarratano and Gary D. Riley: A comprehensive textbook on expert systems principles and programming.
3	"Building Expert Systems" by Frederick Hayes-Roth and others: A textbook on building expert systems.

REFERENCES:

1	RonaldJ. Brachman, HectorJ. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2	ElaKumar, Knowledge Engineering, IK International Publisher House, 2018.
3	JohnF.Sowa: Knowledge Representation: Logical, Philosophical and Computational Foundations, Brooks/ Cole, Thomson Learning,2000

List of Exercises / Experiments

1.	Perform operations with Evidence Based Reasoning.
2.	Perform Evidence based Analysis.
3.	Perform operations on Probability Based Reasoning.
4.	Perform Believability Analysis.
5.	Implement Rule Learning and refinement.


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6. Perform analysis based on learned patterns.
7. Construction of Ontology for a given domain.
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 basics of Knowledge Engineering.
CO2:	Apply methodologies and modelling for Agent Design and Development.
CO3:	Design and develop ontologies.
CO4:	Apply reasoning with onto logies and rules.
CO5:	Understand learning and rule learning.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Python, R	30
2.	Windows, macOS, or Linux	

Mapping of COs with POs and PSOs

Cos / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	1	1	1	1	1	-	-	1	2	1	1	1	1
CO2	3	2	3	2	2	-	-	-	2	1	2	3	3	1
CO3	2	2	3	2	2	-	-	-	3	2	2	3	2	3
CO4	2	2	3	1	1	-	-	-	2	2	2	2	1	1
CO5	2	2	2	1	1	-	-	-	2	1	1	2	1	1
Avg.	2.4	1.8	2.4	1.4	1.4	0.2	0	0	2	1.6	1.6	2.2	1.6	1.4

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


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2402	RECOMMENDER SYSTEMS	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To understand the foundations of the recommender system. • To learn the significance of machine learning and data mining algorithms for Recommender systems • To learn about collaborative filtering • To make students design and implement a recommender system. • To learn collaborative filtering.					

Unit-I	INTRODUCTION	(6)
Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD) Suggested Activities: - Practical learning – Implement Data similarity measures. - External Learning – Singular Value Decomposition (SVD) applications Suggested Evaluation Methods: - Quiz on Recommender systems. - Quiz of python tools available for implementing Recommender systems		
Unit-II	CONTENT-BASED RECOMMENDATION SYSTEMS	(6)
High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms. Suggested Activities: - Assignment on content-based recommendation systems - Assignment of learning user profiles Suggested Evaluation Methods: - Quiz on similarity-based retrieval. - Quiz of content-based filtering		

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Unit-III	COLLABORATIVE FILTERING	(6)
A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection) Suggested Activities: • Practical learning – Implement collaborative filtering concepts • Assignment of security aspects of recommender systems Suggested Evaluation Methods: • Quiz on collaborative filtering • Seminar on security measures of recommender systems		
Unit-IV	ATTACK-RESISTANT RECOMMENDER SYSTEMS	(6)
Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms. Suggested Activities: • Group Discussion on attacks and their mitigation • Study of the impact of group attacks. Suggested Evaluation Methods: • Quiz on attacks on recommender systems • Seminar on preventing attacks using the CAPTCHAs		
Unit-V	EVALUATING RECOMMENDER SYSTEMS	(6)
Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures Suggested Activities: • Group Discussion on goals of evaluation design • Study of accuracy metrics Suggested Evaluation Methods: • Quiz on evaluation design • Problems on accuracy measures		
Total No of Periods to be Taught		30 Periods


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TEXT BOOK:

1	Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2	Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3	Francesco Ricci ,Lior Rokach , Bracha Shapira , Recommender Systems Handbook, 1st ed, Springer (2011),
4	Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3 rd edition, Cambridge University Press, 2020

List of Exercises/Experiments

1. Implement Data similarity measures using Python.	
2. Implement dimension reduction techniques for recommender systems	
3. Implement user profile learning	
4. Implement content-based recommendation systems	
5. Implement collaborative filter techniques	
6. Create an attack for tampering with recommender systems)	
7 Implement accuracy metrics like Receiver Operated Characteristic curves	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:

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

CO1:	Understand the basic concepts of recommender systems
CO2:	Implement machine-learning and data-mining algorithms in recommender systems data sets.
CO3:	Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
CO4:	Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
CO5:	Learn about advanced topics of recommender systems
CO6:	Learn about advanced topics of recommender systems applications


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LIST OF EQUIPMENT 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	Python/R + tools like Jupyter	30
4	ML frameworks and tools, Deployment infrastructure	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	2	2	1	2	1	-	-	1	-	-	1	-	-	-
CO2	1	2	-	-	1	-	-	-	-	-	1	-	-	-
CO3	2	3	1	-	1	-	-	2	-	-	-	-	-	-
CO4	1	1	-	2	1	-	-	2	-	-	2	-	-	-
CO5	2	2	1	1	1	-	-	-	-	-	1	-	-	-
Avg.	1.83	2	0.83	1.16	1	-	-	0.83	-	-	1	-	-	-
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 – CSE 205 – IT 243 - AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2441	Soft Computing	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To introduce the idea so fuzzy sets fuzzy logic and use of heuristics based on human experience. - To provide mathematical background for carrying out the optimization associated with neural network learning - To learn various evolutionary Algorithms. - To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems. - To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing					

Unit-I	INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC	(6)
Introduction – Fuzzy Logic- Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems.		
Unit-II	NEURAL NETWORKS	(6)
Supervised Learning Neural Networks – Perceptron's -Back propagation - Multi layer Perceptron's Unsupervised Learning Neural Networks–Kohonen Self-Organizing Networks		
Unit-III	GENETIC ALGORITHMS	(6)
Chromosome Encoding Schemes -Population initialization and selection methods – Evaluation function-Genetic Operators – Crossover – Mutation - Fitness Function – Maximizing function.		
Unit-IV	NEURO FUZZY MODELING	(6)
ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modelling–Framework–Neuron functions for adaptive networks–Neuro fuzzy spectrum-Analysis of Adaptive Learning Capability		
Unit-V	APPLICATIONS	(6)
Modeling two-input sine function-Printed Character Recognition–Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.		
Total No of Periods to be Taught		30 Periods


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TEXT BOOK:

1	SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, PrenticeHall,1997
2	Himanshu Singh, Yunis Ahmad Lone, Deep Neuro- Fuzzy Systems with Python
3	"Swarm Intelligence: Principles and Applications" by James Kennedy and Russell Eberhart: A comprehensive textbook on swarm intelligence principles and applications.

REFERENCES:

1	roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications,1stEdition, McGraw Hill,2018.
2	S. Rajasekar an and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms",PHI,2003.
3	SamirRoy, Udit Chakraborty, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.

List of Exercises / Experiments

1. Implementation of fuzzy control/inference system	
2. Programming exercise on classification with a discrete perceptron	
3. Implementation of XOR with back propagation algorithm	
4. Implementation of self-organizing maps for a specific application	
5. Programming exercises on maximizing a function using Genetic algorithm	
6. Implementation of two input sine function	
7. Implementation of three input non linear function	
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 fundamentals of fuzzy logic operators and inference mechanisms
CO2:	Understand neural network architecture for AI applications such as classification and clustering
CO3:	Learn the functionality of Genetic Algorithms in Optimization problems


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CO4:	Use hybrid techniques involving Neural networks and Fuzzy logic
CO5:	Apply soft computing techniques in real- world applications

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	MATLAB, Python, R , TensorFlow, Keras	30
2	Windows, macOS, or Linux	

Mapping of COs with POs and PSOs														
Cos / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	3	3	-	-	-	3	1	3	3	1	2
CO2	2	3	3	2	3	-	-	-	3	2	3	2	1	3
CO3	1	3	2	2	1	-	-	-	3	1	1	1	3	2
CO4	1	2	1	3	2	-	-	-	3	3	1	2	1	1
CO5	2	3	1	2	1	-	-	-	3	3	3	1	2	3
Avg.	1.8	2.6	2	2.4	2	-	-	-	3	2	2.2	1.8	1.6	2.2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2404	TEXT AND SPEECH ANALYSIS	L	T	P	C	100
		2	0	2	3	
Course Objectives	• Understand natural language processing basics • Apply classification algorithms to text documents • Build question-answering and dialogue systems • Develop a speech recognition system • Develop a speech synthesizer					

Unit-I	NATURAL LANGUAGE BASICS	(6)
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Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

Suggested Activities

- Flipped classroom on NLP
- Implementation of Text Preprocessing using NLTK
- Implementation of TF-IDF models

Suggested Evaluation Methods

- Quiz on NLP Basics
- Demonstration of Programs.

Unit-II	TEXT CLASSIFICATION	(6)
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Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model –Fast Text model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models

Suggested Activities

- Flipped classroom on Feature extraction of documents
- Implementation of SVM models for text classification
- External learning: Text summarization and Topic models

Suggested Evaluation Methods

- Assignment on above topics
- Quiz on RNN, Transformers
- Implementing NLP with RNN and Transformers

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Unit-III	QUESTION ANSWERING AND DIALOGUE SYSTEMS	(6)
Information retrieval – IR-based question answering – knowledge-based question answering –language models for QA – classic QA models – chatbots – Design of dialogue systems --evaluating dialogue systems Suggested Activities: • Flipped classroom on language models for QA • Developing a knowledge-based question-answering system • Classic QA model development Suggested Evaluation Methods • Assignment on the above topics • Quiz on knowledge-based question answering system • Development of simple chatbots		
Unit-IV	TEXT-TO-SPEECH SYNTHESIS	(6)
Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing -Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems Suggested Activities: • Flipped classroom on Speech signal processing • Exploring Text normalization • Data collection • Implementation of TTS systems Suggested Evaluation Methods • Assignment on the above topics • Quiz on wavenet, deep learning-based TTS systems • Finding accuracy with different TTS systems		
Unit-V	AUTOMATIC SPEECH RECOGNITION	(6)
Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems Suggested Activities: • Flipped classroom on Speech recognition. • Exploring Feature extraction Suggested Evaluation Methods • Assignment on the above topics • Quiz on acoustic modeling		
Total No of Periods to be Taught		30 Periods


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TEXT BOOK:

1	Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022
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REFERENCES:

1	Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress, 2018
2	Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008
3	Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009
4	Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY

List of Exercises/Experiments

1. Create Regular expressions in Python for detecting word patterns and tokenizing text.	
2. Getting started with Python and NLTK - Searching Text, Counting Vocabulary, FrequencyDistribution, Collocations, Bigrams	
3. Accessing Text Corpora using NLTK in Python	
4. Write a function that finds the 50 most frequently occurring words of a text that are not stopwords	
5. Implement the Word2Vec model	
6. Use a transformer for implementing classification	
7. Design a chatbot with a simple dialog system.	
8. Convert text to speech and find accuracy	
9. Design a speech recognition system and find the error rate	
Total No of Periods to be Taught	30Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:

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

CO1:	Explain existing and emerging deep learning architectures for text and speech processing
CO2:	Apply deep learning techniques for NLP tasks, language modelling and machine translation
CO3:	Explain coreference and coherence for text processing
CO4:	Build question-answering systems, chatbots and dialogue systems
CO5:	Apply deep learning models for building speech recognition and text-to-speech systems


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LIST OF EQUIPMENT 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	NLTK (Natural Language Toolkit), SpaCy	30
4	Jupyter Notebook, Google Speech API	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	1	3	-	-	-	1	2	1	2	1	1
CO2	3	1	2	1	3	-	-	-	2	2	1	3	3	2
CO3	2	2	1	3	1	-	-	-	3	3	1	2	3	3
CO4	2	1	1	1	2	-	-	-	2	1	2	2	3	1
CO5	1	3	2	2	1	-	-	-	3	2	1	1	2	3
Avg.	2.2	1.8	1.8	1.6	2	-	-	-	2.2	2	1.2	2	2.4	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2405	BUSINESS ANALYTICS	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand the Analytics Life Cycle. - To comprehend the process of acquiring Business Intelligence - To understand various types of analytics for Business Forecasting - To model the supply chain management for Analytics. - To apply analytics for different functions of a business					

Unit-I	INTRODUCTION TO BUSINESS ANALYTICS	(6)
Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration.		
Unit-II	BUSINESS INTELLIGENCE	(6)
Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions		
Unit-III	BUSINESS FORECASTING	(6)
Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models –Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics.		
Unit-IV	HR & SUPPLY CHAIN ANALYTICS	(6)
Human Resources – Planning and Recruitment – Training and Development - Supply chain network- Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain- Applying HR Analytics to make a prediction of the demand for hourly employees for a year.		
Unit-V	MARKETING & SALES ANALYTICS	(6)
Marketing Strategy, Marketing Mix, Customer Behaviour–selling Process – Sales Planning –Analytics applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and sales		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:	
1	R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2	R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
3	Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4	VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5	Mahadevan B, “Operations Management -Theory and Practice”, 3rd Edition, Pearson Education, 2018

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List of Exercises/Experiments	
Use MS-Excel and Power-BI to perform the following experiments using a Business data set, and make presentations. Students may be encouraged to bring their own real-time socially relevant data set.	
I Cycle – MS Excel :	
1. Explore the features of Ms-Excel	
2.(i) Get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) (ii) Perform data import/export operations for different file formats.	
3. Perform statistical operations - Mean, Median, Mode and Standard deviation, Variance, Skewness, Kurtosis	
4. Perform Z-test, T-test & ANOVA	
5. Perform data pre-processing operations i) Handling Missing data ii) Normalization	
6. Perform dimensionality reduction operation using PCA, KPCA & SVD	
7. Perform bivariate and multivariate analysis on the dataset	
8. Apply and explore various plotting functions on the data set.	
II Cycle – Power BI Desktop:	
9. Explore the features of Power BI Desktop	
10. Prepare & Load data	
11. Develop the data model	
12. Perform DAX calculations	
13. Design a report	
14. Create a dashboard and perform data analysis	
15. Presentation of a case study	
Total No of Periods to be Taught	30Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Explain the real world business problems and model with analytical solutions.
CO2:	Identify the business processes for extracting Business Intelligence.
CO3:	Apply predictive analytics for business fore-casting
CO4:	Apply analytics for supply chain and logistics management
CO5:	Use analytics for marketing and sales.


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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	NLTK (Natural Language Toolkit), SpaCy	30
4	Jupyter Notebook, Google Speech API, MS-Excel and Power-BI	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	2	2	3	1	1	-	-	-	1	2	1	1	2	1
CO2	3	3	3	2	3	-	-	-	1	2	2	2	1	2
CO3	2	2	3	3	2	-	-	-	3	1	1	3	1	2
CO4	2	1	1	2	2	-	-	-	3	3	2	1	3	1
CO5	2	3	2	3	2	-	-	-	3	3	1	3	1	1
Avg.	2.2	2.2	2.4	2.2	2	-	-	-	2.2	2.2	1.4	2	1.6	1.4

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2406	IMAGE AND VIDEO ANALYTICS	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand the basics of image processing techniques for computer vision. - To learn the techniques used for image pre-processing. - To discuss the various object detection techniques. - To understand the various Object recognition mechanisms. - To elaborate on the video analytics techniques.					

Unit-I	INTRODUCTION	(6)
Computer Vision – Image representation and image analysis tasks - Image representations –digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures		
Unit-II	IMAGE PRE-PROCESSING	(6)
Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative- Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-spectral images - Local pre-processing in the frequency domain - Line detection by local preprocessing operators – Image restoration.		
Unit-III	OBJECT DETECTION USING MACHINE LEARNING	(6)
Object detection– Object detection methods – Deep Learning framework for Object detection–bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures		
Unit-IV	FACE RECOGNITION AND GESTURE RECOGNITION	(6)
Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition-Deep Face solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet- Gesture Recognition		
Unit-V	VIDEO ANALYTICS	(6)
Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-ResNet architecture-ResNet and skip connections-Inception Network-GoogleNet architecture- Improvement in Inception v2-Video analytics-ResNet and Inception v3.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4nd edition, Thomson Learning, 2013
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REFERENCES:

1	Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London
2	Limited, 2011
3	Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
4	D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
5	E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press

List of Exercises/Experiments

1.	Write a program that computes the T-pyramid of an image
2.	Write a program that derives the quad tree representation of an image using the homogeneity criterion of equal intensity
3.	Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale (c) Skewing (d) Affine transform calculated from three pairs of corresponding points (e) Bilinear transform calculated from four pairs of corresponding points.
4.	Develop a program to implement Object Detection and Recognition
5.	Develop a program for motion analysis using moving edges, and apply it to your image sequences
6.	Develop a program for Facial Detection and Recognition
7.	Write a program for event detection in video surveillance system
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:

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

CO1:	Understand the basics of image processing techniques for computer vision and video analysis.
CO2:	Explain the techniques used for image pre-processing
CO3:	Develop various object detection techniques.
CO4:	Understand the various face recognition mechanisms
CO5:	Elaborate on deep learning-based video analytics


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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	Python, OpenCV, PyTorch, Google Cloud (Vision AI, AutoML)	30
4	AWS (EC2, S3, Rekognition), Microsoft Azure	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	1	2	2	2	-	-	3	3	2	1	2	1	3
CO2	2	2	3	3	3	-	-	3	2	1	1	2	2	1
CO3	1	2	2	2	3	-	-	1	2	1	2	1	1	3
CO4	1	2	3	2	3	-	-	2	2	2	3	2	2	2
CO5	3	2	1	3	2	-	-	2	1	1	3	3	2	1
Avg.	2	1.8	2.2	2.4	2.6	-	-	2.2	2	1.4	2	2	1.6	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2407	COMPUTER VISION	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand the fundamental concepts related to Image formation and processing. - To learn feature detection, matching and detection - To become familiar with feature based alignment and motion estimation - To develop skills on 3D reconstruction - To understand image based rendering and recognition					

Unit-I	INTRODUCTION TO IMAGE FORMATION AND PROCESSING	(6)
Computer Vision - Geometric primitives and transformations - Photometric image formation – The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms- Pyramids and wavelets - Geometric transformations - Global optimization		
Unit-II	FEATURE DETECTION, MATCHING AND SEGMENTATION	(6)
Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.		
Unit-III	FEATURE-BASED ALIGNMENT & MOTION ESTIMATION	(6)
2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration – Triangulation- Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow – Layered motion.		
Unit-IV	3D RECONSTRUCTION	(6)
Shape from X - Active rangefinding - Surface representations - Point-based representations-Volumetric representations - Model-based reconstruction - Recovering texture maps and albedos		
Unit-V	IMAGE-BASED RENDERING AND RECOGNITION	(6)
View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes -Video-based rendering-Object detection - Face recognition - Instance recognition – Category recognition - Context and scene understanding- Recognition databases and test sets		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer- Texts in Computer Science, Second Edition, 2022.
2.	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

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REFERENCES:

1	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2	Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3	E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

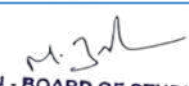
List of Exercises/Experiments

1. OpenCV Installation and working with Python.	
2. Basic Image Processing - loading images, Cropping, Resizing, Thresholding, Contour analysis, Blob detection	
3. Image Annotation – Drawing lines, text circle, rectangle, ellipse on images	
4. Image Enhancement - Understanding Color spaces, color space conversion, Histogram equalization, Convolution, Image smoothing, Gradients, Edge Detection	
5. Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORB Image features, Feature matching, cloning, Feature matching based image alignment.	
6. Image segmentation using Graphcut / Grabcut	
7. Camera Calibration with circular grid	
8. Pose Estimation	
9. 3D Reconstruction – Creating Depth map from stereo images	
10. Object Detection and Tracking using Kalman Filter, Camshift	
Total No of Periods to be Taught	30Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:

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

CO1:	Object Detection and Tracking using Kalman Filter, Camshift
CO2:	To implement basic and some advanced image processing techniques in OpenCV.
CO3:	To apply 2D a feature-based based image alignment, segmentation and motion estimations.
CO4:	To apply 3D image reconstruction techniques
CO5:	To design and develop innovative image processing and computer vision applications


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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	Python, C++ compilers, OpenCV, TensorFlow / PyTorch	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	1	1	1	1	-	-	2	1	3	2	2	1	1
CO2	3	3	3	2	3	-	-	2	1	2	2	3	1	2
CO3	3	3	2	2	3	-	-	1	1	2	2	3	2	2
CO4	2	3	3	2	3	-	-	2	1	2	3	2	2	3
CO5	2	3	3	2	2	2	-	3	1	2	3	3	3	3
Avg.	2.6	2.6	2.4	1.8	2.4	0.4	0	2	1	2.2	2.4	2.6	1.8	2.2
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2410	APP DEVELOPMENT	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To learn development of native applications with basic GUI Components - To develop cross-platform applications with event handling - To develop applications with location and data storage capabilities - To develop web applications with database access					

Unit-I	FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT	(6)
Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design,		
Unit-II	NATIVE APP DEVELOPMENT USING JAVA	(6)
Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props		
Unit-III	HYBRID APP DEVELOPMENT	(6)
Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova,		
Unit-IV	CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE	(6)
What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props		
Unit-V	NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS	(6)
Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Head First Android Development, Dawn Griffiths, O'Reilly, 1 st edition
2	Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3	Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing

REFERENCES:

1	Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition
2	Native Mobile Development by Shaun Lewis, Mike Dunn
3	Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras
4	Apache Cordova 4 Programming, John M Wargo, 2015
5	React Native Cookbook, Daniel Ward, Packt Publishing, 2 nd Edition

List of Exercises/Experiments

1. Using react native, build a cross platform application for a BMI calculator.
2. Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.
3. Develop a cross platform application to convert units from imperial system to metric system (km to miles, kg to pounds etc.,)
4. Design and develop a cross platform application for day to day task (to-do) management.
5. Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.
6. Design and develop an android application using Apache Cordova to find and display the current location of the user.
7. Write programs using Java to create Android application having Databases
 - For a simple library application.
 - For displaying books available, books lend, book reservation. Assume that student information is available in a database which has been stored in a database server.

Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods


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COURSE OUTCOMES:

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

CO1:	Develop Native applications with GUI Components.
CO2:	Develop hybrid applications with basic event handling.
CO3:	Implement cross-platform applications with location and data storage capabilities.
CO4:	Implement cross platform applications with basic GUI and event handling.
CO5:	Develop web applications with cloud database access.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Visual Studio / Android Studio	30
2.	Node.js	30
3.	React Native CLI / Expo	30
4.	Apache Cordova / java JDK / SQLite	30
5.	Windows 10 64-bits	30

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	2	2	1	2	3	-	-	1	1	2	1	2	3	3
CO2	2	1	3	2	2	-	-	3	2	2	3	3	2	1
CO3	2	2	2	1	2	-	-	1	1	1	1	1	1	2
CO4	1	3	1	1	3	-	-	1	1	3	2	1	3	1
CO5	1	1	3	1	3	-	-	1	1	2	1	3	2	1
Avg.	1.6	1.8	2	1.4	2.6	-	-	1.4	1.2	2	1.6	2	2.2	1.6

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2411	CLOUD SERVICES MANAGEMENT	L	T	P	C	100
		2	0	2	3	
Course Objectives	• Introduce Cloud Service Management terminology, definition & concepts • Compare and contrast cloud service management with traditional IT service management • Identify strategies to reduce risk and eliminate issues associated with adoption of cloud Services • Select appropriate structures for designing, deploying and running cloud-based services in a business environment • Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems					

Unit-I	CLOUD SERVICE MANAGEMENT FUNDAMENTALS	(6)
Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.		
Unit-II	CLOUD SERVICES STRATEGY	(6)
Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture		
Unit-III	CLOUD SERVICE MANAGEMENT	(6)
Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management		
Unit-IV	CLOUD SERVICE ECONOMICS	(6)
Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models		
Unit-V	CLOUD SERVICE GOVERNANCE & VALUE	(6)
IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Cloud Service Management and Governance: Smart Service Management in Cloud Eraby Enamul Haque, Enel Publications
2	Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013
3	Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

REFERENCES:

1	Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2	Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi

List of Exercises/Experiments

1. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloud software's like Open stack, Eucalyptus, Open Nebula with Role-based access control
2. Create a Cost-model for a web application using various services and do Cost-benefit analysis.
3. Create alerts for usage of Cloud resources.
4. Create Billing alerts for your Cloud Organization
5. Compare Cloud cost for a simple web application across AWS, Azure and GCP and suggest the best one

Total No of Periods to be Taught

30 Periods

Total No of Periods to be Taught (T&L)

60 Periods

COURSE OUTCOMES:

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

CO1:	Exhibit cloud-design skills to build and automate business solutions using cloud technologies.
CO2:	Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services
CO3:	Solve the real-world problems using Cloud services and technologies


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Amazon Web Services / Google Cloud Platform	30
2.	Microsoft Azure / openstack	30
3.	Google Cloud Billing	30
4.	Azure Cost Management	30
5.	Windows 10 64-bit	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	1	1	1	-	-	2	1	3	2	2	1	3
CO2	3	1	2	3	2	-	-	1	2	3	1	2	2	2
CO3	1	1	3	1	3	-	-	3	3	1	1	3	2	1
CO4	1	1	1	2	3	-	-	2	3	3	1	1	1	1
CO5	1	3	3	2	2	-	-	1	3	1	2	1	3	2
Avg.	1.8	1.8	2	1.8	2.2	-	-	1.8	2.4	2.2	1.4	1.8	1.8	1.8
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2412	UI AND UX DESIGN	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To provide a sound knowledge in UI & UX • To understand the need for UI and UX • To understand the various Research Methods used in Design • To explore the various Tools used in UI & UX • Creating a wireframe and prototype					

Unit-I	FOUNDATIONS OF DESIGN	(6)
UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy		
Unit-II	FOUNDATIONS OF UI DESIGN	(6)
Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides		
Unit-III	FOUNDATIONS OF UX DESIGN	(6)
Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals – Know about Business Goals		
Unit-IV	WIRE FRAMING, PROTOTYPING AND TESTING	(6)
Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing – Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration		
Unit-V	RESEARCH, DESIGNING, IDEATING & INFORMATION ARCHITECTURE	(6)
Identifying and Writing Problem Statements - Identifying Appropriate Research Methods – Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams – Flow Mapping - Information Architecture		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Joel Marsh, “UX for Beginners”, O’Reilly , 2022
2	Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 2021

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REFERENCES:

1	Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition , O'Reilly 2020
2	Steve Schoger, Adam Wathan "Refactoring UI", 2018
3	Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015
4	https://www.nngroup.com/articles/
5	https://www.interaction-design.org/literature.

List of Exercises/Experiments

1. Designing a Responsive layout for an societal application	
2. Exploring various UI Interaction Patterns.	
3. Developing an interface with proper UI Style Guides.	
4. Developing Wire flow diagram for application using open-source software	
5. Exploring various open-source collaborative interface Platform	
6. Hands on Design Thinking Process for an new product.	
7. Brain storming feature for proposed product	
8. Defining the Look and Feel of the new Project.	
9. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles).	
10. Identify a customer problem to solve.	
11. Conduct end-to-end user research-User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping.	
12. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements.	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:

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

CO1:	Build UI for user Applications
CO2:	Evaluate UX design of any product or application
CO3:	Demonstrate UX Skills in product development
CO4:	Implement Sketching principles
CO5:	Create Wireframe and Prototype


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Figma / Adobe XD	30
2.	Sketch / Balsaminq / Draw.io	30
3.	Miro / Conva / inVision	30
4.	Windows 10 64-bits	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	1	1	3	1	-	-	3	3	2	1	3	3	1
CO2	2	3	1	3	2	-	-	1	2	2	2	1	2	2
CO3	1	3	3	2	2	-	-	2	3	1	2	1	3	3
CO4	1	2	3	3	1	-	-	3	2	1	3	3	3	3
CO5	1	2	3	2	1	-	-	2	1	1	1	3	2	2
Avg.	1.6	2.2	2.2	2.6	1.4	-	-	2.2	2.2	1.4	1.8	2.2	2.6	2.2
1 – Slight, 2 – Moderate, 3 –Substantial , BT – Bloom's Taxonomy														

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2413	SOFTWARE TESTING AND AUTOMATION	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand the basics of software testing - To learn how to do the testing and planning effectively - To build test cases and execute them - To focus on wide aspects of testing and understanding multiple facets of testing - To get an insight about test automation and the tools used for test automation					

Unit-I	FOUNDATIONS OF SOFTWARE TESTING	(6)
Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing		
Unit-II	TEST PLANNING	(6)
The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.		
Unit-III	TEST DESIGN AND EXECUTION	(6)
Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.		
Unit-IV	ADVANCED TESTING CONCEPTS	(6)
Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.		
Unit-V	TEST AUTOMATION AND TOOLS	(6)
Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Yogesh Singh, "Software Testing", Cambridge University Press, 2012
2	Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" – Second Edition 2018

REFERENCES:

1	Glen ford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3 rd Edition, 2012, John Wiley & Sons, Inc.
2	Ron Patton, Software testing, 2 nd Edition, 2006, Sams Publishing
3	Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Fourth Edition, 2014, Taylor & Francis Group.
4	Carl Cocchiario, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5	Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6	Satya Avasarala, Selenium Web Driver Practical Guide, 2014, Packt Publishing.
7	Varun Menon, Test Ng Beginner's Guide, 2013, Packt Publishing.

List of Exercises/Experiments

1. Develop the test plan for testing an e-commerce web/mobile application (www.amazon.in).
2. Design the testcases for testing the e-commerce application
3. Test the e-commerce application and report the defects in it.
4. Develop the test plan and design the testcases for an inventory control system.
5. Execute the testcases against a client server or desktop application and identify the defects
6. Test the performance of the e-commerce application
7. Automate the testing of e-commerce applications using Selenium.
8. Integrate Test NG with the above test automation.
9. Mini Project
 - a) Build a data-driven framework using Selenium and TestNG
 - b) Build Page object Model using Selenium and TestNG
 - c) Build BDD framework with Selenium, TestNG and Cucumber

Total No of Periods to be Taught

30 Periods

Total No of Periods to be Taught (T&L)

60 Periods


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COURSE OUTCOMES:

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

CO1:	Understand the basic concepts of software testing and the need for software testing
CO2:	Design Test planning and different activities involved in test planning
CO3:	Design effective test cases that can uncover critical defects in the application
CO4:	Carry out advanced types of testing.
CO5:	Automate the software testing using Selenium and TestNG

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	www.amazon.in / Selenium.	30
2.	TestNG and Cucumber, Junit	30
3.	Eclipse IDE / Visual Studio Code	30
4.	Windows 10 64-bits	30

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1	2	-	-	1	1	3	2	3	2	3
CO2	2	3	1	1	1	-	-	2	2	1	2	1	2	3
CO3	2	2	1	3	1	-	-	1	3	1	2	2	3	2
CO4	2	1	3	2	1	-	-	1	1	1	2	3	1	2
CO5	2	2	1	3	1	-	-	1	3	2	1	2	1	3
Avg.	2.2	2.2	1.6	2	1.2	-	-	1.2	2	1.6	1.8	2.2	1.8	2.6

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2414	WEB APPLICATION SECURITY	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand the fundamentals of web application security - To focus on wide aspects of secure development and deployment of web applications - To learn how to build secure APIs - To learn the basics of vulnerability assessment and penetration testing - To get an insight about Hacking techniques and Tools					

Unit-I	FUNDAMENTALS OF WEB APPLICATION SECURITY	(6)
The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation		
Unit-II	SECURE DEVELOPMENT AND DEPLOYMENT	(5)
Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)		
Unit-III	SECURE API DEVELOPMENT	(6)
API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Micro service APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.		
Unit-IV	VULNERABILITY ASSESSMENT AND PENETRATION TESTING	(6)
Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.		
Unit-V	HACKING TECHNIQUES AND TOOLS	(7)
Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite,etc.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2	Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.
3	Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCES:

1	Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2	Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3	Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4	Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5	Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

List of Exercises/Experiments

1.Install wireshark and explore the various protocols a. Analyze the difference between HTTP vs HTTPS b. Analyze the various security mechanisms embedded with different protocols	
2.Identify the vulnerabilities using OWASP ZAP tool	
3.Create simple REST API using python for following operation .GET a. PUSH b. POST c. DELETE	
4.Install Burp Suite to do following vulnerabilities: . SQL injection a. cross-site scripting (XSS)	
5.Attack the website using Social Engineering method	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods


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COURSE OUTCOMES:

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

CO1:	Understanding the basic concepts of web application security and the need for it
CO2:	Be acquainted with the process for secure development and deployment of web applications
CO3:	Acquire the skill to design and develop Secure Web Applications that use Secure APIs
CO4:	Be able to get the importance of carrying out vulnerability assessment and penetration testing
CO5:	Acquire the skill to think like a hacker and to use hackers tool sets

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	SQL injection, XSS	30
2.	Wireshark, OWASP ZAP	30
3.	Burp Suite	30
4.	Windows 10 64-bits and Ubuntu (Linux)	30

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	1	2	2	1	3	-	-	-	-	-	1	-	-	-
CO2	2	1	2	1	3	-	-	-	-	-	-	-	-	-
CO3	1	1	1	2	3	-	-	-	-	-	1	-	-	-
CO4	1	2	1	1	2	-	-	-	-	-	-	-	-	-
CO5	1	2	2	2	2	-	-	-	-	-	1	-	-	-
Avg.	1.2	1.6	1.6	1.4	2.6	-	-	-	-	-	0.6	-	-	-

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2415	DEVOPS	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To introduce DevOps terminology, definition & concepts • To understand the different Version control tools like Git, Mercurial • To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment) • To understand Configuration management using Ansible • Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems					

Unit-I	INTRODUCTION TO DEVOPS	(6)
Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.		
Unit-II	COMPILE AND BUILD USING MAVEN & GRADLE	(6)
Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artifacts, Dependency management, Installation of Gradle, Understand build using Gradle		
Unit-III	CONTINUOUS INTEGRATION USING JENKINS	(6)
Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.		
Unit-IV	CONFIGURATION MANAGEMENT USING ANSIBLE	(6)
Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible		
Unit-V	BUILDING DEVOPS PIPELINES USING AZURE	(6)
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2	Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCES:

1	Hands-On Azure Devops: Cidc Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020
2	by Mitesh Soni
3	Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
4	David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
5	Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.
6	https://www.jenkins.io/user-handbook.pdf
7	https://maven.apache.org/guides/getting-started/

List of Exercises/Experiments

1. Create Maven Build pipeline in Azure	
2. Run regression tests using Maven Build pipeline in Azure	
3. Install Jenkins in Cloud	
4. Create CI pipeline using Jenkins	
5. Create a CD pipeline in Jenkins and deploy in Cloud	
6. Create an Ansible playbook for a simple web application infrastructure	
7. Build a simple application using Gradle	
8. Install Ansible SSS and configure ansible roles and to write playbooks	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods


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COURSE OUTCOMES:

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

CO1:	Understand different actions performed through Version control tools like Git
CO2:	Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
CO3:	Ability to Perform Automated Continuous Deployment
CO4:	Ability to do configuration management using Ansible
CO5:	Understand to leverage Cloud-based DevOps tools using Azure DevOps

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	https://azure.microsoft.com/en-in/products/devops/website .	30
2.	https://www.jetbrains.com/idea/download/?section=linux .	30
3.	GitHub, Maven, IntelliJ IDEA IDE, AZURE	30
4.	AWS / Jenkins, EC2, Docker HUB, Google Cloud	30
5.	Windows 10 64- bits and Ubuntu (Linux)	30

Mapping of COs with POs and PSOs

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

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2417	CLOUD COMPUTING	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To understand the principles of cloud architecture, models and infrastructure. • To understand the concepts of virtualization and virtual machines. • To gain knowledge about virtualization Infrastructure. • To explore and experiment with various Cloud deployment environments. • To learn about the security issues in the cloud environment.					

Unit-I	CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE	(6)
Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges.		
Unit-II	VIRTUALIZATION BASICS	(6)
Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.		
Unit-III	VIRTUALIZATION INFRASTRUCTURE AND DOCKER	(7)
Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.		
Unit-IV	CLOUD DEPLOYMENT ENVIRONMENT	(6)
Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – Open Stack.		
Unit-V	CLOUD SECURITY	(5)
Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyper jacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2	James Turnbull, “The Docker Book”, O’Reilly Publishers, 2014.
3	Krutz, R. L., Vines, R. D, “Cloud security. A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, 2010.

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REFERENCES:

1	James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2	Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

List of Exercises/Experiments

1. Install Virtual box/VMware/ Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.	
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs.	
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.	
4. Use the GAE launcher to launch the web applications.	
5. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.	
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.	
7. Install Hadoop single node cluster and run simple applications like word count.	
8. Creating and Executing Your First Container Using Docker.	
9. Run a Container from Docker Hub.	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:

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

CO1:	Understand the design challenges in the cloud.
CO2:	Apply the concept of virtualization and its types.
CO3:	Experiment with virtualization of hardware resources and Docker.
CO4:	Develop and deploy services on the cloud and set up a cloud environment.
CO5:	Explain security challenges in the cloud environment.


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF SOFTWARES	REQUIRED NUMBERS
1	https://www.virtualbox.org/ (VMware open source)	30
2	https://google-app-engine.en.soft (Google App Engine open source)	30
3	https://code.google.com/archive/p/cloudsim/downloads (Cloud Sim opensource)	30
4	Apache VCL (Virtual Computing Lab)	30
5	https://docs.docker.com/desktop/setup/install/windows-install/ (Docker opensource)	30

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	1	-	-	2	3	1	3	2	1	3
CO2	3	1	2	2	1	-	-	1	2	1	3	2	2	1
CO3	2	3	2	3	1	-	-	3	1	1	3	1	1	1
CO4	1	2	3	3	3	-	-	3	3	1	2	1	3	3
CO5	2	3	3	1	3	-	-	2	2	1	2	2	2	3
Avg.	2.2	2.2	2.2	2	1.8	-	-	2.2	2.2	1	2.6	1.6	1.8	2.2

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2418	VIRTUALIZATION	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To learn the basics and types of Virtualization. • To understand the Hypervisors and its types. • To Explore the Virtualization Solutions. • To Experiment the virtualization platforms.					

Unit-I	INTRODUCTION TO VIRTUALIZATION	(7)
Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization – Para virtualization-Types of Hypervisors.		
Unit-II	SERVER AND DESKTOP VIRTUALIZATION	(6)
Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization.		
Unit-III	NETWORK VIRTUALIZATION	(6)
Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization VLANWAN Architecture-WAN Virtualization.		
Unit-IV	STORAGE VIRTUALIZATION	(5)
Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID.		
Unit-V	VIRTUALIZATION TOOLS	(6)
VMWare-Amaon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw-Hill , New Delhi – 2010
2	Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3	David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach
4	Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APress, 2005
5	James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
6	David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006.

List of Exercises/Experiments

1. Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE.
2. Shrink and extend virtual disk b. Create, Manage, Configure and schedule snapshots c. Create Spanned, Mirrored and Striped volume d. Create RAID 5 volume.
3. Desktop Virtualization using VNC b. Desktop Virtualization using Chrome Remote Desktop.
4. Create type 2 virtualization on ESXI 6.5 server.
5. Create a VLAN in CISCO packet tracer.
6. Install KVM in Linux.
7. Create Nested Virtual Machine(VM under another VM)

Total No of Periods to be Taught

30 Periods

Total No of Periods to be Taught (T&L)

60 Periods

COURSE OUTCOMES:

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

CO1:	Analyze the virtualization concepts and Hypervisor
CO2:	Apply the Virtualization for real-world applications
CO3:	Install & Configure the different VM platforms
CO4:	Experiment with the VM with various software


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF SOFTWARE	REQUIRED NUMBERS
1	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 2+ cores), 4GB RAM, 64GB storage	30
2	https://www.virtualbox.org/ (VMware open source)	30
3	https://remotedesktop.google.com/ (chrome remote desktop)	30
4	https://www.netacad.com/articles/news/download-cisco-packet-tracer (cisco packet tracer)	30
5	https://www.linux-kvm.org/page/Downloads (KVM)	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	1	3	1	3	2				1	1	3	2	3	2
CO2	3	2	2	1	2				1	2	2	3	2	1
CO3	3	2	1	3	1				2	2	1	3	3	2
CO4	1	1	2	3	3				3	3	1	3	2	2
CO5	1	3	2	3	1				2	1	3	1	1	2
Avg.	1.8	2.2	1.6	2.6	1.8				1.8	1.8	2	2.4	2.2	1.8
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2419	DATA WAREHOUSING AND DATA MINING	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand the principles of Data warehousing and Data Mining. - To be familiar with the Data warehouse architecture and its Implementation. - To know the Architecture of a Data Mining system. - To understand the various Data preprocessing Methods. - To perform classification and prediction of data.					

Unit-I	INTRODUCTION TO DATA WAREHOUSE	(5)
Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.		
Unit-II	DATA MINING AND ASSOCIATION RULE MINING	(6)
Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture Of A Typical Data Mining Systems- Classification Of Data Mining Systems. Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.		
Unit-III	CLASSIFICATION	(7)
Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.		
Unit-IV	CLUSTERING	(6)
Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.		
Unit-V	DATA MINING	(6)
Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008. approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2	Ralph Kimball, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", Third edition, 2013.

List of Exercises/Experiments

1.	Experiments on Input Techniques: Concepts, instances, attributes.
2.	Experiments on Output Techniques: Knowledge Representation.
3.	Classification Experiments - Basic methods.
4.	Classification Using Decision Trees.
5.	Classification Using C4.5.
6.	Classification Using CA RT
7.	Bayesian Classification.
8.	K-means clustering
9.	Experiments on Clustering Techniques.
10.	Experiments on Association s Techniques.
11.	Experiments on Visualization Techniques.
12.	Experiments on Summarization Techniques.
Total No of Periods to be Taught	
30 Periods	
Total No of Periods to be Taught (T&L)	
60 Periods	

COURSE OUTCOMES:

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

CO1:	Design and implement data warehouses
CO2:	Apply data mining techniques:
CO3:	Analyze the partitioning strategy
CO4:	Explain the differentiation of various schema for given problem
CO5:	Analyze the multidimensional data


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF SOFTWARE	REQUIRED NUMBERS
1	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 2+ cores), 4GB RAM, 64GB storage	30
2	https://weka.en.softonic.com/ (Weka Tool Open Souce)	30
3	https://www.knime.com/downloads (KNME Tool Open Source)	30
4	https://docs.aws.amazon.com/redshift/latest/mgmt/odbc-driver-windows-how-to-install.html (Amazon Redshift Tool)	30
5	https://www.snowflake.com/en/developers/downloads/ (Snowflake Tool)	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2	-	-	-	3	-	-	3	3	3
CO2	3	2	2	2	3	-	-	-	2	-	2	2	3	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO5	3	2	2	2	-	2	-	-	-	-	2	2	3	2
Avg.	3	2.6	2.6	1.2	2.5	1	-	-	2.5	-	2	2.6	3	2.6
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2420	SOFTWARE DEFINED NETWORKS	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To understand the need for SDN and its data plane operations. • To understand the functions of control plane. • To comprehend the migration of networking functions to SDN environment. • To explore various techniques of network function virtualization. • To comprehend the concepts behind network virtualization.					

Unit-I	SDN: INTRODUCTION	(6)
Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane, Control plane and Application Plane.		
Unit-II	SDN DATA PLANE AND CONTROL PLANE	(6)
Data Plane functions and protocols - Open Flow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, Open Daylight, ONOS - Distributed Controllers.		
Unit-III	SDN APPLICATIONS	(6)
SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking.		
Unit-IV	NETWORK FUNCTION VIRTUALIZATION	(6)
Network Virtualization - Virtual LANs – Open Flow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture.		
Unit-V	NFV FUNCTIONALITY	(6)
NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015.
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List of Exercises/Experiments	
1. Setup your own virtual SDN lab i) Virtual box/Mininet Environment for SDN - http://mininet.org ii) https://www.kathara.org iii) GNS3.	
2. Create a simple mininet topology with SDN controller and use Wireshark to capture and visualize the Open Flow messages such as Open Flow FLOW MOD, PACKET IN, PACKET OUT etc.	
3. Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.	
4. Create a simple end-to-end network service with two VNFs using vim-emu https://github.com/containernet/vim-emu .	
5. Install OSM and onboard and orchestrate network service.	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	Describe the motivation behind SDN
CO2:	Identify the functions of the data plane and control plane
CO3:	Design and develop network applications using SDN.
CO4:	Orchestrate network services using NFV
CO5:	Explain various use cases of SDN and NFV

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF SOFTWARE	REQUIRED NUMBERS
1	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 2+ cores), 4GB RAM, 64GB storage	30
2	http://mininet.org https://www.kathara.org	30
3	https://www.wireshark.org/download.html (Wireshark Tool)	30
4	https://github.com/containernet/vim-emu (VNF)	30
5	https://api.openstreetmap.org/api/0.6/map?bbox=11.54,48.14,543,48.145 (OSM download)	30


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Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	1	-	-	2	3	1	3	2	1	3
CO2	3	1	2	2	1	-	-	1	2	1	3	2	2	1
CO3	2	3	2	3	1	-	-	3	1	1	3	1	1	1
CO4	1	2	3	3	3	-	-	3	3	1	2	1	3	3
CO5	2	3	3	1	3	-	-	2	2	1	2	2	2	3
Avg.	2.2	2.2	2.2	2	1.8	-	-	2.2	2.2	1	2.6	1.6	1.8	2.2

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


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2421	STREAM PROCESSING	L	T	P	C	100
		2	0	2	3	
Course Objectives	- Introduce Data Processing terminology, definition & concepts. - Define different types of Data Processing. - Explain the concepts of Real-time Data processing. - Select appropriate structures for designing and running real-time data services in a business environment. - Illustrate the benefits and drive the adoption of real-time data services to solve real world problems.					

Unit-I	FOUNDATIONS OF DATA SYSTEMS	(6)
Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges.		
Unit-II	REAL-TIME DATA PROCESSING	(6)
Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage.		
Unit-III	DATA MODELS AND QUERY LANGUAGES	(6)
Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many to-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL.		
Unit-IV	EVENT PROCESSING WITH APACHE KAFKA	(6)
Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API.		
Unit-V	REAL-TIME PROCESSING USING SPARK STREAMING	(6)
Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication.
2	Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media
3	Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing

List of Exercises/Experiments

1.	Install MongoDB
2.	Design and Implement Simple application using MongoDB.
3.	Query the designed system using MongoDB.
4.	Create a Event Stream with Apache Kafka.
5.	Create a Real-time Stream processing application using Spark Streaming.
6.	Build a Micro-batch application.
7.	Real-time Fraud and Anomaly Detection.
8.	Real-time personalization, Marketing, Advertising.
Total No of Periods to be Taught	
30 Periods	
Total No of Periods to be Taught (T&L)	
60 Periods	

COURSE OUTCOMES:

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

CO1:	Understand the applicability and utility of different streaming algorithms
CO2:	Describe and apply current research trends in data-stream processing.
CO3:	Analyze the suitability of stream mining algorithms for data stream systems.
CO4:	Program and build stream processing systems, services and applications
CO5:	Solve problems in real-world applications that process data streams.


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF SOFTWARE	REQUIRED NUMBERS
1	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 2+ cores), 4GB RAM, 64GB storage	30
2	https://www.mongodb.com/try/download/shell (MONGODB)	30
3	https://kafka.apache.org/community/downloads/ (Apache Kafka)	30
4	https://spark.apache.org/downloads.html (Apache Kafka)	30
5	https://www.oracle.com/database/sqldeveloper/technologies/download/ (Oracle SQL)	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	3	1			2	3	1	2	1	3	3
CO2	2	1	1	2	2			3	2	2	3	1	2	1
CO3	3	1	2	3	3			2	2	1	1	2	2	1
CO4	2	1	3	3	3			3	3	1	1	1	2	1
CO5	3	3	1	2	2			3	3	2	3	2	3	2
Avg.	2.6	1.8	1.8	2.6	2.2			2.6	2.6	1.4	2	1.4	2.4	1.6
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														


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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2422	SECURITY AND PRIVACY IN CLOUD	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To Introduce Cloud Computing terminology, definition & concepts. • To understand the security design and architectural considerations for Cloud. • To understand the Identity, Access control in Cloud. • To follow best practices for Cloud security using various designs patterns. • To be able to monitor and audit cloud applications for security					

Unit-I	FUNDAMENTALS OF CLOUD SECURITY CONCEPTS	(7)
Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.		
Unit-II	SECURITY DESIGN AND ARCHITECTURE FOR CLOUD	(6)
Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key.		
Unit-III	ACCESS CONTROL AND IDENTITY MANAGEMENT	(6)
Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention.		
Unit-IV	CLOUD SECURITY DESIGN PATTERNS	(6)
Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.		
Unit-V	MONITORING, AUDITING AND MANAGEMENT	(5)
Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Raj Kumar Buyya , James Broberg, andrzej Goscinski, “Cloud Computing:ll, Wiley 2013
2	Dave shackleford, “Virtualization Securityll, SYBEX a wiley Brand 2013.
3	Mather, Kumaraswamy and Latif, “Cloud Security and Privacyll, OREILLY 2011

List of Exercises/Experiments

1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim	
2. Simulate resource management using cloud sim	
3. Simulate log forensics using cloud sim	
4. Simulate a secure file sharing using a cloud sim	
5. Implement data anonymization techniques over the simple dataset (masking, k-anonymization, etc)	
6. Implement any encryption algorithm to protect the images	
7. Implement any image obfuscation mechanism	
8. Implement a role-based access control mechanism in a specific scenario	
9. Implement an attribute-based access control mechanism based on a particular scenario	
10. Develop a log monitoring system with incident management in the cloud	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:

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

CO1:	Understand the cloud concepts and fundamentals.
CO2:	Explain the security challenges in the cloud..
CO3:	Define cloud policy and Identity and Access Management.
CO4:	Understand various risks and audit and monitoring mechanisms in the cloud.
CO5:	Define the various architectural and design considerations for security in the cloud.


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF SOFTWARE	REQUIRED NUMBERS
1	Windows 11 requires a modern 64-bit processor (1 GHz or faster, 2+ cores), 4GB RAM, 64GB storage	30
2	https://code.google.com/archive/p/cloudsim/downloads (Cloud Sim open source)	30
3	https://www.site24x7.com/cloud-monitoring.html?ad_src=google_cloud_monitoring_in&ad_grp=cloud_monitoring&network=g&device=c&keyword=cloud%20infrastructure%20monitoring&campaignid=11483605405&creative=479193051257&matchtype=p&adposition=&placement=&adgroup=112532945455&targetid=kwd-57623829834&location=9148812&gad_source=1&gad_campaignid=11483605405&gbraid=0AAAAAChAObuvdO-3YeRoZhQKD5VWhx0Y0&gclid=EAlaIQobChMlhsSbn_vGkwMVh8w8Ah28GTgTEAAiAAAEgKRmPD_BwE (Cloud Monitoring Tool)	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	1	2			1	1	1	3	3	1	2
CO2	1	3	2	3	1			2	2	3	2	3	1	2
CO3	3	2	2	3	2			3	1	1	2	2	3	1
CO4	2	1	2	3	3			3	2	3	3	1	1	2
CO5	1	3	3	1	1			2	3	3	2	2	3	2
Avg.	2	2.4	2.4	2.2	1.8			2.2	1.8	2.2	2.4	2.2	1.8	1.8
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2423	ETHICAL HACKING	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To understand the basics of computer based vulnerabilities. • To explore different foot printing, reconnaissance and scanning methods. • To expose the enumeration and vulnerability analysis methods. • To understand hacking options available in Web and wireless applications. • To explore the options for network protection. • To practice tools to perform ethical hacking to expose the vulnerabilities.					

Unit-I	INTRODUCTION	(6)
Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security		
Unit-II	FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS	(6)
Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall		
Unit-III	ENUMERATION AND VULNERABILITY ANALYSIS	(6)
Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss		
Unit-IV	SYSTEM HACKING	(6)
Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade -		
Unit-V	NETWORK PROTECTION SYSTEMS	(6)
Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network- Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2	The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3	The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCES:

1	Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.
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List of Exercises/Experiments

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
2. Practice the basics of reconnaissance.
3. Using FOCA / SearchDiggity tools, extract metadata and expanding the target list.
4. Aggregates information from public databases using online free tools like Paterva's Maltego.
3. Information gathering using tools like Robtex.
4. Scan the target using tools like Nessus.
5. View and capture network traffic using Wireshark.
6. Automate dig for vulnerabilities and match exploits using Armitage
FOCA : <http://www.informatica64.com/foca.aspx>.
Nessus : <http://www.tenable.com/products/nessus>.
Wireshark : <http://www.wireshark.org>.
Armitage : <http://www.fastandeasyhacking.com/>.
Kali or Backtrack Linux, Metasploitable, Windows XP

Total No of Periods to be Taught

30 Periods

Total No of Periods to be Taught (T&L)

60 Periods


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COURSE OUTCOMES:

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

CO1:	To express knowledge on basics of computer based vulnerabilities
CO2:	To gain understanding on different foot printing, reconnaissance and scanning methods.
CO3:	To demonstrate the enumeration and vulnerability analysis methods
CO4:	To gain knowledge on hacking options available in Web and wireless applications.
CO5:	To acquire knowledge on the options for network protection.
CO6:	To use tools to perform ethical hacking to expose the vulnerabilities

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF SOFTWARES	REQUIRED NUMBERS
1	Sleuth kit, Autopsy, Linux(Ubuntu / Kail Linux).	30
2	WireShark	30
3	Armitage	30
4	Nessus	30
5	FOCA	30

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	2	2	3	2	1	-	-	1	2	2	1	1	2	3
CO2	1	2	1	2	1	-	-	2	2	1	1	1	2	2
CO3	2	2	3	3	1	-	-	1	2	1	2	2	3	1
CO4	2	1	1	2	1	-	-	1	3	3	3	3	2	1
CO5	2	3	1	1	2	-	-	2	1	1	1	1	1	3
Avg.	1.8	2	1.8	2	1.2	-	-	1.4	2	1.6	1.6	1.6	2	2

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2424	DIGITAL AND MOBILE FORENSICS	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To understand basic digital forensics and techniques. • To understand digital crime and investigation. • To understand how to be prepared for digital forensic readiness. • To understand and use forensics tools for iOS devices. • To understand and use forensics tools for Android devices.					

Unit-I	INTRODUCTION TO DIGITAL FORENSICS	(6)
Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase		
Unit-II	DIGITAL CRIME AND INVESTIGATION	(6)
Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence		
Unit-III	DIGITAL FORENSIC READINESS	(6)
Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics		
Unit-IV	iOS FORENSICS	(6)
Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud		
Unit-V	ANDROID FORENSICS	(6)
Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Andre Arnes, "Digital Forensics", Wiley, 2018.
2	Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press, 2022.

REFERENCES:

1	Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.
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List of Exercises/Experiments

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.	
2. Data extraction from call logs using Sleuth Kit.	
3. Data extraction from SMS and contacts using Sleuth Kit.	
4. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups	
5. Process and parse records from the iOS system.	
6. Extract installed applications from Android devices.	
7. Extract diagnostic information from Android devices through the adb protocol.	
8. Generate a unified chronological timeline of extracted records.	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:

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

CO1:	Have knowledge on digital forensics.
CO2:	Know about digital crime and investigations.
CO3:	Be forensic ready.
CO4:	Investigate, identify and extract digital evidence from iOS devices.
CO5:	Investigate, identify and extract digital evidence from Android devices.


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF SOFTWARES	REQUIRED NUMBERS
1	Sleuth kit, Autopsy, Linux(Ubuntu / Kail Linux).	30
2	Android Debug Bridge(ADB).	30
3	Mobile Verification Toolkit.	30
4	SQLite Browser.	30
5	FTK Imager,Plaso	30

Mapping of COs with POs and PSOs

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

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2425	SOCIAL NETWORK SECURITY	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To develop semantic web related simple applications - To explain Privacy and Security issues in Social Networking - To explain the data extraction and mining of social networks - To discuss the prediction of human behavior in social communities - To describe the Access Control, Privacy and Security management of social networks.					

Unit-I	FUNDAMENTALS OF SOCIAL NETWORKING	(6)
Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security		
Unit-II	SECURITY ISSUES IN SOCIAL NETWORKS	(6)
The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world		
Unit-III	EXTRACTION AND MINING IN SOCIAL NETWORKING DATA	(6)
Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy		
Unit-IV	PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES	(6)
Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties		
Unit-V	ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT	(6)
Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:	
1	Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2	Borko Furht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3	Learning Neo4j 3.x –Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing
4	David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a Highly Connected World, First Edition, Cambridge University Press, 2010.

REFERENCES:	
1	Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World, Cambridge University Press, 2010.
2	Jackson, Matthew O., Social and Economic Networks, Princeton University Press, 2008.
3	Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
4	Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
5	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling, IGI Global Snippet, 2009
6	John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web, Springer, 2009.

List of Exercises/Experiments	
1.Design own social media application	
2.Create a Network model using Neo4j	
3.Read and write Data from Graph Database	
4.Find “Friend of Friends” using Neo4j	
5.Implement secure search in social media	
6.Create a simple Security & Privacy detector	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods


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COURSE OUTCOMES:

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

CO1:	Develop semantic web related simple applications
CO2:	Address Privacy and Security issues in Social Networking
CO3:	Explain the data extraction and mining of social networks
CO4:	Discuss the prediction of human behaviour in social communities
CO5:	Describe the applications of social networks

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF SOFTWARES	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	Neo4j (Browser, Desktop).	30
4	Python.Java, JavaScript.	30

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	1	2	3	2	-	-	3	2	1	2	3	3	2
CO2	2	2	2	3	3	-	-	1	2	2	3	3	3	2
CO3	2	1	1	3	2	-	-	1	2	1	1	1	3	3
CO4	3	3	3	3	2	-	-	1	1	1	1	2	1	3
CO5	1	3	2	2	2	-	-	1	1	3	1	2	3	3
Avg.	2.2	2	2	2.8	2.2	-	-	1.4	1.6	1.6	1.6	2.2	2.6	2.6

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2426	MODERN CRYPTOGRAPHY	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To learn about Modern Cryptography. - To focus on how cryptographic algorithms and protocols work and how to use them. - To build a Pseudo random permutation. - To construct Basic cryptanalytic techniques. - To provide instruction on how to use the concepts of block ciphers and message authentication codes.					

Unit-I	INTRODUCTION	(6)
Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser - Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.		
Unit-II	FORMAL NOTIONS OF ATTACKS	(6)
Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NM-CCA2, Inter-relations among the attack model		
Unit-III	RANDOM ORACLES	(6)
Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo-random Functions (PRF)		
Unit-IV	BUILDING A PSEUDORANDOM PERMUTATION	(6)
The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.		
Unit-V	MESSAGE AUTHENTICATION CODES	(6)
Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag.
2	Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)

REFERENCES:

1	Shaffi Goldwasser and MihirBellare, Lecture Notes on Cryptography, Available at http://citeseerx.ist.psu.edu/ .
2	Oded Goldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23
3	William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 3rd Edition, 2006

List of Exercises/Experiments

1.Implement Feige-Fiat-Shamir identification protocol	
2. Implement GQ identification protocol.	
3. Implement Schnorr identification protocol.	
4. Implement Rabin one-time signature scheme.	
5. Implement Merkle one-time signature scheme.	
6. Implement Authentication trees and one-time signatures.	
7. Implement GMR one-time signature scheme.	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods

COURSE OUTCOMES:

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

CO1:	Interpret the basic principles of cryptography and general cryptanalysis.
CO2:	Determine the concepts of symmetric encryption and authentication.
CO3:	Identify the use of public key encryption, digital signatures, and key establishment.
CO4:	Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions
CO5:	Express the use of Message Authentication Codes.


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Windows 10 / Ubuntu / Kali	30
2.	Python, Java, C++.	30
3.	Visual Studio Code / IDE	30
4.	PYCryptodome or Cryptography	30

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	1	-	-	2	1	1	2	2	1	1
CO2	1	3	2	1	2	-	-	3	2	2	2	2	1	3
CO3	1	1	2	3	2	-	-	1	1	1	3	1	1	3
CO4	3	1	2	1	3	-	-	3	2	1	2	3	2	1
CO5	2	3	3	3	3	-	-	3	1	1	1	2	1	1
Avg.	2	2.2	2.4	2.2	2.2	-	-	2.4	1.4	1.2	2	2	1.2	1.8
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2427	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C	100
		2	0	2	3	
Course Objectives	- Know the importance and need for software security. - Know about various attacks. - Learn about secure software design. - Understand risk management in secure software development. - Know the working of tools related to software security.					

Unit-I	NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS	(6)
Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory- Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks		
Unit-II	SECURE SOFTWARE DESIGN	(7)
Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles		
Unit-III	SECURITY RISK MANAGEMENT	(5)
Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management		
Unit-IV	SECURITY TESTING	(8)
Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing		
Unit-V	SECURE PROJECT MANAGEMENT	(4)
Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Julia H. Allen, "Software Security Engineering", Pearson Education, 2008
2	Evan Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", First edition, Syngress Publishing, 2011
3	Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, "The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)", Addison-Wesley Professional, 2006

REFERENCES:

1	Robert C. Seacord, "Secure Coding in C and C++ (SEI Series in Software Engineering)", Addison-Wesley Professional, 2005.
2	Jon Erickson, "Hacking: The Art of Exploitation", 2nd Edition, No Starch Press, 2008.
3	Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First edition, Syngress Publishing, 2012
4	Bryan Sullivan and Vincent Liu, "Web Application Security, A Beginner's Guide", Kindle Edition, McGraw Hill, 2012
5	Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Kindle Edition, Packt Publishing, 2012
6	Jason Grembi, "Developing Secure Software"

List of Exercises/Experiments

1. Implement the SQL injection attack.	
2. Implement the Buffer Overflow attack.	
3. Implement Cross Site Scripting and Prevent XSS.	
4. Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like Kali Linux.	
5.Develop and test the secure test cases	
6.Penetration test using kali Linux	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods


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COURSE OUTCOMES:

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

CO1:	Identify various vulnerabilities related to memory attacks.
CO2:	Apply security principles in software development.
CO3:	Evaluate the extent of risks
CO4:	Involve selection of testing techniques related to software security in the testing phase of software development.
CO5:	Use tools for securing software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF SOFTWARES	REQUIRED NUMBERS
1	Kail Linux	30
2	OWASP ZAP / SQL Injection / SQL MAP	30
3	DVWA / OWASP Juice Shop	30
4	Language C and GCC / Burp Suite	30

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	2	3	2	3	2	-	-	2	1	2	2	2	2	1
CO2	2	2	2	3	3	-	-	2	1	2	2	1	2	1
CO3	1	2	2	2	1	-	-	1	1	2	1	2	2	1
CO4	2	3	2	2	2	-	-	2	1	2	2	2	2	1
CO5	2	1	2	2	3	-	-	2	1	1	2	2	1	2
Avg.	1.8	2.2	2	2.4	2.2	-	-	1.8	1	1.8	1.8	1.8	1.8	1.2

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


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2428	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand the basics of Blockchain - To learn Different protocols and consensus algorithms in Blockchain - To learn the Blockchain implementation frameworks - To understand the Blockchain Applications - To experiment the Hyperledger Fabric, Ethereum networks					

Unit-I	INTRODUCTION TO BLOCKCHAIN	(7)
Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function- Hash pointer and Merkle tree		
Unit-II	BITCOIN AND CRYPTOCURRENCY	(6)
A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay		
Unit-III	BITCOIN CONSENSUS	(6)
Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool- Permissioned model and use cases.		
Unit-IV	HYPERLEDGER FABRIC & ETHEREUM	(5)
Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.		
Unit-V	BLOCKCHAIN APPLICATIONS	(6)
Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc- Case Study.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2	Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.

REFERENCES:

1	Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
2	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3	Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015
4	RiteshModi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing
5	Handbook of Research on Blockchain Technology published by Elsevier Inc. ISBN: 9780128198162, 2020.

List of Exercises/Experiments

1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.	
2.Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.	
3. Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.	
4. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network	
5. Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards	
6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan	
Total No of Periods to be Taught	30 Periods
Total No of Periods to be Taught (T&L)	60 Periods


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COURSE OUTCOMES:

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

CO1:	Understand emerging abstract models for Blockchain Technology
CO2:	Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
CO3:	It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
CO4:	Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF SOFTWARES	REQUIRED NUMBERS
1	Docker	30
2	Node.js / java	30
3	Hyperledger Fabric SDK node.js and java	30
4	IBM Blockchain / Visual Studio	30
5	Windows 10 / Ubuntu.	30

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS O1	PSO 2	PSO 3
CO1	3	3	2	2	1	-	-	1	-	-	2	3	3	1
CO2	3	3	3	3	1	-	-	2	-	-	2	3	3	1
CO3	3	3	3	3	2	-	-	3	-	-	2	3	3	3
CO4	3	2	3	2	3	-	-	3	-	-	2	3	2	3
Avg.	3	2.75	2.75	2.5	1.75	-	-	2.25	-	-	2	3	2.75	2

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


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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2429	NETWORK SECURITY	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To learn the fundamentals of cryptography. • To learn the key management techniques and authentication approaches. • To explore the network and transport layer security techniques. • To understand the application layer security standards. • To learn the real time security practices.					

Unit-I	INTRODUCTION	(6)
Basics of cryptography, conventional and public-key cryptography, hash functions, authentication, and digital signatures		
Unit-II	KEY MANAGEMENT AND AUTHENTICATION	(6)
Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.		
Unit-III	ACCESS CONTROL AND SECURITY	(6)
Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application.		
Unit-IV	APPLICATION LAYER SECURITY	(6)
Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security		
Unit-V	SECURITY PRACTICES	(6)
Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN 13:9780133354690
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REFERENCES:

1	Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.
2	Linux iptables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978- 0596005696.
3	Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327- 141-1.
4	Network Security, Firewalls And VPNs, J. Michael Stewart, Jones & Bartlett Learning, 2013, ISBN-10: 1284031675, ISBN-13: 978-1284031676.
5	The Network Security Test Lab: A Step-By-Step Guide, Michael Gregg, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

List of Exercises/Experiments

1.Implement symmetric key algorithms
2.Implement asymmetric key algorithms and key exchange algorithms
3.Implement digital signature schemes
4. Installation of Wire shark, tcpdump and observe data transferred in client-server communication using UDP/TCP and identify the UDP/TCP datagram.
5.Check message integrity and confidentiality using SSL
6.Experiment Eavesdropping, Dictionary attacks, MITM attacks
7.Experiment with Sniff Traffic using ARP Poisoning
8. Demonstrate intrusion detection system using any tool.
9.Explore network monitoring tools
10.Study to configure Firewall, VPN

Total No of Periods to be Taught

30 Periods

Total No of Periods to be Taught (T&L)

60 Periods


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COURSE OUTCOMES:

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

CO1:	Classify the encryption techniques
CO2:	Illustrate the key management technique and authentication.
CO3:	Evaluate the security techniques applied to network and transport layer
CO4:	Discuss the application layer security standards.
CO5:	Apply security practices for real time applications.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	DESCRIPTION OF SOFTWARES	REQUIRED NUMBERS
1	Open SSL, WireShark,Tcpdump	30
2	Kali Linux, Ettercap, Snot	30
3	Nagios,Zabbix, openVPN	30

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	2	-	-	2	1	2	1	2	3	1
CO2	1	1	3	2	2	-	-	2	2	1	1	3	1	2
CO3	1	2	1	1	2	-	-	3	3	1	3	2	1	3
CO4	2	2	3	2	3	-	-	3	3	2	1	2	1	3
CO5	2	1	3	2	2	-	-	2	1	1	3	2	1	1
Avg.	1.8	1.8	2.4	1.8	2.2	-	-	2.4	2	1.4	1.8	2.2	1.4	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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Department		AGRI		Programme Code & Name				Open to All Departments	
Course Code	Course Name			Hours/Week		Credit	Maximum Marks		
UAIOE2401	INTRODUCTION TO FOOD PROCESSING			L	T	P	C	100	
				3	0	0	3		
Course Objectives									
The course aims to introduce the students to the area of Food Processing. This is necessary for effective understanding of a detailed study of food processing and technology subjects. This course will enable students to appreciate the importance of food processing with respect to the producer, manufacturer and consumer.									
UNIT I		PROCESSING OF FOOD AND ITS IMPORTANCE						9	
Source of food - plant, animal and microbial origin; different foods and groups of foods as raw materials for processing – cereals, pulses, grains, vegetables and fruits, milk and animal foods, sea weeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives; need and significance of processing these foods.									
UNIT II		METHODS OF FOOD HANDLING AND STORAGE						9	
Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods.									
UNIT III		LARGE-SCALE FOOD PROCESSING						9	
Milling of grains and pulses; edible oil extraction; Pasteurization of milk and yoghurt; canning and bottling of foods; drying – Traditional and modern methods of drying, Dehydration of fruits, vegetables, milk, animal products etc; preservation by use of acid, sugar and salt; Pickling and curing with microorganisms, use of salt, and microbial fermentation; frying, baking, extrusion cooking, snack foods.									
UNIT IV		FOOD WASTES IN VARIOUS PROCESSES						9	
Waste disposal-solid and liquid waste; rodent and insect control; use of pesticides; ETP; selecting and installing necessary equipment.									
UNIT V		FOOD HYGIENE						9	
Food related hazards – Biological hazards – physical hazards – microbiological considerations in foods. Food adulteration – definition, common food adulterants, contamination with toxic metals, pesticides and insecticides; Safety in food procurement, storage handling and preparation; Relationship of microbes to sanitation, Public health hazards due to contaminated water and food; Personnel hygiene; Training& Education for safe methods of handling and processing food; sterilization and disinfection of manufacturing plant; use of sanitizers, detergents, heat, chemicals, Cleaning of equipment and premises.									
Total								45 Periods	



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TEXT BOOK:

- 1 Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge, 2003.

REFERENCES:

- 1 VanGarde, S.J. and Woodburn. M “Food Preservation and Safety Principles and Practice”.Surbhi Publications, 2001.
- 2 Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.
- 3 Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005.

COURSE OUTCOMES:

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

- | | |
|------|--|
| CO1: | Be aware of the different methods applied to processing foods. |
| CO2: | Be able to understand the significance of food processing and the role of food and beverage industries in the supply of foods. |
| CO3: | Describe about large-scale food processing methods. |
| CO4: | Distinguish Food Wastes in Various Processes techniques. |
| CO5: | Understand the concepts of Food process methods, Storage techniques, food handling methods, reduces food waste and food hygiene process. |

Mapping of COs with POs and PSOs

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

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



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Department		AGRI		Programme Code & Name				Open to All Departments	
Course Code	Course Name			Hours/Week		Credit	Maximum Marks		
UAIOE2402	TRADITIONAL INDIAN FOODS			L	T	P	C	100	
				3	0	0	3		
Course Objectives									
To help students acquire a sound knowledge on diversities of foods, food habits and patterns in India with focus on traditional foods.									
UNIT – I		HISTORICAL AND CULTURAL PERSPECTIVES						9	
Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols; importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditionson food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.									
UNIT II		TRADITIONAL METHODS OF FOOD PROCESSING						9	
Traditional methods of milling grains –rice, wheat and corn –equipments and processes as compared to modern methods. Equipments and processes for edible oil extraction, paneer, butter and ghee manufacture – comparison of traditional and modern methods. Energy costs, efficiency, yield,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	PSO 2	PSO 3
CO1	3	3	3	2	2	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	2	1	-	-	-	3	3	3	3

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	
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

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		
UAIOE2404	REMOTE SENSING CONCEPTS			L	T	P	C	100	
				3	0	0	3		
Course Objectives									
- To introduce the concepts of remote sensing processes and its components. - To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation									
UNIT – I		REMOTE SENSING AND ELECTROMAGNETIC RADIATION						9	
Definition–components of RS – History of Remote Sensing –Merits and demerits of data collation between conventional and remote sensing methods Electromagnetic Spectrum– Radiation principles - Wave theory, Planck’s law, Wien’s Displacement Law, Stefan’s Boltzmann law, Kirchoff’s law – Radiation sources : active & passive - Radiation Quantities.									
UNIT II		EMRINTERACTION WITH ATMOSPHERE AND EARTH MATERIAL						9	
Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectro radio meter–Spectral Signature concepts –Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.									
UNIT III		ORBITS AND PLATFORMS						9	
Motions of planets and satellites – Newton’s law of gravitation - Gravitational field and potential - Escape velocity - Kepler ‘s law of planetary motion - Orbit elements and types – Orbital per turbations and maneuvers–Types of remote sensing platforms- Ground based, Airborne platforms and Space borne platforms –Classification of satellites –Sun synchronous and Geosynchronous satellites – Lagrange Orbit.									
UNIT IV		SENSING TECHNIQUES						9	
Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV – Orbital and sensor characteristics of live Indian earth observation satellites									
UNIT V		DATA PRODUCTS AND INTERPRETATION						9	
Photographic and digital products –Types, levels and open source satellite data products – selection and procurement of data– Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification									
Total								45 Periods	



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TEXT BOOK:

1	Thomas M. Lilles and, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York,2015.
2	George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Third Edition Universities Press (India) Private limited, Hyderabad, 2018

COURSE OUTCOMES:

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

CO1:	Understand the concepts and laws related to remote sensing
CO2:	Understand the interaction of electromagnetic radiation with atmosphere and earth material.
CO3:	Acquire knowledge about satellite or bits and different types of satellites.
CO4:	Understand the different types of remote sensors.
CO5:	Gain knowledge about the concepts of interpretation of satellite imagery

Mapping of COs with POs and PSOs

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

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



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Department		AGRI		Programme Code & Name				Open to All Departments	
Course Code	Course Name			Hours/Week			Credit	Maximum Marks	
UAIOE2405	BASICS OF INTEGRATED WATER RESOURCES MANAGEMENT			L	T	P	C	100	
				3	0	0	3		
Course Objectives									
- To introduce the inter disciplinary approach of water management. - To develop knowledge base and capacity building on IWRM.									
UNIT – I		OVER VIEW OF INTEGRATED WATER RESOURCES MANAGEMENT						9	
Facts about water – Definition – Key challenges – Paradigm shift – Water management Principles – Social equity – Ecological sustainability – Economic efficiency - SDGs- World Water Forums.									
UNIT II		WATER USE SECTORS : IMPACTS AND SOLUTION						9	
Water users : People, Agriculture, ecosystem and others - Impacts of the water use sectors on water resources -Securing water for people, food production, ecosystems and other uses - IWRM relevance in water resources management.									
UNIT III		WATER ECONOMICS						9	
Economic characteristics of water good and services –Economic instruments –Private sector involvement in water resources management - PPP experiences through case studies.									
UNIT IV		RECENTTRE AND SIN WATER MANAGEMENT						9	
Riverbasin management - Ecosystem Regeneration –5 Rs - WASH – Sustainable livelihood – Water management in the context of climate change.									
UNIT V		IMPLEMENTATION OF IWRM						9	
Barriers to implementing IWRM - Policy and legal framework - Bureaucratic reforms and inclusive development - Institutional Transformation - Capacity building - Case studies on conceptual framework of IWRM.									
Total								45 Periods	

TEXT BOOK:

1	Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. 2003.
2	Mollinga P. <i>et al.</i> “Integrated Water Resources Management”, Water in South Asia Volume I, Sage Publications, 2006.

REFERENCES:

1	Technical Advisory Committee, Background Papers No:1, 4 and 7, Stockholm, Sweden.2002.
2	IWRM Guidelines at River Basin Level (UNESCO, 2008).

COURSE OUTCOMES:

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

CO1:	Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.
CO2:	Discuss on the different water uses; how it is impacted and ways to tackle the seimpacts.



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CO3:	Explain the economic aspects of water and choose the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.
CO4:	Illustrate the recent trend in water management.
CO5:	Understand the implementation hitches and the institutional framework.

Mapping of COs with POs and PSOs

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

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
UBMOE2401	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:

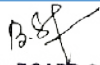
On completion of the course, the students will be able to

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		-	-

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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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BSP
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Department	BME	Programme Code & Name	Open to all Departments
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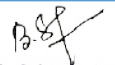
Semester

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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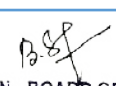


Department	BME	Programme Code & Name	Open to all Departments
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Semester

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	-

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

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Department	Chemical Engineering	Programme Code & Name	Open to all Departments
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCHOE2403	ENZYME ENGINEERING	L	T	P	C	100
		3	0	0	3	
Course Objectives	Focuses on the introduction to enzymes and gives an overview of kinetics, production, immobilization, fermentation process and its industrial applications.					

Unit-I	ENZYMES AND KINETICS	(9)
Classification of enzymes; Principle of enzymatic catalysis; Enzyme kinetics-Factors affecting the enzyme activity- Concentration, pH and temperature. Kinetics of a single-substrate enzyme catalysed reaction, Michealis-Menten Equation, Km, Vmax, L.B Plot, Turnover number, Kcat. Kinetics of Enzyme Inhibition.		
Unit-II	ENZYME PRODUCTION	(9)
Extraction of crude enzyme from plant, animal and microbial source; Purification of enzymes by the help of different methods. Methods of characterization of enzymes; criteria of purity. Unit of enzyme activity - definition and importance. Development of enzyme assays.		
Unit-III	ENZYME IMMOBILIZATION	(9)
Immobilization Type: Adsorption, Matrix entrapment, Encapsulation, Cross linking, Covalent binding and their examples; Advantages and disadvantages of different immobilization techniques. Structure & stability of immobilized enzymes, kinetic properties of immobilized enzymes- partition effect, diffusion effect.		
Unit-IV	LARGE SCALE PRODUCTION	(9)
Fermentation using continuously stirred aerated tank bioreactors. Mixing power correlation. Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power.		
Unit-V	INDUSTRIAL APPLICATIONS OF ENZYMES	(9)
Industrial Enzymes in:Dairy, Bread making, Starch processing, Brewing; Bioethanol production and other fermentation processes; Thermophilic enzymes, amylases, lipases, proteolytic enzymes in Meat and Leather industry, Cellulose degrading enzymes in Paper and Pulp industry; Metal degrading and pollutant degradation. Biosensors		
Total No of Periods to be Taught		45

TEXT BOOK:

1	Nicolas C. Price and Lewis Stevens, "Fundamentals of enzymology: Cell and Molecular Biology of Catalytic Proteins", 3rd Edition, Oxford University Press, United States of America, 2000 for Unit I.
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2	Young JeYoo, Yan Feng, Yong Hwan Kim Camila Flor J. Yagonia, "Fundamentals of Enzyme Engineering", 1st Edition, Springer Inc, United Kingdom, 2017 for Units II, III, IV & V.
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REFERENCES:

1	Trevor Palmer and Philip Bonner, "Enzymes: Biochemistry, Biotechnology and Clinical Chemistry", 2nd Edition, Woodhead Publishing, United Kingdom, 2001.
2	Nalwa H.S., Encyclopedia of Nanoscience and Nanotechnology, American Scientific Publishers 2004

COURSE OUTCOMES:

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

CO1:	Classify enzymes and elaborate the principles of catalysis and enzyme kinetics
CO2:	Describe the enzyme production, purification, characterisation and assay
CO3:	Outline the immobilization of enzymes
CO4:	Elaborate the large scale fermentation process using bioreactors
CO5:	Apply enzyme science in its industrial applications

Mapping of COs with POs and PSOs

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

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

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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	-	-	-

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
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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Mecheri, Salem Dt-636453, Tamilnadu

Department	CIVIL	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
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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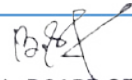
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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2401	INDUSTRIAL ELECTRONICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• 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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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

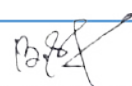
REFERENCES:

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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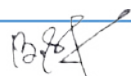
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Mapping of COs with POs and PSOs

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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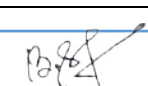


Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2403	4G / 5G COMMUNICATION NETWORKS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To learn the evolution of wireless networks.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

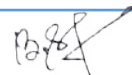
On completion of the course, the students will be able to

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:

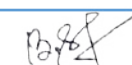
On completion of the course, the students will be able to

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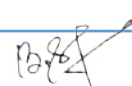
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Department	ECE	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UECOE2405	EMBEDDED AND REAL TIME SYSTEMS	L 3	T 0	P 0	C 3	100
Course Objectives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

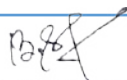
REFERENCES:

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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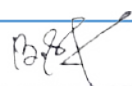
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Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	1	-	3	3	1	-	-	-	1	-	3
CO2	-	-	-	1	-	3	3	2	-	-	-	1	-	3
CO3	-	-	-	1	-	3	2	2	-	-	-	1	-	3
CO4	-	-	-	1	-	3	3	1	-	-	-	1	-	3
CO5	-	-	-	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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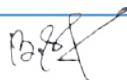
REFERENCES:

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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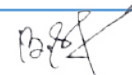
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Mapping of COs with POs and PSOs

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:

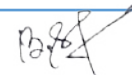
On completion of the course, the students will be able to

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

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

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



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TEXT BOOK:

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

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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

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



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TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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

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

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



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TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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

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



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TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

Mapping of COs with POs and PSOs

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

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
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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

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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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TEXT BOOK:

1	Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th Edition, 2007, ISBN No: 978- 3- 658- 01783- 5
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REFERENCES:

1	Barry Hole beak, "Automotive Electrical and Electronics" , Delmar Publishers, Clifton Park,USA,2010
2	James D Halderman, "Automotive Electrical and Electronics", Prentice Hall, USA, 2013
3	Tom Denton, "Automotive Electrical and Electronics Systems," Third Edition, 2004, SAE International
4	William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth- Heinemann Publishers, 2012.

COURSE OUTCOMES:

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

CO1:	Define the glossary related to vehicle electrical and electronic system
CO2:	Explain the need for starter batteries, starter motor and alternator in the vehicle.
CO3:	Differentiate the conventional and modern vehicle architecture and the data transfer among the different electronic control unit using different communication protocols
CO4:	List common types of sensor and actuators used in vehicles
CO5:	Understand networking in vehicles.

Mapping of COs with POs and PSOs

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

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Department	EEE	Programme Code & Name	Open to All Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
UEEOE2411	INTRODUCTION TO EMBEDDED SYSTEMS	3	0	0	3	100
Course Objectives	To familiarize students with the fundamental concepts of embedded systems, including their architecture, hardware, and software components, and to provide experience in designing and implementing simple embedded systems					

Unit-I	BASICS OF COMPUTER ARCHITECTURE AND THE BINARY NUMBER SYSTEM	(9)
Basics of computer architecture, computer languages, RISC and CISC architectures, number systems, number format conversions, computer arithmetic, units of memory capacity.		
Unit-II	INTRODUCTION TO EMBEDDED SYSTEMS	(9)
Application domain of embedded systems, desirable features and general characteristics of embedded systems, model of an embedded system, microprocessor Vs microcontroller, example of a simple embedded system, merit for an embedded system, classification of MCUs: 4/8/16/32 bits, history of embedded systems		
Unit-III	EMBEDDED SYSTEMS-THE HARDWARE POINT OF VIEW	(9)
Microcontroller unit(MCU), a popular 8-bit MCU, memory for embedded systems, low power design, pull up and pull down resistors		
Unit-IV	SENSORS, ADCs AND ACTUATORS	(9)
Sensors: Temperature Sensor, Light Sensor, Proximity/range Sensor; Analog to digital converters: ADC Interfacing; Actuators Displays, Motors, Opto couplers / Opto isolators, relays.		
Unit-V	EXAMPLES OF EMBEDDED SYSTEMS	(9)
Mobile phone, automotive electronics, radio frequency identification (RFID), wireless sensor networks(WISENET), robotics, biomedical applications, brain machine interface		
Total No of Periods to be Taught		45



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TEXT BOOK:

1	Lyla B Das, Embedded systems: An Integrated Approach, 1st Ed., Pearson, 2013
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REFERENCES:

1	Shibu, K.V., Introduction to Embedded Systems, 1st Ed., TMH, 2009
2	KantaRao B, Embedded Systems, 1st Ed., PHI
3	Frank Vahid& Tony Givargis, Embedded System Design, 2nd Edition, John Wiley,

COURSE OUTCOMES:

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

CO1:	learn about the general principles of computer architecture
CO2:	learn about the working of a simple embedded system and embedded system applications
CO3:	learn the hardware aspects of embedded systems
CO4:	Understand the sensors, ADCs and actuators used in embedded systems
CO5:	Understand the real world examples of embedded systems

Mapping of COs with POs and PSOs

COs/POs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	-	3	2	2	-	-	-	3	3	3
CO2	3	2	3	2	-	-	-	-	3	-	3	3	3
CO3	3	2	3	-	3	2	-	-	-	-	3	3	3
CO4	3	2	3	-	-	-	2	-	-	-	-	3	3
CO5	3	2	3	2	3	-	-	-	3	-	3	3	3
Avg.	3	2	3	2	3	2	2	-	3	-	3	3	3

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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	-	-	-	-	-	-	-	-	-	-

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
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

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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

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


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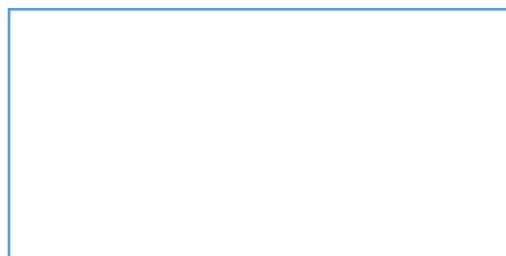
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Department	Mechanical	Programme Code & Name	Open to all Departments
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UMEOE2404	ENERGY TECHNOLOGY	L	T	P	C	100
		3	0	0	3	
Course Objectives	- 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

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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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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2430	Augmented Reality / Virtual Reality	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To impart the fundamental aspects and principles of AR/VR technologies. • To know the internals of the hardware and software components involved in the development of AR/VR enabled applications. • To learn about the graphical processing units and their architectures. • To gain knowledge about AR/VR application development. • To know the technologies involved in the development of AR/VR based applications.					

UNIT – I	INTRODUCTION	(7)
Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.		
Unit-II	VR MODELING	(6)
Modelling – Geometric Modelling – Virtual Object Shape – Object Visual Appearance – Kinematics Modelling – Transformation Matrices – Object Position – Transformation Invariants – Object Hierarchies – Viewing the 3D World – Physical Modelling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behaviour Modelling – Model Management.		
Unit-III	VR PROGRAMMING	(6)
VR Programming – Toolkits and Scene Graphs – World Toolkit – Java 3D – Comparison of World Toolkit and Java 3D		
Unit-IV	APPLICATIONS	(6)
Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society- Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.		

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Unit-V	AUGMENTED REALITY	(5)
Introduction to Augmented Reality Computer Vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packet Publisher, 2018
2	Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice",
3	Virtual Reality" by Lauri J. Buckley and David W. Schloerb: An introductory textbook on VR.

REFERENCES:

1	D.Schmalstieg and T.Hollerer, Augmented reality: Principles and practice, Addison – Wesley, 2016.
2	A.Y.C Nee and S.K. Ong, springer handbook of augmented reality, springer, 2022.
3	S.Aukstakalnis, practical augmented reality, addition – Wesley, 2016.

List of Exercises / Experiments

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.	
2. Use the primitive objects and apply various projection types by handling camera.	
3. Download objects from asset store and apply various lighting and shading effects.	
4. Model three-dimensional objects using various modelling techniques and apply textures over them.	
5. Create three-dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.	
6. Add audio and text special effects to the developed application.	
7. Develop VR enabled applications using motion trackers and sensors incorporating fullhaptic interactivity.	
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.	
9. Develop AR enabled simple applications like human anatomy visualization, DNA/RNAstructure visualization and surgery simulation.	
10. Develop simple MR enabled gaming applications.	
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 basic concepts of AR and VR
CO2:	Understand the tools and technologies related to AR/VR
CO3:	Know the working principle of AR/VR related Sensor devices
CO4:	Design of various models using modelling techniques
CO5:	Develop AR/VR applications in different domains

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Unity (free version)	30
2	Windows 10/11, GPU drivers (NVIDIA/AMD), VR headset drivers	

Mapping of COs with POs and PSOs

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

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2431	Multimedia and Animation	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To grasp the fundamental knowledge of Multimedia elements and systems - To get familiar with Multimedia file formats and standards - To learn the process of Authoring multimedia presentations - To learn the techniques of animation in 2D and 3D and for the mobile UI - To explore different popular applications of multimedia					

Unit-I	INTRODUCTION TO MULTIMEDIA	(6)
Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.		
Unit-II	MULTIMEDIA FILE FORMATS AND STANDARDS	(6)
File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Colouring image and video, Colour Models. Multimedia data and file formats for the web.		
Unit-III	MULTIMEDIA AUTHORING	(6)
Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.		
Unit-IV	ANIMATION	(6)
Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.		

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Unit-V	MULTIMEDIA APPLICATIONS	(6)
Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

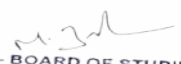
1	Ze-Nian Li, Mark S. Drew, Jiangshan Liu, Fundamentals of Multimedia”, Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)
2	Multimedia: Making It Work" by Tay Vaughan: A comprehensive textbook on multimedia concepts and applications.
3	"Multimedia Systems" by Ralf Steinmetz and Klara Nahrstedt: A textbook on multimedia systems and technologies.

REFERENCES:

1	John M Blain, The Complete Guide to Blender Graphics: Computer Modelling & Animation,CRC press, 3rd Edition, 2016.
2	Gerald Friedland, Ramesh Jain, “Multimedia Computing”, Cambridge University Press, 2018.
3	Prabhat Mohsen Amini Salehi, Xiangguo Li, “Multimedia Cloud Computing Systems”, Springer Nature, 1st Edition, 2021.

List of Exercises / Experiments

1.	Working with Image Editing tools: Install tools like GIMP/ Inkscape / Krita / Pencil and perform editing operations: Use different selection and transform tools to modify or improve an image Create logos and banners for home pages of websites.
2.	Working with Audio Editing tools: Install tools like, Audacity / Ardor for audio editing, sound mixing and special effects like fade- in or fade-out etc., Perform audio compression by choosing a proper codec.
3.	Working with Video Editing and conversion tools: Install tools like Opens hot / Celera / Handbrake for editing video content. Edit and mix video content, remove noise, create special effects, add captions. Compress and convert video file format to other popular formats.
4.	Working with web/mobile authoring tools: Adapt / Composer/ Blue Griffon / Bluefish / Apana Studio/ NetBeans / WordPress /Expression Web Design simple Home page with banners, logos, tables quick links etc. Provide a search interface and simple navigation from the home page to the inside pages of the website. Design Responsive web pages for use on both web and mobile interfaces.
5.	working with animation tools


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6.	Install tools like, Krita, Wick Editor, Blender: Perform a simple 2D animation with sprites Perform simple 3D animation with keyframes, kinematics Working with Mobile UI animation tools: Origami studio / Lottie / Framer etc.,		
7.	Working with E-Learning authoring tools:		
8.	Install tools like Dapp / Molly / Course Lab/ Isay and Cam Studio/Apache, Videoland: Demonstrate screen recording and further editing for e-learning content. Create a simple E-Learning module for a topic of your choice.		
9.	Creating VR and AR applications: Any affordable VR viewer like Google Cardboard and any development platform like Open space 3D / Arcoren etc.		
Note: all tools listed are open source. Usage of any proprietary tools in place of open-source tools is not restricted.			
<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:	Get the bigger picture of the context of Multimedia and its applications
CO2:	Use the different types of media elements of different formats on content pages
CO3:	Author 2D and 3D creative and interactive presentations for different target multimedia applications.
CO4:	Use different standard animation techniques for 2D, 2 1/2 D, 3D applications
CO5:	Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Blender + Resolve + Audacity	30
2	Windows 10/11 , GPU drivers (NVIDIA/AMD)	

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Mapping of COs with POs and PSOs														
COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	-	-	-	3	2	1	3	2	3
CO2	3	3	3	3	3	-	-	-	3	3	2	3	2	3
CO3	3	3	3	3	3	-	-	-	3	3	2	3	2	3
CO4	3	3	3	3	3	2	-	-	3	3	3	3	3	3
CO5	3	3	3	3	3	2	-	-	3	3	3	3	3	3
Avg.	3	2.8	3	2.8	3	2	-	-	3	2.8	2.2	3	2.4	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy														

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2432	Video Creation and Editing	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To introduce the broad perspective of linear and nonlinear editing concepts. • To understand the concept of Storytelling styles. • To be familiar with audio and video recording. To apply different media tools. • To learn and understand the concepts of AVID XPRESS DV 4.					

Unit-I	FUNDAMENTALS	(6)
Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.		
Unit-II	STORYTELLING	(6)
Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images – managing RESolutions - mechanics of digital editing pointer files - media management.		
Unit-III	USING AUDIO AND VIDEO	(6)
Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.		
Unit-IV	WORKING WITH FINAL CUTPRO	(6)
Working with clips and the Viewer - working with sequences, the Timeline, and the canvas – Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques – Working with Audio-Using Media Tools-Viewing and Setting Preferences.		
Unit-V	WORKING WITH AVIDXPRESS DV 4	(6)
Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage -Using Time line and Working in Trim Mode- Working with Audio-Output Options.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.
2	Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creative
3	Adobe Premiere Pro CC: Classroom in a Book" by Adobe Creative Team: A practical guide to video editing with Adobe Premiere Pro.

REFERENCES:

1	In the blink of an eye – walter murch
2	The technique of Film and video editing – Ken Dancyger
3	Cut by cut: editing your film or video – gael chandler

List of Exercises / Experiments

1. Write a Movie Synopsis (Individual/Team Writing)	
2. Present team stories in class.	
3. Script/Storyboard Writing (Individual Assignment)	
4. Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts & agreements	
5. Production: Single camera production personnel & equipment, Documentary Production	
6. Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching	
7. Write Documentary & Animation Treatment	
8. Post-production: Editing, Sound design, Finishing	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

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

CO1:	Compare the strengths and limitations of Nonlinear
CO2:	Identify the infrastructure and significance of storytelling.
CO3:	Apply suitable methods for recording to CDs and VCDs
CO4:	Address the core issues of advanced editing and training techniques
CO5:	Design and develop projects using AVIDXPRESS DV4


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Resolver + blender + audacity	30
2	Windows 10/11 , CPU Drivers (NVIDIA / AMD) , camera and audio drivers	

Mapping of COs with POs and PSOs														
COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	1	2	1	1	-	-	-	1	2	3	3	1	1
CO2	2	3	3	3	1	-	-	-	1	2	2	1	1	1
CO3	2	2	3	3	1	-	-	-	3	1	1	2	1	2
CO4	2	2	2	2	1	-	-	-	3	1	1	2	2	2
CO5	2	1	3	3	1	-	-	-	3	2	1	2	2	1
Avg.	2.2	1.8	2.6	2.4	1	-	-	-	2.2	1.6	1.6	2	1.4	1.4
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy														

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2433	Digital marketing	L	T	P	C	100
		2	0	2	3	
Course Objectives	• The primary objective of this module is to examine and explore the role and importance of digital marketing in today’s rapidly changing business environment. • It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured					

Unit-I	INTRODUCTION TO ONLINE MARKET	(6)
Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.		
Unit-II	SEARCH ENGINE OPTIMISATION	(6)
Search Engine optimization - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques- Off-Page Techniques. Search Engine Marketing- How Search Engine works- Subcomponent's-PPC advertising-Display Advertisement		
Unit-III	E-MAIL MARKETING	(6)
E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation – Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, MobilePASS, Mobile Commerce, SMS Campaigns-Profilng and targeting		
Unit-IV	SOCIAL MEDIA MARKETING	(6)
Social Media Marketing - Social Media Channels - Leveraging Social media for brand conversations and buzz. Successful / benchmark social media campaigns. Engagement Marketing-Building Customer relationships- Creating Loyalty Drivers-Influencer Marketing.		
Unit-V	DIGITAL TRANSFORMATION	(6)
Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Digital Marketing Essentials: A Comprehensive Digital marketing – Jeff Larson & Stuart Draper
2	Fundamentals of digital marketing – Puneet Singh Bhatia
3	E – Marketing – Judy Strauss & Raymond Frost

REFERENCES:

1	Digital marketing for dummies – Ryan Deiss & Russ Henneberry
2	Digital marketing : Strategy implementation and practice – Dave Chaffey & Fiona Ellis - Chadwick
3	The new rules of marketing and PR – David Meerman Scott

List of Exercises / Experiments

1.	Subscribe to a weekly/quarterly newsletter and analyze how its content and structure aid with the branding of the company and how it aids its potential customer segments.		
2.	Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool.		
3.	Demonstrate how to use the Google Webmasters Indexing API		
4.	Discuss an interesting case study regarding how an insurance company manages leads.		
5.	Discuss negative and positive impacts and ethical implications of using social media for political advertising.		
6.	Discuss how Predictive analytics is impacting marketing automation		
<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:	To examine and explore the role and importance of digital marketing in today's rapidly changing business environment
CO2:	To focus on how digital marketing can be utilized.
CO3:	To know the key elements of a digital marketing strategy.
CO4:	To study how the effectiveness of a digital marketing campaign can be measured.
CO5:	To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	canva	30
2	Windows 10/11 , Antivirus software, internet connection	

Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1	3	-	-	-	1	2	3	3	3	3
CO2	2	2	2	1	3	-	-	-	1	2	3	3	3	3
CO3	1	1	1	2	2	-	-	-	1	2	1	3	2	1
CO4	3	2	2	3	1	-	-	-	1	3	2	2	3	2
CO5	2	3	1	3	3	-	-	-	2	3	1	1	2	1
Avg.	2.2	2.2	1.6	2	2.4	-	-	-	1.2	2.4	2	2.4	2.6	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy														

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2434	Visual Effects	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To get a basic idea on animation principles and techniques • To get exposure to CGI, color and light elements of VFX • To have a better understanding of basic special effects techniques • To have a knowledge of state-of-the-art techniques • To become familiar with popular compositing techniques.					

Unit-I	ANIMATION BASICS	(6)
VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.		
Unit-II	CGI, COLOR, LIGHT	(6)
CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modelling and Rendering: colour - Colour spaces, colour depth, Colour grading, colour effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model		
Unit-III	SPECIAL EFFECTS	(6)
Special Effects – props, scaled models, animatronics, pyro techniques, Schiffman process, Particle effects – wind, rain, fog, fire.		
Unit-IV	VISUAL EFFECTS TECHNIQUES	(6)
Motion Capture, Matt Painting, Rigging, Front Projection. Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving.		

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Unit-V	COMPOSITING	(6)
Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2	Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3	John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014

REFERENCES:

1	Jon Gress, “Digital Visual Effects and Compositing”, New Riders Press, 1st Edition, 2014.
2	Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics”, Morgan Kauffman, 2008.
3	Luiz Velho, Bruno Madeira, “Introduction to Visual Effects A Computational Approach”, Routledge, 2023

List of Exercises / Experiments

Using Natron:

1. Understanding Natron Environment:
2. Working with color and using color grading
3. using Channels
4. Merging images
5. Using Roto paint
6. performing Tracking and stabilizing
7. Transforming elements
8. Stereoscopic compositing

Using Blender:

1. Motion Tracking – camera and object tracking
2. Camera fx, color grading, vignettes
3. Compositing images and video files
4. Multilayer rendering

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:	To implement animation in 2D / 3D following the principles and techniques
CO2:	To use CGI, color and light elements in VFX applications
CO3:	To create special effects using any of the state of the art tools
CO4:	To apply popular visual effects techniques using advanced tools
CO5:	To use compositing tools for creating VFX for a variety of applications

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Blender + DaVinci resolve + Fusion	30
2	Windows 10/11 , GPU Drivers (NVIDIA/AMD), Render farm setup (optional for advanced labs)	

Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	1	-	-	-	1	2	1	3	3	2
CO2	1	3	3	2	1	-	-	-	3	2	2	1	1	1
CO3	2	3	3	2	1	-	-	-	1	2	1	2	2	2
CO4	3	3	2	2	3	-	-	-	3	3	2	2	3	1
CO5	1	2	1	1	2	-	-	-	1	3	2	2	3	1
Avg.	2	2.8	2.4	2	1.6	-	-	-	1.8	2.4	1.6	2	2.4	1.4

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2435	Game Development	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To know the basics of 2D and 3D graphics for game development. • To know the stages of game development. • To understand the basics of a game engine. • To survey the gaming development environment and tool kits. • To learn and develop simple games using Pygame environment.					

Unit-I	3D GRAPHICS FOR GAME DESIGN	(6)
Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.		
Unit-II	GAME DESIGN PRINCIPLES	(6)
Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.		
Unit-III	GAME ENGINE DESIGN	(6)
Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Path finding.		
Unit-IV	OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS	(6)
Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, Unity Single player and multi-Player games.		
Unit-V	GAME DEVELOPMENT USING PYGAME	(6)
Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games– Puzzle Games.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison Wesley,2013.
2	Will McGugan, “Beginning Game Development with Python and Pyjama: From Novice to Professional”, Apress,2007.
3	David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time ComputerGraphics”, Second Edition, CRC Press,2006.

REFERENCES:

1	"Unity Game Development Essentials" by Will Goldstone: A practical guide to game development with Unity.
2	"Unreal Engine 4 Game Development" by William Sherif: A guide to game development with Unreal Engine 4.
3	"Godot Engine Game Development" by Juan Linietsky: A guide to game development with Godot Engine.

List of Exercises / Experiments

- | |
|--|
| 1. Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game. |
| 2. Character design, sprites, movement and character control |
| 3. Level design: design of the world in the form of tiles along with interactive and collectible objects. |
| 4. Design of interaction between the player and the world, optionally using the physics engine. |
| 5. Developing a 2D interactive using Pyjama |
| 6. Developing a Puzzle game |
| 7. Design of menus and user interaction in mobile platforms. |
| 8. Developing a 3D Game using Unreal |
| 9. Developing a Multiplayer game using unity |

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 concepts of 2D and 3d Graphics
CO2:	Design game design documents.
CO3:	Implementation of gaming engines
CO4:	Survey gaming environments and frameworks.
CO5:	Implement a simple game in Pyjama.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Visual Studio: A popular integrated development environment (IDE) for coding.	30
2.	Windows, macOS, or Linux	

Mapping of COs with POs and PSOs

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

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2436	Multimedia Data Compression and Storage	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand the basics of compression techniques - To understand the categories of compression for text, image and video - To explore the modalities of text, image and video compression algorithms - To know about basics of consistency of data availability in storage devices - To understand the concepts of data streaming services					

Unit-I	BASICS OF DATA COMPRESSION	(6)
Introduction —Lossless and Lossy Compression– Basics of Huffman coding- Arithmetic coding - Dictionary techniques- Context based compression – Applications.		
Unit-II	IMAGE COMPRESSION	(6)
Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimile encoding.		
Unit-III	VIDEO COMPRESSION	(6)
Introduction – Motion Compensation – Video Signal Representation–H.261–MPEG-1-MPEG-2-H.263		
Unit-IV	DATA PLACEMENT ON DISKS	(6)
Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system.		
Unit-V	DISK SCHEDULING METHODS	(6)
Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams.		
Total No of Periods to be Taught	30 Periods	

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TEXT BOOK:

1	Khalid Sayoc, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2	Philip K.C. Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008
3	"JPEG: Still Image Compression Standard" by William B. Pennebaker and Joan L. Mitchell: A reference book on the JPEG image compression standard.

REFERENCES:

1	David Salomon, A concise introduction to data compression, 2008.
2	Leland Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.
3	Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis, 2019

List of Exercises / Experiments

1.	Construct Huffman codes for given symbol probabilities.
2.	Encode run lengths with fixed-length code.
3.	Lempel-Ziv algorithm for adaptive variable-length encoding
4.	Compress the given word using arithmetic coding based on the frequency of the letters.
5.	Write a shell script, which converts all images in the current directory in JPEG.
6.	Write a program to split images from a video without using any primitives.
7.	Create a photo album of a trip by applying appropriate image dimensions and format.
8.	Write the code for identifying the popularity of content retrieval from media server.
9.	Write the code for ensuring data availability in disks using strip-based method.
10.	Program for scheduling requests for data streams.
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 basics of text, Image and Video compression
CO2:	Understand the various compression algorithms for multimedia content
CO3:	Explore the applications of various compression techniques
CO4:	Explore knowledge on multimedia storage on disks
CO5:	Understand scheduling methods for request streams


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Open – source + MATLAB	30
2	Windows 10/11/ Linux (ubuntu)	

Mapping of COs with POs and PSOs

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

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2437	Robotic Process Automation	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand the basic concepts of Robotic Process Automation. - To expose to the key RPA design and development strategies and methodologies. - To learn the fundamental RPA logic and structure. - Explain Exception Handling, Debugging and Logging operations in RPA. - To learn to deploy and maintain the software bot.					

Unit-I	INTRODUCTION TO ROBOTIC PROCESS AUTOMATION	(6)
Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation -Benefits of RPA- Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools-Templates, User Interface, Domain in Activities, Workflow Files.		
Unit-II	AUTOMATION PROCESS ACTIVITIES	(6)
Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, Ui Explorer, Handling Events.		
Unit-III	APP INTEGRATION, RECORDING AND SCRAPING	(6)
App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, scraping data from website and writing to CSV. Process Mining.		
Unit-IV	EXCEPTION HANDLING AND CODE MANAGEMENT	(6)
Exception handling, Common exceptions, Logging-Debugging techniques, collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.		
Unit-V	DEPLOYMENT AND MAINTENANCE	(6)
Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open-Source RPA, Future of RPA.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Learning Robotic Process Automation: Create Software robot sand automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packet Publishing, 2018.
2	Tom Taulli, "The Robotic Process Automation Hand book: A Guide to Implementing RPA Systems", A press publications, 2020.
3	Robotic process automation: Management , Technology, Applications – Christian Czarnecki & peter Fettke

REFERENCES:

1	Robotic process automation – Alok Mani Tripathi
2	Robotic process automation with automation anywhere – Husan Mahey
3	Robotic process automation – S. Muhkerjee

List of Exercises / Experiments

1. Create a sequence to obtain user inputs and display them using a message box.	
2. Create a flowchart to navigate to a desired page based on a condition.	
3. Create a state machine workflow to compare user input with a random number.	
4. Build a process in the RPA platform using UI Automation activities.	
5. Create an automation process using key System Activities, Variables, and Arguments.	
6. Implement automation using a System Trigger.	
7. Automate login to a (web) email account.	
8. Record mouse and keyboard actions.	
9. Scrape data from a website and write it to a CSV file.	
10. Implement error handling in the RPA platform.	
11. Perform web scraping.	
12. Process email queries.	
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:	Enunciate the key distinctions between RPA and existing automation techniques and platforms.
CO2:	Use Ui Path to design control flow and workflows for the target process
CO3:	Implement recording, web scraping and process mining by automation
CO4:	Use UI Path Studio to detect, and handle exceptions in automation processes
CO5:	Implement and use Orchestrator for creation, monitoring, scheduling and controlling of automated bots and processes.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Ui path + python + Excel automation	30
2	Windows 10/ 11, .NET framework , Antivirus software	

Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	3	-	-	-	1	3	3	2	2	1
CO2	1	1	2	3	3	-	-	-	1	2	3	3	2	1
CO3	2	3	2	3	3	-	-	-	2	3	1	3	3	3
CO4	1	2	1	2	2	-	-	-	1	2	1	3	3	2
CO5	3	3	3	3	3	-	-	-	3	1	1	3	2	1
Avg.	2	2.2	2	2.4	2.8	-	-	-	1.6	2.2	1.8	2.8	2.4	1.6

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

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Department	CSE	Programme Code & Name	Common to 104 – CSE, 205 – IT, 243 – AI&DS
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2403	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To understand the basics in deep neural networks - To understand the basics of associative memory and unsupervised learning networks - To apply CNN architectures of deep neural networks - To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks. - To apply autoencoders and generative models for suitable applications.					

Unit-I	INTRODUCTION	(6)
Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction Evolution Of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.		
Unit-II	ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS	(6)
Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.		
Unit-III	THIRD-GENERATION NEURAL NETWORKS	(6)
Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression.		
Unit-IV	DEEP FEEDFORWARD NETWORKS	(6)
History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.		
Unit-V	RECURRENT NEURAL NETWORKS	(6)
Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.		
Total No of Periods to be Taught		30Periods

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TEXT BOOK:

1	Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press, 2016
2	Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications,2021.

REFERENCES:

1	AurélienGéron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, Oreilly, 2018.
2	Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media,2017
3	Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 1st Edition, 2018.

List of Exercises/Experiments

1. Implement simple vector addition in Tensor Flow
2. Implement a regression model in Keras.
3. Implement a perceptron in Tensor Flow/Keras Environment.
4. Implement a Feed-Forward Network in Tensor Flow/Keras
5. Implement an Image Classifier using CNN in Tensor Flow/Keras
6. Improve the Deep learning model by fine tuning hyper parameters
7. Implement a Transfer Learning concept in Image Classification.
8. Using a pre-trained model on Keras for Transfer Learning
9. Perform Sentiment Analysis using RNN
10. Implement an LSTM based Autoencoder in Tensor Flow/Keras.
11. Image generation using GAN

Additional Experiments:

12. Train a Deep learning model to classify a given image using pre-trained model
13. Recommendation system from sales data using Deep Learning
14. Implement Object Detection using CNN
15. Implement any simple Reinforcement Algorithm for an NLP problem

Total No of Periods to be Taught	30Periods
Total No of Periods to be Taught (T&L)	60 Periods


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COURSE OUTCOMES:

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

CO1:	Apply Convolution Neural Network for image processing.
CO2:	Understand the basics of associative memory and unsupervised learning networks.
CO3:	Understand the basics of associative memory and unsupervised learning networks.
CO4:	Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
CO5:	Apply autoencoders and generative models for suitable applications.

LIST OF EQUIPMENT 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	Powerful hardware (GPU-based systems), Deep learning frameworks.	30
4	Large datasets and Cloud support	30

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	1	-	-	2	1	-	-	2	2
CO2	3	1	2	1	-	-	-	-	-	1	2	2	-	1
CO3	3	3	3	3	3	1	-	-	2	1	-	-	2	2
CO4	3	3	3	3	3	-	-	-	2	-	2	3	2	2
CO5	1	1	3	2	3	-	-	-	2	-	-	-	1	1
Avg.	2.6	2	2.8	2.2	2.4	0.4	0	0	1.6	0.6	0.8	1	1.4	1.6

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2438	Cyber Security	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To learn cybercrime and cyberlaw. • To understand the cyber-attacks and tools for mitigating them. • To understand information gathering. • To learn how to detect a cyber-attack. • To learn how to prevent a cyber-attack.					

Unit-I	INTRODUCTION	(6)
Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment		
Unit-II	ATTACKS AND COUNTER MEASURES	(6)
OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach– Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack –Wireless Network Attack – Web Application Attack – Attack Tools – Counter measures.		
Unit-III	RECONNAISSANCE	(6)
Harvester – Who is – Net craft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning– Scanning Methodology– Ping Sweeper Techniques– Nmap Command Switches– SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.		
Unit-IV	INTRUSION DETECTION	(6)
Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.		

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Unit-V	INTRUSION PREVENTION	(6)
Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy– Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021 (Unit 1)
2	Nina Godbole, Sunit Bela pure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011 (Unit 1)
3	https://owasp.org/www-project-top-ten

REFERENCES:

1	David Kim, Michael Solomon, “Fundamentals of Information Systems Security”, Jones & Bartlett Learning Publishers, 2013 (Unit 2)
2	Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy”, Elsevier, 2011 (Unit 3)
3	Imberly Graves, “CEH Official Certified Ethical Hacker Review Guide”, Wiley Publishers, 2007 (Unit 3)

List of Exercises / Experiments

1. Install Kali Linux on Virtual box	
2. Explore Kali Linux and bash scripting	
3. Perform open-source intelligence gathering using Net craft, who is Look ups, DNS Reconnaissance, Harvester and Malte	
4. Understand then map command and scanning using map	
5. Install metasploitable2 on the virtual box and search for unpatched vulnerabilities	
6. Use Metasploit to exploit an unpatched vulnerability	
7. Install Linus server on the virtual box and installs	
8. Use Fail2ban to scan log files and ban Ips that show the malicious signs	
9. Launch brute-force attacks on the Linux server using Hydra.	
10. Perform real-time network traffic analysis and data pocket logging using Snort	
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 basics of cyber security, cybercrime and cyber law (K2).
CO2:	Classify various types of attacks and learn the tools to launch the attacks (K2)
CO3:	Apply various tools to perform information gathering(K3)
CO4:	Apply intrusion techniques to detect intrusion(K3)
CO5:	Apply intrusion prevention techniques to prevent intrusion(K3)

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Kali linux , virtual box , basic tools	30
2	Windows 10/11 , ubuntu	

Mapping of COs with POs and PSOs

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

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2439	Quantum Computing	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To know the background of classical computing and quantum computing. • To learn the fundamental concepts behind quantum computation. • To study the details of quantum mechanics and its relation to Computer Science. • To gain knowledge about the basic hardware and mathematical models of quantum computation. • To learn the basics of quantum information and the theory behind it.					

Unit-I	QUANTUM COMPUTING BASIC CONCEPTS	(6)
ComplexNumbers-LinearAlgebra-MatricesandOperators-GlobalPerspectivesPostulatesof Quantum Mechanics – Quantum Bits - Representations of Qubits – Superpositions.		
Unit-II	QUANTUM GATES AND CIRCUITS	(5)
Universal logic gates-Basic single qubit gates-Multiple qubit gates-Circuit development- Quantum error correction.		
Unit-III	QUANTUM ALGORITHMS	(7)
Quantum parallelism- Deutsch’s algorithm-The Deutsch–Jozsa algorithm-Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover’s Algorithm.		
Unit-IV	QUANTUM INFORMATION THEORY	(6)
Data compression - Shannon’s noiseless channel coding theorem - Schumacher’s quantum noiseless channel coding theorem - Classical information over noisy quantum channels.		
Unit-V	QUANTUM CRYPTOGRAPHY	(6)
Classical cryptography basic concepts – Private key cryptography - Shor’s Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Parag K. Lala, Quantum Computing: A Beginner's Introduction, First Edition, McGraw Hill Education, 1 November 2020.
2	Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Tenth Edition, Cambridge University Press, 2010.
3	Chris Bernhardt, Quantum Computing for Everyone, Reprint Edition, The MIT Press, 8 September 2020.

REFERENCES:

1	Quantum computing : A gentle introduction – Eleanor Rieffel & Wolfgang Polak
2	Quantum computer science – N.david Mermin
3	Quantum computing for computer scientists – Noson S. Yanofsky & Michael A. Mannucci

List of Exercises / Experiments

1. Single qubit gate simulation – Quantum Composer	
2. Multiple qubit gate simulation – Quantum Composer	
3. Compose simple quantum circuits with quantum gates and measure the output into classical bits	
4. Introduction to the IBM Qi skit platform	
5. Implementation of Shor’s Algorithm	
6. Implementation of Grover’s Algorithm	
7. Implementation of Deutsch’s Algorithm	
8. Implementation of the Deutsch-Jozsa Algorithm	
9. Integer factorization using Shor’s Algorithm	
10. Quantum Key Distribution (QKD) simulation	
11. Mini project: Implementing an API for efficient search using Grover’s 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 basics of quantum computing.
CO2:	Understand the background of Quantum Mechanics.
CO3:	Analyse the computation models.
CO4:	Model the circuits using quantum computation. Environments and frame works.
CO5:	Understand the quantum operations such as noise and error– correction.


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Python + Qiskit + jupyter	30
2	Windows 10/11 , Linux (ubuntu)	

Mapping of COs with POs and PSOs														
COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	-	-	-	-	2	-	-	2	3	2
CO2	3	2	2	2	-	-	-	-	2	-	-	2	3	1
CO3	3	3	3	3	2	-	-	-	3	-	-	3	2	2
CO4	3	3	3	3	3	-	-	-	3	-	-	1	3	2
CO5	3	3	2	3	-	-	-	-	2	-	-	1	3	3
Avg.	3	2.6	2.4	2.6	1				2.4			1.8	2.8	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy														

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2440	3D Printing and Design	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To discuss on basics of 3D printing • Explaining the principles of 3D printing technique • To explain and illustrate inkjet technology • To explain and illustrate laser technology • To discuss the applications of 3D printing					

Unit-I	INTRODUCTION	(6)
Introduction; Design considerations–Material, Size, Resolution, Process; Modelling and viewing- 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats.		
Unit-II	PRINCIPLE	(6)
Processes – Extrusion, Wire, Granular, Lamination, Photo polymerization; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations.		
Unit-III	INKJET TECHNOLOGY	(6)
Printer-Working Principle, Positioning System, print head, print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication –Continuous jet, Multijet; Powder based fabrication – Colored.		
Unit-IV	LASER TECHNOLOGY	(6)
Light Sources–Types, Characteristics; Optics–Deflection, Modulation; Material feeding and flow–Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures.		
Unit-V	INDUSTRIAL APPLICATIONS	(6)
Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays, Future trends.		
Total No of Periods to be Taught	30 Periods	


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TEXT BOOK:

1	Additive Manufacturing Technologies – Ian Gibson, David W. Rosen & Brent Stucker
2	3D Printing and Additive Manufacturing – Chee Kai Chua & Kah Fai Leong
3	Additive Manufacturing Handbook – Product Development Team (Wiley)

REFERENCES:

1	The 3D Printing Handbook – 3D Hubs (now Hubs)
2	3D Printing for Dummies – Kalani Kirk Hausman & Richard Horne
3	Mastering 3D Printing – Joan Horvath

List of Exercises / Experiments

1. Study the interface and basic tools in the CAD software.
2. Study 3D printers, including:(Print heads, Build envelope, Materials used, Support removal systems)
3. Review geometric terms relevant to a 3D mesh.
4. Learn commands for transitioning from 2D to 3D in CAD software.
5. Explore advanced CAD commands to navigate and manipulate models in 3D space.
6. Design four everyday objects using CAD software.
7. Reference websites such as [Thing verse](#), [Shape ways](#), and [GitLab](#) to design four everyday objects that utilize the advantages of 3D printing.
8. Choose four models from a sharing site (Thing verse, Shape ways, or GitLab).
9. Improve upon a file and make it your own.
10. Some ideas include (Repair a 3D mesh using freeware utilities)

Autodesk Mesh Mixer: <http://goo.gl/x5nhYc>

MeshLab: <http://goo.gl/fgztlL>

Netfabb Basic or Cloud Service: <http://goo.gl/Q1P47a>

Use freeware tool tutorials:

Netfabb Basic or Cloud Service: <http://goo.gl/Q1P47a>

Netfabb and MeshLab: <http://goo.gl/WPOVec>

Explore professional tools: Magics or Netfabb

Equipment: One 3D printer for every 10–15 students)

Redesign the model with a specific user in mind.

Redesign the model for a slightly different purpose.

Improve the appearance and aesthetics of the product.

Use CAM software to prepare files for 3D printing.

Manipulate machine movements and material layering for optimized printing.

Repair 3D mesh using Free ware utilities: Auto desk Mesh Mixer (<http://goo.gl/x5nhYc>), MeshLab


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(<http://goo.gl/fgztLL>) or

Net fib Basic or Cloud Service (<http://goo.gl/Q1P47a>)

Free ware tool tutorials: Netfabb Basic or Cloud Service (<http://goo.gl/Q1P47a>), Net
fabb and MeshLab (<http://goo.gl/WPOVec>)

Professional tools: Magics or Net fob Equipment:one3Dprinter for every10-15students

Total No of Periods to be Taught

30 Periods

COURSE OUTCOMES:

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

CO1:	Outline and examine the basic concepts of 3D printing technology
CO2:	Outline 3D printing workflow
CO3:	Explain and categorise the concepts and working principles of 3D printing using inkjet technique
CO4:	Explain and categorize the working principles of 3D printing using laser technique
CO5:	Explain various method for designing and modelling for industrial applications

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	MeshLab: A free, open-source software for 3D mesh processing	30
2.	Windows, macOS, or Linux, RAM: 8 GB , Graphics Card: Dedicated graphics card (NVIDIA or AMD, Storage: SSD (solid-state drive)	

Mapping of COs with POs and PSOs

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

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

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STREAM III – AI&DS

Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2442	Bio-Inspired Optimization Techniques	L	T	P	C	100
		2	0	2	3	
Course Objectives	• To understand fundamental topics in bio-inspired optimization techniques • To Learn the collective systems such as ACO, PSO, and BCO • To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems • To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies. • To implement the Bio-inspired technique with other traditional algorithms					

Unit-I	INTRODUCTION	(6)
Optimization Techniques: Introduction to Optimization Problems – Single and Multi- objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding -representation – fitness function		
Unit-II	SWARM INTELLIGENCE	(6)
Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization -Ant Colonies: Ant Foraging Behavior – Towards Artificial Ants – Ant Colony Optimization (ACO) -S-ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization		
Unit-III	NATURAL TO ARTIFICIAL SYSTEMS	(6)
Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging –Division of Labor – Task Allocation – Cemetery Organization and Brood Sorting – Nest Building – Cooperative transport.		
Unit-IV	SWARM ROBOTICS	(6)
Foraging for food – Clustering of objects – Collective Prey retrieval – Scope of Swarm Robotics -Social Adaptation of Knowledge: Particle Swarm – Particle Swarm Optimization (PSO) – Particle 164 Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering.		

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Unit-V	CASE STUDIES	(6)
Other Swarm Intelligence algorithms: Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems – Travelling Salesman problem.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

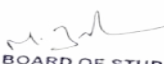
1	A. E. Elben and J. E. Smith, "Introduction to Evolutionary Computing", Springer, 2010.
2	2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
3	Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007.

REFERENCES:

1	Eric Bonabeau, Marco Dorigo, Guy Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", Oxford University press, 2000.
2	Christian Blum, Daniel Merkle (Eds.), "Swarm Intelligence: Introduction and Applications", Springer Verlag, 2008.
3	Leandro N De Castro, Fernando J Von Zuben, "Recent Developments in Biologically Inspired Computing", Idea Group Inc., 2005.

List of Exercises / Experiments

1. Implement ACO (Ant Colony Optimization) algorithm	
2. Bio – Inspired Optimization Techniques for Disease Detection in Deep Learning System	
3. Implement feed forward neural networks algorithm	
4. Implement convolutional neural network algorithms	
5. Implement particle swarm optimization(PSO) algorithm	
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:	Familiarity with the basics of several biologically inspired optimization techniques.
CO2:	Familiarity with the basics of several biologically inspired computing paradigms.
CO3:	Ability to select an appropriate bio-inspired computing method and implement for any application and data set
CO4:	Theoretical understanding of the differences between the major bio-inspired computing
CO5:	Learn other swarm intelligence algorithms and implement the bio – inspired technique with other traditional algorithm

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	MATLAB: A high-level language for numerical computation and optimization.	30
2	Windows, macOS, or Linux	

Mapping of COs with POs and PSOs

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

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2443	Game Theory	L	T	P	C	100
Course Objectives	- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets. - To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in 41odelling applications. - To draw the connections between game theory, computer science, and economics, especially emphasizing computational issues. - To introduce contemporary topics in the intersection of game theory, computer science, and economics. - To apply game theory in searching, auctioning and trading.					

Unit-I	INTRODUCTION	(6)
Introduction-Making rational choices: basics of Games- strategy — preferences — payoffs — Mathematical basics — Game theory — Rational Choice — Basic solution concepts-non-cooperative versus cooperative games — Basic computational issues — finding equilibria and learning in games- Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).		
Unit-II	GAME SWITH PERFECT INFORMATION	(6)
Games with Perfect Information—Strategic games—prisoner's dilemma, matching pennies-Nash equilibria — mixed strategy equilibrium — zero-sum games.		
Unit-III	GAME SWITH IMPERFECT INFORMATION	(6)
Games with Imperfect Information—Bayesian Games—Motivational Examples—General Definitions—Information aspects—Illustrations—Extensive Games with Imperfect—Information —Strategies—Nash Equilibrium—Repeated Games—The Prisoner's Dilemma—Bargaining.		
Unit-IV	NON-COOPERATIVE GAME THEORY	(6)
Non-cooperative Game Theory — Self-interested agents — Games in normal form — Analysing games: from optimality to equilibrium — Computing Solution Concepts of Normal —Form Games- Computing		

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Nash equilibria of two-player, zero-sum games —Computing Nash equilibria of two- player, general-sum games — Identifying dominated strategies		
Unit-V	MECHANISM DESIGN	(6)
Aggregating Preferences—Social Choice—Formal Model—Voting—Existence of social functions — Ranking systems—Protocols for Strategic Agents: Mechanism Design—Mechanism design with unrestricted preferences.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:	
1	"Game Theory" by Roger Myerson: A comprehensive introduction to game theory.
2	"A Course in Game Theory" by Martin Osborne and Ariel Rubinstein: A graduate-level textbook on game theory.
3	"Game Theory 101" by William Spaniel: A beginner-friendly introduction to game theory.

REFERENCES:	
1	The Art of Strategy" by Avinash K. Dixit and Barry J. Nalebuff: A practical guide to applying game theory.
2	"Game Theory for Applied Economists" by Robert Gibbons: A book on applying game theory to economics.
3	"Strategy: An Introduction to Game Theory" by Joel Watson: A textbook on game theory with a focus on strategy.

List of Exercises / Experiments
1. Prisoner's Dilemma
2. Pure Strategy Nash Equilibrium
3. Extensive Form – Graphs and Trees, Game Trees
4. Strategic Form – Elimination of Dominant Strategies
5. Minimax Theorem, Minimax Strategies
6. Perfect Information Games: Trees, Players Assigned to Nodes, Payoffs, Backward Induction, Subgame Perfect Equilibrium
7. Imperfect Information Games – Mixed Strategy Nash Equilibrium – Finding Mixed-Strategy Nash Equilibria for Zero-Sum Games, Mixed versus Behavioural Strategies

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8. Repeated Games
9. Bayesian Nash Equilibrium
Total No of Periods to be Taught
30 Periods

COURSE OUTCOMES:

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

CO1:	Discuss the notion of a strategic game and equilibria and identify the characteristics of the main applications of these concepts.
CO2:	Discuss the use of Nash Equilibrium for solving problems beyond standard game-theoretic models.
CO3:	Identify key strategic aspects and, based on these, be able to connect them to appropriate game-theoretic concepts in real-world situations.
CO4:	Identify some applications that require aspects of Bayesian Games.
CO5:	Implement a typical virtual business scenario using game theory.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.N O	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	MATLAB Game Theory Toolbox: A collection of game theory algorithms	30
2.	Windows, macOS, or Linux	

Mapping of COs with POs and PSOs

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2444	Cognitive Science	L	T	P	C	100
		2	0	2	3	
Course Objectives	- To know the theoretical background of cognition. - To understand the link between cognition and computational intelligence. - To explore probabilistic programming language. - To study the computational inference models of cognition. - To study the computational learning models of cognition.					

Unit-I	PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE	(6)
Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing – Cognitive Neuroscience–Perception–Decision–Learning and Memory–Language Understanding and Processing.		
Unit-II	COMPUTATIONAL INTELLIGENCE	(6)
Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems– Logical Representation and Reasoning–Logical Decision Making–Learning–Language – Vision.		
Unit-III	PROBABILISTIC PROGRAMMING LANGUAGE	(6)
Web PPL Language–Syntax–Using Java script Libraries–Manipulating probability types and distributions– Finding Inference–Exploring random computation–Coroutines: Functions that receive continuations– Enumeration		
Unit-IV	INFERENCE MODEL SOFCOGNITION	(6)
Generative Models–Conditioning–Causalandstatisticaldependence–Conditionaldependence–Data Analysis– Algorithms for Inference.		
Unit-V	LEARNING MODEL SOFCOGNITION	(6)
Learning as Conditional Inference–Learning with a Language of Thought–Hier archival Models– Learning (Deep) Continuous Functions – Mixture Models.		
Total No of Periods to be Taught	30 Periods	

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TEXT BOOK:

1	ChrisRoda, Real Time Visual Effects for the Technical Artist, CRCPress,1stEdition,2022.
2	Steve Wright, Digital Compositing for film and video, Routledge,4thEdition,2017.
3	John Gress, Digital Visual Effects and Compositing, New RidersPress,1stEdition,2014.

REFERENCES:

1	Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison Wesley,2013.
2	Will McGugan, "Beginning Game Development with Python and Pyjama: From Novice to Professional", Apress,2007.
3	Paul Craven, "Python Arcade games", ApressPublishers,2016.

List of Exercises / Experiments

1.	Demonstration of Mathematical Functions using Wept
2.	Implementation of Reasoning Algorithms
3.	Developing an Application System using a Generative Model
4.	Developing an Application using a Conditional Inference Learning Model
5.	Application Development using a Hierarchical Model
6.	Application Development using a Mixture Model
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 underlying theory behind cognition
CO2:	Connect to the elements of cognition computationally
CO3:	Implement mathematical functions through Wept
CO4:	Develop applications using a cognitive inference model
CO5:	Develop applications using a cognitive learning model


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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	Python: A popular language for cognitive science	30
2.	Windows, macOS, or Linux	

Mapping of COs with POs and PSOs

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2445	Ethics and AI	L	T	P	C	100
		2	0	2	3	
Course Objectives	• Study the morality and ethics in AI • Learn about the Ethical initiatives in the field of artificial intelligence • Study about AI standards and Regulations • Study about social and ethical issues of Robot Ethics • Study about AI and Ethics- challenges and opportunities					

Unit-I	INTRODUCTION	(6)
Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust.		
Unit-II	ETHICAL INITIATIVES IN AI	(6)
International ethical initiatives-Ethical harms and concerns- Case study: health care robots, Autonomous Vehicles Warfare and weaponization.		
Unit-III	AIST AND ARDS AND REGULATION	(6)
Model Process for Addressing Ethical Concerns During System Design-Transparency of Autonomous Systems-Data Privacy Process-Algorithmic Bias Considerations-Ontological Standard for Ethically Driven Robotics and Automation Systems		
Unit-IV	ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS	(6)
Robot-Robo ethics-Ethics and Morality-Moral Theories-Ethics in Science and Technology -Ethical Issues in an ICT Society-Harmonization of Principles-Ethics and Professional Responsibility-Robo ethics Taxonomy.		
Unit-V	AI AND ETHICS-CHALLENGES AND OPPORTUNITIES	(6)
Challenges-Opportunities-ethical issues in artificial intelligence-Societal Issues Concerning the Application of Artificial Intelligence in Medicine-decision-making role in industries-National and International Strategies on AI.		
Total No of Periods to be Taught	30 Periods	

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TEXT BOOK:

1	y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield, "The ethics of artificial intelligence: Issues and initiatives", EPRS European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2	Patrick Lin, Keith Abney, Georgie, " Robot Ethics: The Ethical and Social Implications Of Robotics", The MIT Press-January 2014.
3	"Ethics and AI: A Systematic Review of the Ethical Issues" by Luciano Floridi: A comprehensive review of the ethical issues surrounding AI.

REFERENCES:

1	Towards Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2	Mark Steckelberg, " AI Ethics", The MIT Press Essential Knowledge series, April 2020
3	Weblink: https://sci-hub.mkssa.top/10.1007/978-3-540-30301-5_65

List of Exercises / Experiments

1.	Recent Case Study of Ethical Initiatives in Healthcare, Autonomous Vehicles, and Defence
2.	Exploratory Data Analysis on a Two-Variable Linear Regression Model
3.	Experiment with the Regression Model Without Bias and With Bias
4.	Classification of a Dataset from the UCI Repository Using a Perceptron (With and Without Bias)
5.	Case Study on Ontology Where Ethics Is at Stake
6.	Identification of Optimization in AI Affecting Ethics
Total No of Periods to be Taught	
30 Periods	

COURSE OUTCOMES:

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

CO1:	Learn about Morality and Ethics in AI
CO2:	Understand the Various Compression Algorithms for Multimedia Content
CO3:	Explore the Applications of Various Compression Techniques
CO4:	Explore Knowledge on Multimedia Storage on Disks
CO5:	Understand Scheduling Methods for Request Streams

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1.	python: A popular language for AI and ethics	30
2.	Windows, macOS, or Linux	

Mapping of COs with POs and PSOs

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2446	Health Care Analytics	L	T	P	C	100
		2	0	2	3	
Course Objectives	- Understand the fundamentals of different data format including preprocessing and visualization of the data - Learn the various data analytic and management skills using real time clinical database - Understand the principles and fundamentals of applying supervised and unsupervised models on medical data - Understand the basic concepts and techniques of deep learning models on medical image and text data Create machine learning and deep learning models for use cases in health care					

Unit-I	INTRODUCTION TO HEALTHCARE ANALYSIS	(6)
Introduction to Analytics – Data and Information – Decision-Making – Types of Clinical Records – Types of Data – EHR, Clinical Data, Health Care, Big Data Sources, Patient Data, Administrative Data, Genomics Data, Imaging Data, Insurance Data, Diagnostic Data, Clinical Data, Social Media, Survey Data, Family Data, Clinical Ethics - Quality of Care - Health Care Policy; Data format – Structured, Unstructured, Imaging, Other data format; Components of HCA – Business context, Data, Analytics, Quality and performance management, Presentation; Pipeline - Loading the data, Cleaning and preprocessing the data, Aggregating data, Parsing data, Converting types; Pre-processing – Exploring and visualizing the data – Chart, Plot, Histograms; Feature Engineering – Feature Selection, Feature Weighting, Feature Scaling; Training the model parameters – Evaluating model performance - Sensitivity (Sn), Specificity (Sp), Positive predictive value (PPV), Negative predictive value (NPV), False-positive rate (FPR), Accuracy (Acc), Receiver operating characteristic (ROC) curves, Precision-recall curves, Continuously valued target variables		
Unit-II	ANALYTICS ON DATABASE	(6)
Introduction to databases - Data engineering with SQL an example case - SQL (Structured Query Language) – Case details predicting mortality for a cardiology practice - The clinical database - The PATIENT table, The VISIT table, The MEDICATIONS table, The LABS table, The VITALS table, The MORT table, Starting an SQLite session - Data engineering, one table at a time with SQL – Adding columns – Data Manipulation – Binning and Aggregating diagnoses – Counting medications - Binning abnormal lab results - Imputing missing variables - Adding the target variable Technical features of clinical data models using MIMIC3 – Query the real clinical data set – Visualizing the SQLite - Data Quality Assessments.		

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Unit-III	ANALYTICS ON MACHINE LEARNING	(6)
Introduction to machine learning (ML) – Types of ML - List of common ML algorithms - Supervised ML fundamentals - Logistic Regression - Decision Tree Classifier - K-Nearest Neighbor Classifier - Gaussian Naive Bayes Classifier - Support Vector Classifier Unsupervised learning techniques – Clustering - K-mean clustering - Hierarchical clustering - Principal Component Analysis (PCA).		
Unit-IV	HEALTHCARE AND DEEP LEARNING	(6)
Introduction to Deep Learning (DL) – Types of DL – Convolution Neural Network (CNN) – CNN in Image Processing - Segmentation and Classification Recurrent Neural Network (RNN) – Types of RNN – Long Short Term Memory – Gated Recurrent Unit – RNN in Natural Language Processing – Sentiment Analysis – Named Entity Recognition.		
Unit-V	CASE STUDIES	(6)
Clinical Documentation and Electronic Health Records, Clinical Decision Support, Health Information Extraction and Summarization Disease Diagnosis and Detection, Medical Image Segmentation, Image Enhancement and Denoising, Medical Image Synthesis Vital Sign Monitoring, Remote Patient Monitoring, Predictive Analytics, Disease Monitoring and Management.		
Total No of Periods to be Taught		30 Periods

TEXT BOOK:

1	Chandan K.Reddy, Charu C. Aggarwal, "Health Care Data Analysis", First edition, CRC, 2015
2	Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018
3	Healthcare Analytics: From Data to Knowledge to Healthcare Improvement" by Hui Yang and Eva K. Lee: A comprehensive textbook on healthcare analytics.

REFERENCES:

1	Jason Brownlee, "Deep Learning for Natural Language Processing", Machine Learning Mastery, 2017
2	Introduction To Machine Learning By Prof. Sudeshna Sarkar, IIT Kharagpur - https://onlinecourses.nptel.ac.in/noc22_cs97/preview
3	Deep Learning By Prof. Prabir Kumar Biswas, IIT Kharagpur - https://onlinecourses.nptel.ac.in/noc23_cs56/preview

List of Exercises / Experiments

1. Pre-processing steps on medical data Lab
2. Feature Scaling and Feature Selection Lab
3. Pipelining and Explanatory Data Analysis Lab
4. Constructing the real life dataset
5. Query the real dataset using Python for EDA

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6. Applying supervised model on clinical data
7. Applying unsupervised model on clinical data
8. Applying dimensional reduction on medical data
9. Application of CNN on medical imaging
10. Application of sequential model on textual data
Total No of Periods to be Taught
30 Periods

COURSE OUTCOMES:

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

CO1:	Ability to understand various clinical datasets and perform analytics using modern techniques and tools.
CO2:	Apply the data management techniques for healthcare data.
CO3:	Learn the use of machine learning algorithms in healthcare.
CO4:	Gain knowledge of applying deep learning methods to medical information.
CO5:	Design of prediction and classification model and evaluate the performance metrics and measure on real life use cases.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
	Python or R	30
	Windows, macOS, or Linux	

Mapping of COs with POs and PSOs

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

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Department	Computer Science and Engineering	Programme Code & Name	Common to 104 -CSE 205 – IT 243 – AI&DS
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCSPE2447	Optimization Techniques	L	T	P	C	100
		2	0	2	3	
Course Objectives	• Formulate and solve linear programming problems (LPP) • Evaluate Integer Programming Problems, Transportation and Assignment Problems. • Obtain a solution to network problems using CPM and PERT techniques. • Able to optimize the function subject to the constraints. • Identify and solve problems under Markovian queuing models.					

Unit-I	LINEAR MODELS	(6)
Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Two-Phase method.		
Unit-II	INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS	(6)
Integer programming: Branch and bound method- Transportation and Assignment problems - Traveling salesman problem.		
Unit-III	PROJECT SCHEDULING	(6)
Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM		
Unit-IV	CLASSICAL OPTIMIZATION THEORY	(6)
Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method, Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions.		
Unit-V	QUEUING MODELS	(6)
Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline, Single channel models, multiple service channels.		
Total No of Periods to be Taught		30 Periods

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TEXT BOOK:

1	Hamdy A Taha, Operations Research: An Introduction, Pearson, 10 th Edition, 2017.
2	Linear Programming and Network Flows" by Mokhtar S. Bazaraa and John J. Jarvis: A comprehensive textbook on linear programming.
3	"Linear Programming: Foundations and Extensions" by Robert J. Vanderbei: A graduate-level textbook on linear programming.

REFERENCES:

1	ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4 th Edition, 2011.
2	J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5 th Edition, 2012.
3	Hiller F.S, Liberman G.J, Introduction to Operations Research, 10 th Edition McGraw Hill, 2017.

List of Exercises / Experiments

1. Solving simplex maximization problems using R programming.	
2. Solving simplex minimization problems using R programming.	
3. Solving mixed constraints problems – Big M & Two phase method using TORA.	
4. Solving transportation problems using R.	
5. Solving assignment problems using R.	
6. Solving optimization problems using LINGO.	
7. Studying Primal-Dual relationships in LP using TORA.	
8. Solving LP problems using dual simplex method using TORA.	
9. Sensitivity & post optimality analysis using LINGO.	
10. Solving shortest route problems using optimization software	
11. Solving Project Management problems using optimization software	
12. Testing random numbers and random variates for their uniformity.	
13. Testing random numbers and random variates for their independence	
14. Solve single server queuing model using simulation software package.	
15. Solve multi server queuing model using simulation software package	
Total No of Periods to be Taught	30 Periods

COURSE OUTCOMES:

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

CO1:	Formulate and solve linear programming problems (LPP)
CO2:	Evaluate Integer Programming Problems, Transportation and Assignment Problems.


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CO3:	Obtain a solution to network problems using CPM and PERT techniques.
CO4:	Able to optimize the function subject to the constraints.
CO5:	Identify and solve problems under Markovian queuing models

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S. NO	DESCRIPTION OF EQUIPMENT	REQUIRED NUMBERS
1	Python, MATLAB, R	30
2	Windows, macOS, or Linux	

Mapping of COs with POs and PSOs														
COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1	1	-	-	-	2	1	1	3	3	3
CO2	3	1	2	2	3	-	-	-	3	2	3	2	1	1
CO3	2	3	3	2	2	-	-	-	3	3	1	1	3	1
CO4	2	2	1	1	3	-	-	-	2	1	3	2	1	2
CO5	2	1	1	3	2	-	-	-	3	3	1	3	2	1
Avg.	2.4	2	1.8	1.8	2.2	-	-	-	2.6	2	1.8	2.2	2	1.6
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														

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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2401	FINANCIAL MANAGEMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To acquire the knowledge of the decision areas in finance. • To learn the various sources of Finance • To describe about capital budgeting and cost of capital. • To discuss on how to construct a robust capital structure and dividend policy • To develop an understanding of tools on Working Capital Management.					

Unit-I	INTRODUCTION TO FINANCIAL MANGEMENT	(9)
Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts.		
Unit-II	SOURCES OF FINANCE	(9)
Long term sources of Finance -Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc.		
Unit-III	INVESTMENT DECISIONS	(9)
Investment Decisions: capital budgeting – Need and Importance – Techniques of Capital Budgeting - Payback -ARR – NPV – IRR –Profitability Index.Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.		
Unit-IV	FINANCING AND DIVIDEND DECISION	(9)
Operating Leverage and Financial Leverage- EBIT-EPS analysis. Capital Structure – determinants of Capital structure- Designing an Optimum capital structure . Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - - Determinants of Dividend Policy.		
Unit-V	WORKING CAPITAL DECISION	(9)
Working Capital Management: Working Capital Management - concepts - importance -Determinants of Working capital. Cash Management: Motives for holding cash – Objectives and Strategies of Cash Management. Receivables Management: Objectives - Credit policies.		
Total No of Periods to be Taught		45 periods

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TEXT BOOK:

1	M.Y. Khan and P.K.Jain Financial management, Text, Tata McGraw Hill.
2	M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd.

REFERENCES:

1	James C. Vanhorne –Fundamentals of Financial Management– PHI Learning,
2	Prasanna Chandra, Financial Management.
3	Srivatsava, Mishra, Financial Management, Oxford University Press, 2011.

COURSE OUTCOMES:

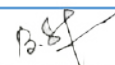
On completion of the course, the students will be able to

CO1:	Understand the fundamental concepts and objectives of financial management.
CO2:	Analyze various sources of finance and their suitability for business needs.
CO3:	Apply capital budgeting techniques and calculate cost of capital for investment decisions.
CO4:	Evaluate financing and dividend decisions to design an optimal capital structure.
CO5:	Manage working capital and related components effectively.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	1	-	-	-	3	2	-
CO2	3	3	2	2	2	-	-	1	-	-	-	3	3	-
CO3	3	3	3	3	3	-	-	1	-	-	-	3	3	-
CO4	3	3	3	2	2	-	-	2	2	-	-	3	3	-
CO5	3	3	3	2	3	-	-	2	-	-	-	3	3	-
Avg.	3	3	2.6	2.3	2	-	-	2.2	1	-	-	3	3	-

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


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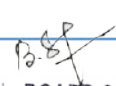


Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2402	FUNDAMENTALS OF INVESTMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Describe the investment environment in which investment decisions are taken. - Explain how to Value bonds and equities - Explain the various approaches to value securities - Describe how to create efficient portfolios through diversification - Discuss the mechanism of investor protection in India.					

Unit-I	THE INVESTMENT ENVIRONMENT	(9)
The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.		
Unit-II	FIXED INCOME SECURITIES	(9)
Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.		
Unit-III	APPROACHES TO EQUITY ANALYSIS	(9)
Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.		
Unit-IV	PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES	(9)
Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India.		
Unit-V	INVESTOR PROTECTION	(9)
Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness and activism.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Charles P. Jones, Gerald R. Jensen. Investments: analysis and management. Wiley, 14TH Edition, 2019.
2	Chandra, Prasanna. Investment analysis and portfolio management. McGraw-hill education, 5th, Edition, 2017.
3	Rustagi, R. P. Investment Management Theory and Practice. Sultan Chand & Sons, 2021.
4	ZviBodie, Alex Kane, Alan J Marcus, PitabusMohanty, Investments, McGraw Hill Education (India), 11 Edition (SIE), 2019.

COURSE OUTCOMES:

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

CO1:	Understand the investment environment, types of investment avenues, and the functioning of the Indian securities market.
CO2:	Analyze fixed income securities by evaluating bond features, pricing, yields, and various types of bond-related risks.
CO3:	Apply fundamental and technical analysis, and evaluate equity securities using valuation models like dividend and P/E models.
CO4:	Assess portfolio risk and return, understand mutual funds, and gain foundational knowledge of financial derivatives.
CO5:	Understand the role of regulatory bodies like SEBI in investor protection and analyze the mechanisms for grievance redressal.

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

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


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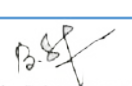


Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2403	BANKING, FINANCIAL SERVICES AND INSURANCE	L	T	P	C	100
		3	0	0	3	
Course Objectives	- Understand the Banking system in India. - Grasp how banks raise their sources and how they deploy it - Understand the development in banking technology - Understand the financial services in India - Understand the insurance Industry in India					

Unit-I	INTRODUCTION TO INDIAN BANKING SYSTEM	(9)
Overview of Banking system – Structure – Functions –Banking system in India - Key Regulations in Indian Banking sector –RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.		
Unit-II	MANAGING BANK FUNDS/ PRODUCTS	(9)
Liquid Assets - Investment in securities - Advances - Loans. Negotiable Instruments – Cheques, Bills of Exchange & Promissory Notes. Designing deposit schemes– Asset and Liability Management – NPA's – Current issues on NPA's – M&A's of banks into securities market.		
Unit-III	DEVELOPMENT IN BANKING TECHNOLOGY	(9)
Payment system in India – paper based – e payment –electronic banking –plastic money – e-money – forecasting of cash demand at ATM's –The Information Technology Act, 2000 in India – RBI's Financial Sector Technology vision document – security threats in e-banking & RBI's Initiative.		
Unit-IV	FINANCIAL SERVICES	(9)
Introduction – Need for Financial Services – Financial Services Market in India – NBFC — Leasing and Hire Purchase — mutual funds. Venture Capital Financing –Bill discounting –factoring – Merchant Banking.		
Unit-V	INSURANCE	(9)
Insurance –Concept - Need - History of Insurance industry in India. Insurance Act, 1938 –IRDA – Regulations – Life Insurance - Annuities and Unit Linked Policies - Lapse of the Policy – revival – settlement of claim.		
Total No of Periods to be Taught		45 periods


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TEXT BOOK:

1	Padmalatha Suresh and Justin Paul, “Management of Banking and Financial Services, Pearson, Delhi, 2017.
2	Meera Sharma, “Management of Financial Institutions – with emphasis on Bank and Risk Management”, PHI Learning Pvt. Ltd., New Delhi 2010.
3	Peter S. Rose and Sylvia C. and Hudgins, “Bank Management and Financial Services”, Tata McGraw Hill, New Delhi, 2017 .

COURSE OUTCOMES:

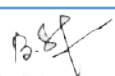
On completion of the course, the students will be able to

CO1:	Understand the structure, functions, and key regulations of the Indian banking system, including types of banking and accounts.
CO2:	Analyze bank fund management, various financial products, negotiable instruments, and current issues like NPAs and bank M&As.
CO3:	Examine advancements in banking technology, electronic payment systems, and cybersecurity in the context of RBI regulations.
CO4:	Evaluate various financial services in India such as NBFCs, leasing, mutual funds, venture capital, and merchant banking.
CO5:	Understand the concept and evolution of insurance in India, including regulatory frameworks and policy lifecycle management.

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

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


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2404	INTRODUCTION TO BLOCK CHAIN AND ITS APPLICATIONS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To introduce the fundamental concepts of block chain technology. • To provide a comprehensive understanding of cryptocurrencies • To explain the Ethereum ecosystem. • To familiarize students with Web3 technologies and enterprise block chain protocols. • To explore emerging trends, platforms, and tools in block chain.					

Unit-I	INTRODUCTION TO BLOCKCHAIN	(9)
Block chain: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in blockchain. Decentralization: Decentralization using blockchain - Methods of decentralization - Routes to decentralization- Blockchain and full ecosystem decentralization - Smart contracts - Decentralized Organizations- Platforms for decentralization.		
Unit-II	INTRODUCTION TO CRYPTOCURRENCY	(9)
Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin limitations – Name coin – Prime coin – Zcash – Smart Contracts – Ricardian Contracts- Deploying smart contracts on a blockchain.		
Unit-III	ETHEREUM	(9)
Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptocurrency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network.		
Unit-IV	WEB3 AND HYPERLEDGE	(9)
Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.		
Unit-V	EMERGING TRENDS	(9)
Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools.		
Total No of Periods to be Taught		45 periods


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TEXT BOOK:

1	Imran. Bashir. Mastering block chain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained. Packt Publishing, 2nd Edition, 2018.
2	Peter Borovykh ,Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018.
3	ArshdeepBahga, Vijay Madiseti, “Blockchain Applications: A Hands On Approach”, VPT, 2017.

COURSE OUTCOMES:

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

CO1:	Understand the foundational principles, architecture, and decentralization features of blockchain systems.
CO2:	Analyze cryptocurrencies such as Bitcoin and altcoins, their operations, smart contracts, and deployment mechanisms.
CO3:	Apply knowledge of Ethereum architecture, token systems, and virtual machines in blockchain development.
CO4:	Evaluate Web3 and enterprise blockchain solutions like Hyperledger and Corda for decentralized application development.
CO5:	Explore emerging platforms, challenges, and trends in blockchain technology, including scalability, privacy, and tools.

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

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


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2405	FINTECH PERSONAL FINANCE AND PAYMENTS	L	T	P	C	100
		3	0	0	3	
Course Objectives	•To introduce the concept and applications of cryptocurrencies and digital payment systems. •To explore the evolution of digital finance and alternative finance models. •To examine the emergence of InsurTech. •To understand Peer-to-Peer (P2P) lending and crowdfunding ecosystems. •To analyze the regulatory framework and challenges in FinTech and RegTech.					

Unit-I	CURRENCY EXCHANGE AND PAYMENT	(9)
Understand the concept of Crypto currency- Bitcoin and Applications -Cryptocurrencies and Digital Crypto Wallets -Types of Cryptocurrencies - Cryptocurrencies and Applications, block chain, Artificial Intelligence, machine learning. Fintech users, Individual Payments, RTGS Systems, Immediate Page 54 of 90 Payment Service (IMPS), Unified Payments Interface (UPI).Legal and Regulatory Implications of Crypto currencies, Payment systems and their regulations. Digital Payments Smart Cards, Stored-Value Cards, EC Micropayments, Payment Gateways, Mobile Payments, Digital and Virtual Currencies, Security, Ethical, Legal, Privacy, and Technology Issues.		
Unit-II	DIGITAL FINANCE AND ALTERNATIVE FINANCE	(9)
A Brief History of Financial Innovation, Digitization of Financial Services, Crowd funding, Charity and Equity,. Introduction to the concept of Initial Coin Offering.		
Unit-III	INSURETECH	(9)
InsurTech Introduction , Business model disruption AI/ML in Insur Tech ● IoT and InsurTech ,Risk Modeling ,Fraud Detection Processing claims and Underwriting Innovations in Insurance Services.		
Unit-IV	PEER TO PEER LENDING	(9)
P2P and Marketplace Lending, New Models and New Products in market place lending P2P Infrastructure and technologies , Concept of CrowdfundingCrowdfunding Architecture and Technology ,P2P and Crowdfunding unicorns and business models , SME/MSME Lending: Unique opportunities and Challenges, Solutions and Innovations.		
Unit-V	REGULATORY ISSUES	(9)
FinTech Regulations: Global Regulations and Domestic Regulations, Evolution of RegTech, RegTech Ecosystem: Financial Institutions, RegTech Ecosystem: StartupsRegTech, Startups: Challenges, RegTech Ecosystem: Regulators, Use of AI in regulation and Fraud detection.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Swanson Seth, Fintech for Beginners: Understanding and Utilizing the power of technology, Createspace Independent Publishing Platform, 2016.
2	Models AuTanda, FintechBigtech And Banks Digitalization and Its Impact On Banking Business, Springer, 2019.
3	Henning Diedrich, Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations, Wildfire Publishing, 2016.
4	Jacob William, FinTech: The Beginner's Guide to Financial Technology, Createspace Independent Publishing Platform, 2016.
5	IIBF, Digital Banking, Taxmann Publication, 2016.

COURSE OUTCOMES:

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

CO1:	Understand the fundamentals of cryptocurrencies, digital wallets, payment systems (e.g., UPI, RTGS), and associated legal and ethical issues.
CO2:	Analyze digital finance innovations and alternative financial models, including crowdfunding, ICOs, and equity-based platforms.
CO3:	Examine the role of InsurTech and how AI, ML, and IoT are transforming risk modeling, fraud detection, and insurance operations.
CO4:	Understand peer-to-peer lending and crowdfunding technologies, and evaluate their applications for SMEs and MSMEs.
CO5:	Analyze FinTech and RegTech regulatory environments globally and domestically, including AI-driven compliance and fraud detection.

Mapping of COs with POs and PSOs

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

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

10-8/1
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Mecheri, Salem Dt-636453, Tamilnadu



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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2406	INTRODUCTION TO FINTECH	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To learn about history, importance and evolution of Fintech. • To acquire the knowledge of Fintech in payment industry. • To acquire the knowledge of Fintech in insurance industry. • To learn the Fintech developments around the world. • To know about the future of Fintech.					

Unit-I	INTRODUCTION	(9)
Fintech - Definition, History, concept, meaning, architecture, significance, Goals, key areas in Fintech, Importance of Fintech, role of Fintech in economic development, opportunities and challenges in Fintech, Evolution of Fintech in different sectors of the industry - Infrastructure, Banking Industry, Startups and Emerging Markets, recent developments in FinTech, future prospects and potential issues with Fintech.		
Unit-II	PAYMENT INDUSTRY	(9)
FinTech in Payment Industry-Multichannel digital wallets, applications supporting wallets, on boarding and KYC application, FinTech in Lending Industry- Formal lending, Informal lending, P2P lending, POS lending, Online lending, Payday lending, Microfinance, Crowdfunding.		
Unit-III	INSURANCE INDUSTRY	(9)
FinTech in Wealth Management Industry-Financial Advice, Automated investing, Socially responsible investing, Fractional Investing, Social Investing. FinTech in Insurance Industry- P2P insurance, On-Demand Insurance, On-Demand Consultation, Customer engagement through Quote to sell, policy servicing, Claims Management, Investment linked health insurance.		
Unit-IV	PEER TO PEER LENDING	(9)
FinTech developments - US, Europe and UK, Germany, Sweden, France, China, India, Africa, Australia, New Zealand, Brazil and Middle East, Regulatory and Policy Assessment for Growth of FinTech. FinTech as disruptors, Financial institutions collaborating with FinTech companies, The new financial world.		
Unit-V	FUTURE OF FINTECH	(9)
How emerging technologies will change financial services, the future of financial services, banking on innovation through data, why FinTech banks will rule the world, The FinTech Supermarket, Banks partnering with FinTech start-ups, The rise of BankTech, Fintech impact on Retail Banking, A future without money, Ethics in Fintech.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Arner D., Barbers J., Buckley R, The evolution of FinTech: a new post crisis paradigm, University of New South Wales Research Series, 2015
2	Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications, 2016.
3	Richard Hayen, FinTech: The Impact and Influence of Financial Technology on Banking and the Finance Industry, 2016.
4	Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018.
5	Sanjay Phadke, FintechFuture : The Digital DNA of Finance Paperback .Sage Publications, 2020.

COURSE OUTCOMES:

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

CO1:	Understand the evolution, scope, architecture, and economic significance of FinTech across various industries.
CO2:	Analyze FinTech applications in payments and lending, including wallet systems, KYC, P2P lending, and crowdfunding.
CO3:	Evaluate FinTech innovations in insurance and wealth management, including digital advice, P2P insurance, and claim automation.
CO4:	Compare global FinTech developments, regulatory policies, and collaborations between traditional institutions and FinTech firms.
CO5:	Explore the future of FinTech with emerging technologies, ethics, partnerships, and innovations in banking and finance.

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

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


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2407	FOUNDATIONS OF ENTREPRENEURSHIP	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To develop and strengthen the entrepreneurial quality and motivation of learners. • To impart the entrepreneurial skills and traits essential to become successful entrepreneurs. • To apply the principles and theories of entrepreneurship and management in Technology oriented businessess. • To empower the learners to run a Technology driven business efficiently and effectivelyTo know about the future of Fintech.					

Unit-I	INTRODUCTION TO ENTREPRENEURSHIP	(9)
Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development.		
Unit-II	BUSINESS OWNERSHIP & ENVIRONMENT	(9)
Types of Business Ownership – BuinessEnvrionemental Factors – Political-Economic-Sociological-Technological-Environmental-Legal aspects – Human Reosurces Mobilisation-Basics of Managing Finance- Eentials of Marketing Management - Production and Operations Planning – Systems Management and Administration.		
Unit-III	FUNDAMENTALS OF TECHNOPRENEURSHIP.	(9)
Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characterisitcis of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportuinites in Technopreneurship - Recent trends.		
Unit-IV	APPLICATIONS OF TECHNOPRENEURSHIP	(9)
Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship -- Success Stories of Technopreneurs - Case Studies.		
Unit-V	EMERGING TRENDS IN ENTREPRENERUSHIP	(9)
Effective Business Management Strategies For Franchising - Sub-Contracting- Leasing- Technopreneurs – Agripreneurs - Netpreneurs- Portfolio entrepreneuruship - NGO Entrepreneurship – Recent EntrperneruialDeveloments - Local – National – Global perspectives.		
Total No of Periods to be Taught		45 periods


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TEXT BOOK:

1	S.S.Khanka, "Entrepreneurial Development" S.Chand& Co. Ltd. Ram Nagar New Delhi, 2021.
2	Donal F Kuratko Entrepreneurship (11th Edition) Theory, Process, Practice by Published 2019 by Cengage Learning.

REFERENCES:

1	Daniel Mankani. 2003. Technopreneurship: The successful Entrepreneur in the new Economy. Prentice Hall.
2	Edward Elgar. 2007. Entrepreneurship, Cooperation and the Firm: The Emergence and Survival of High-Technology Ventures in Europe. Edi: Jan Ulijn, Dominique Drillon, and Frank Lasch. Wiley Pub.
3	Lang, J. 2002, The High Tech Entrepreneur's Handbook, Ft.com.

COURSE OUTCOMES:

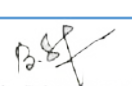
On completion of the course, the students will be able to

CO1:	Learn the basics of Entrepreneurship.
CO2:	Understand the business ownership patterns and environment.
CO3:	Understand the Job opportunitites in Industries relating to Technopreneurship.
CO4:	Learn about applications of tehnpreneurship and successful technopreneurs.
CO5:	Acquaint with the recent and emerging trends in entrepreneurship.

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

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


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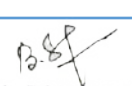


Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2408	TEAM BUILDING & LEADERSHIP MANAGEMENT FOR BUSINESS	L	T	P	C	100
		3	0	0	3	
Course Objectives	•To develop and strengthen the Leadership qualities and motivation of learners. •To impart the Leadership skills and traits essential to become successful entrepreneurs. • To apply the principles and theories of Team Building in managing Technology oriented businessess. •To empower the learners.					

Unit-I	INTRODUCTION TO MANAGING TEAMS	(9)
Introduction to Team - Team Dynamics - Team Formation – Stages of Team Development - Enhancing teamwork within a group - Team Coaching - Team Decision Making - Virtual Teams - Self Directed Work Teams (SDWTs) -Multicultural Teams.		
Unit-II	MANAGING AND DEVELOPING EFFECTIVE TEAMS	(9)
Team-based Organisations- Leadership roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.		
Unit-III	INTRODUCTION TO LEADERSHIP.	(9)
Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation - Leadership Attributes - Personality Traits and Leadership- Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment .		
Unit-IV	LEADERSHIP IN ORGANISATIONS	(9)
Leadership Styles – LMX Theory- Leadership Theory and Normative Decision Model - Situational Leadership Model - Contingency Model and Path Goal Theory – Transactional and Transformational Leadership - Charismatic Leadership - Role of Ethics and Values in Organisational Leadership.		
Unit-V	LEADERSHIP EFFECTIVENESS	(9)
Leadership Behaviour - Assessment of Leadership Behaviors - Destructive Leadership - Motivation and Leadership - Managerial Incompetence and Derailment Conflict Management - Negotiation and Leadership - Culture and Leadership - Global Leadership – Recent Trends in Leadership.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Hughes, R.L., Ginnett, R.C., &Curphy, G.J., Leadership: Enhancing the lessons of experience ,9th Ed, McGraw Hill Education, Chennai, India. (2019).
2	Katzenback, J.R., Smith, D.K., The Wisdom of Teams: Creating the High Performance Organisations, Harvard Business Review Press, (2015).
3	Halдар, U.K., Leadership and Team Building, Oxford University Press, (2010).
4	Daft, R.L., The Leadership Experience, Cengage, (2015).
5	Daniel Levi, Group Dynamics for Teams ,4th Ed, (2014), Sage Publications.
6	Dyer, W. G., Dyer, W. G., Jr., & Dyer, J. H..Team building: Proven strategies for improving team performance, 5thed, Jossey-Bass, (2013).

COURSE OUTCOMES:

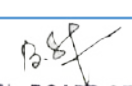
On completion of the course, the students will be able to

CO1:	Learn the basics of managing teams for business.
CO2:	Understand developing effective teams for business management.
CO3:	Understand the fundamentals of leadership for running a business.
CO4:	Learn about the importance of leadership for business development.
CO5:	Acquaint with emerging trends in leadership effectiveness for entrepreneurus.”

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

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


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2409	CREATIVITY & INNOVATION IN ENTREPRENEURSHIP	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To develop the creativity skills among the learners - To impart the knowledge of creative intelligence essential for entrepreneurs - To know the applications of innovation in entrepreneurship. - To develop innovative business models for business.					

Unit-I	CREATIVITY	(9)
Creativity: Definition- Forms of Creativity-Essence, Elaborative and Expressive Creativities- Quality of Creativity-Existential, Entrepreneurial and Empowerment Creativities – Creative Environment- Creative Technology- - Creative Personality and Motivation.		
Unit-II	CREATIVE INTELLIGENCE	(9)
Creative Intelligence: Convergent thinking ability – Traits Congenial to creativity – Creativity Training-- Criteria for evaluating Creativity-Credible Evaluation- Improving the quality of our creativity – Creative Tools and Techniques - Blocks to creativity- fears and Disabilities- Strategies for Unblocking- Designing Creativity Enabling Environment.		
Unit-III	INNOVATION.	(9)
Innovation: Definition- Levels of Innovation- Incremental Vs Radical Innovation-Product Innovation and Process- Technological, Organizational Innovation – Indicators- Characteristics of Innovation in Different Sectors. Theories in Innovation and Creativity- Design Thinking and Innovation- Innovation as Collective Change-Innovation as a system.		
Unit-IV	INNOVATION AND ENTREPRENEURSHIP	(9)
Innovation and Entrepreneurship: Entrepreneurial Mindset , Motivations and Behaviours- Opportunity Analysis and Decision Making- Industry Understanding - Entrepreneurial Opportunities- Entrepreneurial Strategies – Technology Pull/Market Push – Product -Market fit.		
Unit-V	INNOVATIVE BUSINESS MODELS	(9)
Innovative Business Models: Customer Discovery-Customer Segments-Prospect Theory and Developing Value Propositions- Developing Business Models: Elements of Business Models – Innovative Business Models: Elements, Designing Innovative Business Models- Responsible Innovation and Creativity.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Creativity and Innovation in Entrepreneurship, Kankha, Sultan Chand.
2	Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata McGraw Hill, 2004.
3	Paul Trott, Innovation Management and New Product Development, 4e, Pearson, 2018.
4	Vinnie Jauhari, Sudanshu Bhushan, Innovation Management, Oxford Higher Education, 2014.
5	Innovation Management, C.S.G. Krishnamacharyulu, R. Lalitha, Himalaya Publishing House, 2010.
6	A. Dale Timpe, Creativity, Jaico Publishing House, 2003.

COURSE OUTCOMES:

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

CO1:	Learn the basics of creativity for developing Entrepreneurship.
CO2:	Understand the importance of creative intelligence for business growth.
CO3:	Understand the advances through Innovation in Industries.
CO4:	Learn about the importance of leadership for business development.
CO5:	Acquaint with developing innovative business models to run the business efficiently and effectively.

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

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


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2410	PRINCIPLES OF MARKETING MANAGEMENT FOR BUSINESS	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To provide basic knowledge of concepts, principles, tools and techniques of marketing for entrepreneurs • To provide an exposure to the students pertaining to the nature and Scope of marketing, which they are expected to possess when they enter the industry as practitioners. • To give them an understanding of fundamental premise underlying market driven strategies and the basic philosophies and tools of marketing management for business owners.					

Unit-I	INTRODUCTION TO MARKETING MANAGEMENT	(9)
Introduction - Market and Marketing – Concepts- Functions of Marketing - Importance of Marketing - Marketing Orientations - Marketing Mix-The Traditional 4Ps - The Modern Components of the Mix - The Additional 3Ps - Developing an Effective Marketing Mix.		
Unit-II	MARKETING ENVIRONMENT	(9)
Introduction - Environmental Scanning - Analysing the Organisation's Micro Environment and Macro Environment - Differences between Micro and Macro Environment – Techniques of Environment Scanning - Marketing organization - Marketing Research and the Marketing Information System, Types and Components.		
Unit-III	PRODUCT AND PRICING MANAGEMENT	(9)
Product- Meaning, Classification, Levels of Products – Product Life Cycle (PLC) - Product Strategies - Product Mix - Packaging and Labelling - New Product Development - Brand and Branding - Advantages and disadvantages of branding Pricing - Factors Affecting Price Decisions - Cost Based Pricing - Value Based and Competition Based Pricing - Pricing Strategies - National and Global Pricing.		
Unit-IV	PROMOTION AND DISTRIBUTION MANAGEMENT	(9)
Introduction to Promotion – Marketing Channels- Integrated Marketing Communications (IMC) - Introduction to Advertising and Sales Promotion – Basics of Public Relations and Publicity - Personal Selling - Process - Direct Marketing - Segmentation, Targeting and Positioning (STP)-Logistics Management- Introduction to Retailing and Wholesaling.		
Unit-V	CONTEMPORARY ISSUES IN MARKETING MANAGEMENT	(9)


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Introduction - Relationship Marketing Vs. Relationship Management - Customer Relationship Management (CRM) - Forms of Relationship Management - CRM practices - Managing Customer Loyalty and Development – Buyer-Seller Relationships- Buying Situations in Industrial / Business Market - Buying Roles in Industrial Marketing - Factors that Influence Business - Services Marketing - E-Marketing or Online Marketing.

Total No of Periods to be Taught

45 periods

REFERENCES:

1	Marketing Management, Sherlekar S.A, Himalaya Publishing House, 2016.
2	Marketing Management , Philip Kortler and Kevin Lane Keller, PHI 15th Ed, 2015.
3	Paul Trott, Innovation Management and New Product Development, 4e, Pearson, 2018.
4	Marketing Management- An Indian perspective, Vijay PrakashAnand, Biztantra, Second edition, 2016.
5	Marketing Management, S.H.H. Kazmi, 2013, Excel Books India.
6	Marketing Management- text and Cases, Dr.C.B.Gupta&Dr.N.Rajan Nair, 17th edition, 2016.

COURSE OUTCOMES:

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

CO1:	Have the awareness of marketing management process.
CO2:	Understand the marketing environment.
CO3:	Acquaint about product and pricing strategies.
CO4:	Knowledge of promotion and distribution in marketing management.
CO5:	Comprehend the contemporary marketing scenairos and offer solutions to marketing issues.

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

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

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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2411	HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To introduce the basic concepts, structure and functions of human resource management for entrepreneurs. - To create an awareness of the roles, functions and functioning of human resource department. - To understand the methods and techniques followed by Human Resource Management practitioners.					

Unit-I	INTRODUCTION TO HRM	(9)
Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles- Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting - HR Audit - Challenges in HRM.		
Unit-II	HUMAN RESOURCE PLANNING	(9)
HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends.		
Unit-III	RECRUITMENT AND SELECTION	(9)
Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.		
Unit-IV	TRAINING AND EMPLOYEE DEVELOPMENT	(9)
Types of Training - On-The-Job, Off-The-Job - Training Needs Analysis – Induction and Socialisation Process - Employee Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices.		
Unit-V	CONTROLLING HUMAN RESOURCES	(9)
Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Gary Dessler and BijuVarkkey, Human Resource Management, 14e , Pearson, 2015.
2	Mathis and Jackson, Human Resource Management, Cengage Learning 15e, 2017.
3	David A. Decenzo, Stephen.P.Robbins, and Susan L. Verhulst, Human Resource Management, Wiley, International Student Edition, 11th Edition, 2014.
4	R. Wayne Mondy, Human Resource Management, Pearson , 2015.
5	Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012.
6	John M. Ivancevich, Human Resource Management, 12e, McGraw Hill Irwin, 2013.

COURSE OUTCOMES:

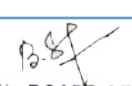
On completion of the course, the students will be able to

CO1:	To understand the Evolution of HRM and Challenges faced by HR Managers.
CO2:	To learn about the HR Planning Methods and practices.
CO3:	To acquaint about the Recruitment and Selection Techniques followed in Industries.
CO4:	To known about the methods of Training and Employee Development.
CO5:	To comprehend the techniques of controlling human resources in organisations.

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

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


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Mecheri, Salem Dt-636453, Tamilnadu



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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2412	FINANCING NEW BUSINESS VENTURES	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To develop the basics of business venture financing. • To impart the knowledge essential for entrepreneurs for financing new ventures. • To acquaint the learners with the sources of debt and equity financing. • To empower the learners towards fund raising for new ventures effectively.					

Unit-I	ESSENTIALS OF NEW BUSINESS VENTURE	(9)
Setting up new Business Ventures – Need - Scope - Franchising - Location Strategy, Registration Process - State Directorate of Industries- Financing for New Ventures - Central and State Government Agencies - Types of loans – Financial Institutions - SFC, IDBI, NSIC and SIDCO.		
Unit-II	INTRODUCTION TO VENTURE FINANCING	(9)
Venture Finance – Definition – Historic Background - Funding New Ventures- Need – Scope – Types - Cost of Project - Means of Financing - Estimation of Working Capital - Requirement of funds – Mix of Debt and Equity - Challenges and Opportunities.		
Unit-III	SOURCES OF DEBT FINANCING	(9)
Fund for Capital Assets - Term Loans - Leasing and Hire-Purchase - Money Market instruments – Bonds, Corporate Papers – Preference Capital- Working Capital Management- Fund based Credit Facilities - Cash Credit - Over Draft.		
Unit-IV	SOURCES OF EQUITY FINANCING	(9)
Own Capital, Unsecured Loan - Government Subsidies , Margin Money- Equity Funding - Private Equity Fund- Schemes of Commercial banks - Angel Funding – Crowdfunding- Venture Capital.		
Unit-V	METHODS OF FUND RAISING FOR NEW VENTURES	(9)
Investor Decision Process - Identifying the appropriate investors- Targeting investors- Developing Relationships with investors - Investor Selection Criteria- Company Creation- Raising Funds - Seed Funding- VC Selection Criteria – Process- Methods- Recent Trends.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Principles of Corporate Finance by Brealey and Myers et al., 12TH ed, McGraw Hill Education (India) Private Limited, 2018.
2	Prasanna Chandra, Projects : Planning ,Analysis,Selection ,Financing,Implementation and Review, McGraw Hill Education India Pvt Ltd ,New Delhi , 2019.
3	Introduction to Project Finance. Andrew Fight, Butterworth-Heinemann, 2006
4	R. Wayne Mondy, Human Resource Management, Pearson , 2015.
5	May, John; Simons, Cal. Every Business Needs An Angel: Getting The Money You Need To Make Your Business Grow. Crown Business, 2001.
6	Feld, Brad; Mendelson, Jason. Venture Deals. Wiley, 2011.

COURSE OUTCOMES:

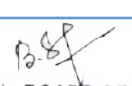
On completion of the course, the students will be able to

CO1:	Learn the basics of starting a new business venture.
CO2:	Understand the basics of venture financing.
CO3:	Understand the sources of debt financing.
CO4:	Understand the sources of equity financing.
CO5:	Acquaint with the methods of fund raising for new business ventures.

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

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


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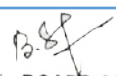


Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2413	PRINCIPLES OF PUBLIC ADMINISTRATION	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To introduce the meaning, nature, and scope of Public Administration and its relevance in contemporary governance and administrative systems. • To provide an understanding of the evolution of Public Administration including traditional, New Public Administration, and New Public Management perspectives. • To examine the relationship between Public Administration and other social sciences, and analyze classical and scientific approaches to administrative theory. • To explore the major administrative approaches such as the bureaucratic, human relations, and ecological approaches, along with their key proponents and impacts. • To understand essential administrative functions including leadership, communication, and decision-making processes and techniques in public administration.					

Unit-I	FUNDAMENTALS OF PUBLIC ADMINISTRATION	(9)
1. Meaning, Nature and Scope of Public Administration. 2. Importance of Public Administration. 3. Evolution of Public Administration.		
Unit-II	CONTEMPORARY APPROACHES TO PUBLIC ADMINISTRATION	(9)
1. New Public Administration. 2. New Public Management. 3. Public and Private Administration.		
Unit-III	THEORETICAL FOUNDATIONS AND INTERDISCIPLINARY PERSPECTIVES	(9)
1. Relationships with Political Science, History and Sociology. 2. Classical Approach. 3. Scientific Management Approach.		
Unit-IV	ADMINISTRATIVE APPROACHES AND THINKERS	(9)
1. Bureaucratic Approach: Max Weber. 2. Human Relations Approach : Elton Mayo. 3. Ecological Approach : Riggs.		
Unit-V	ADMINISTRATIVE SKILLS AND DECISION-MAKING PROCESSES	(9)
1. Leadership: Leadership - Styles – Approaches. 2. Communication: Communication Types - Process – Barriers. 3. Decision Making: Decision Making - Types, Techniques and Processes.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Avasthi and Maheswari: Public Administration in India, Agra:LakshmiNarain Agarwal,2013.
2	Ramesh K Arora: Indian Public Administration, New Delhi: WishwaPrakashan, 2012.
3	R.B. Jain: Public Administration in India,21st Century Challenges for Good Governance, New Delhi: Deep and Deep, 2002.
4	RumkiBasu: Public Administration:Concept and Theories, New Delhi:Sterling, 2013.
5	R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.

COURSE OUTCOMES:

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

CO1:	Understand the meaning, nature, scope, importance, and historical evolution of Public Administration.
CO2:	Explain the concepts and developments in New Public Administration and New Public Management, and compare with private administration.
CO3:	Analyze the interdisciplinary nature of Public Administration and classical theories including Scientific Management.
CO4:	Evaluate the relevance of key administrative approaches such as Bureaucratic, Human Relations, and Ecological theories.
CO5:	Apply leadership, communication, and decision-making principles in the context of public administration.

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

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

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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2414	CONSTITUTION OF INDIA	L	T	P	C	100
		3	0	0	3	

Course Objectives	- To provide foundational knowledge of the constitutional development in India from 1909 to 1947 and the making of the Indian Constitution. - To familiarize students with the core features of the Constitution including Fundamental Rights, Duties, and Directive Principles of State Policy. - To understand the structure and functioning of the Union Government – President, Parliament, and the Supreme Court. - To explore the federal structure by analyzing the role and powers of the Governor, State Legislature, and High Courts. - To develop awareness about the constitutional principles of secularism, social justice, and the rights and safeguards for minorities in India.
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Unit-I	HISTORICAL BACKGROUND AND MAKING OF THE INDIAN CONSTITUTION	(9)
1. Meaning, Nature and Scope of Public Administration. 2. Importance of Public Administration. 3. Evolution of Public Administration.		
Unit-II	FUNDAMENTAL RIGHTS, DUTIES, AND DIRECTIVE PRINCIPLES OF STATE POLICY	(9)
1. Fundamental Rights 2. Fundamental Duties 3. Directive Principles of State Policy.		
Unit-III	THE PRESIDENT, PARLIAMENT, AND SUPREME COURT OF INDIA	(9)
1. President 2. Parliament 3. Supreme Court.		
Unit-IV	GOVERNOR, STATE LEGISLATURE, AND HIGH COURT	(9)
1. Governor. 2. State Legislature. 3. High Court.		
Unit-V	SECULARISM, SOCIAL JUSTICE, AND MINORITY SAFEGUARDS	(9)
1. Secularism. 2. Social Justice. 3. Minority Safeguards.		


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Total No of Periods to be Taught	45 periods
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REFERENCES:

1	Basu. D.D.: Introduction to Indian Constitution ; Prentice Hall; New Delhi.
2	Kapur. A.C: Indian Government and Political System; S.Chand and Company Ltd., New Delhi.
3	Johari J.C.: Indian Politics, Vishal Publications Ltd, New Delhi.
4	Agarwal R.C: Indian Political System; S.Chand& Co., New Delhi.

COURSE OUTCOMES:

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

CO1:	Understand the historical development of the Indian Constitution from 1909 to 1947, including the framing process and role of the Constituent Assembly.
CO2:	Explain the significance and provisions of Fundamental Rights, Fundamental Duties, and Directive Principles of State Policy.
CO3:	Analyze the structure, powers, and functions of the President, Parliament, and Supreme Court of India.
CO4:	Describe the roles and responsibilities of the Governor, State Legislature, and High Courts within the Indian federal system.
CO5:	Evaluate the constitutional principles of secularism, social justice, and the safeguards provided for minorities in India.

Mapping of COs with POs and PSOs

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

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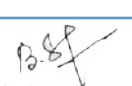


Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2415	PUBLIC PERSONNEL ADMINISTRATION	L	T	P	C	100
Course Objectives	• To understand the meaning, scope, and importance of personnel administration and its systems. • To examine the roles of generalists, specialists, and civil servants in relation to the political executive. • To explore recruitment methods, training types, and promotion practices in public administration. • To analyze the structure, functions, and service conditions of All India Services and State Public Service Commissions. • To study employer-employee relations, wage systems, and employee benefits in public administration.					

Unit-I	INTRODUCTION TO PERSONNEL ADMINISTRATION	(9)
1. Meaning, Scope and Importance of Personnel Administration. 2. Types of Personnel Systems: Bureaucratic, Democratic and Representative systems.		
Unit-II	ROLES AND ETHICS IN PERSONNEL ADMINISTRATION	(9)
1. Meaning, Scope and Importance of Personnel Administration. 2. Types of Personnel Systems: Bureaucratic, Democratic and Representative systems.		
Unit-III	PERSONNEL DEVELOPMENT AND CAREER MANAGEMENT	(9)
1. Recruitment: Direct Recruitment and Recruitment from Within 2. Training: Kinds of Training 3. Promotion.		
Unit-IV	PUBLIC SERVICE STRUCTURE AND REGULATORY BODIES	(9)
1. All India Services 2. Service Conditions 3. State Public Service Commission.		
Unit-V	EMPLOYEE RELATIONS AND COMPENSATION MANAGEMENT	(9)
1. Employer Employee Relations. 2. Wage and Salary Administration. 3. Allowances and Benefits.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Stahl Glean O: Public Personnel Administration.
2	ParnandikarPai V.A: Personnel System for Development Administration.
3	Bhambhiru . P: Bureaucracy and Policy in India.
4	Dwivedi O.P and Jain R.B: India's Administrative state.
5	Muttalis M.A: Union Public Service Commission.
6	BhakaraRao .V: Employer Employee Relations in India

COURSE OUTCOMES:

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

CO1:	Understand the meaning, scope, importance, and types of personnel systems in public administration.
CO2:	Analyze the roles of generalists and specialists, and evaluate the ethical relationship between civil servants and political executives.
CO3:	Explain the processes of recruitment, training, and promotion in personnel administration.
CO4:	Examine the structure, roles, and functions of the All India Services and State Public Service Commissions, including service conditions.
CO5:	Evaluate employer-employee relations, wage and salary administration, and the system of allowances and benefits in public sector employment.

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	0	0	0	0				3	2	
CO2	3	3	2	2	1	1	0	0				3	2	
CO3	3	3	3	2	1	1	0	0				3	3	
CO4	2	3	3	2	2	1	1	0				2	3	
CO5	2	2	2	3	3	2	1	1				2	3	
Avg.	3	3	3	3	3	2	1	1				3	3	

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

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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2416	ADMINISTRATIVE THEORIES	L	T	P	C	100
Course Objectives	- To understand the meaning, scope, significance, and historical evolution of Public Administration as a discipline.. - To study major organizational theories including Scientific Management, Classical, and Human Relations theories. - To analyze organizational goals, behavior, group dynamics, and organizational design principles. - To examine various motivation and leadership theories along with decision-making processes and techniques. - To learn about key administrative thinkers and their contributions to the field of Public Administration.					

Unit-I	INTRODUCTION TO PUBLIC ADMINISTRATION: MEANING, SCOPE, SIGNIFICANCE, AND EVOLUTION	(9)
Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a discipline and Identity of Public Administration.		
Unit-II	THEORIES OF ORGANIZATION: SCIENTIFIC MANAGEMENT, CLASSICAL, AND HUMAN RELATIONS THEORIES	(9)
Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory.		
Unit-III	ORGANIZATIONAL GOALS, BEHAVIOR, GROUP DYNAMICS, AND DESIGN	(9)
Organization goals and Behaviour, Groups in organization and group dynamics, Organizational Design.		
Unit-IV	MOTIVATION, LEADERSHIP THEORIES, AND DECISION-MAKING PROCESSES	(9)
Motivation Theories, content, process and contemporary; Theories of Leadership: Traditional and Modern: Process and techniques of decision-making.		
Unit-V	CONTRIBUTIONS OF ADMINISTRATIVE THINKERS	(9)
Administrative thinkers: Kautilya, Woodrow Willson, C.I. Barnard . Peter Drucker.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	CrozierM : The Bureaucratic phenomenon (Chand).
2	Blau. P.M and Scott. W : Formal Organizations (RKP).
3	Presthus. R : The Organizational Society (MAC).
4	Dwivedi O.P and Jain R.B: India's Administrative state.
5	Alvi, Shum Sun Nisa : Eminent Administrative Thinkers.
6	Keith Davis : Organization Theory (MAC).

COURSE OUTCOMES:

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

CO1:	Understand the scope, significance, and evolution of Public Administration as a discipline.
CO2:	Explain key organizational theories including Scientific Management, Classical, and Human Relations.
CO3:	Analyze organizational goals, behavior, group dynamics, and design.
CO4:	Evaluate motivation and leadership theories, and apply decision-making techniques.
CO5:	Assess the contributions of major administrative thinkers to the field of Public Administration.

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

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

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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2417	INDIAN ADMINISTRATIVE SYSTEM	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand the evolution and constitutional framework of Indian Administration. - To learn about the structure and functioning of district and local administration. - To examine the key features of the 73rd and 74th Constitutional Amendments. - To explore the effects of coalition politics and administrative vigilance mechanisms. - To gain knowledge about anti-corruption institutions like Lokpal and Lokayukta.					

Unit-I	CONSTITUTIONAL FRAMEWORK AND AUTHORITIES IN INDIAN ADMINISTRATION	(9)
Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India.		
Unit-II	DISTRICT ADMINISTRATION AND LOCAL GOVERNANCE	(9)
Role & Functions of the District Collector, Relationship between the District Collector and Superintendent of Police, Role of Block Development Officer in development programmes, Local Government		
Unit-III	PANCHAYATI RAJ AND URBAN LOCAL GOVERNANCE: 73RD AND 74TH CONSTITUTIONAL AMENDMENTS	(9)
Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Constitutional Amendment Act 1992.		
Unit-IV	COALITION POLITICS, INTEGRITY, AND VIGILANCE IN INDIAN ADMINISTRATION	(9)
Coalition politics in India, Integrity and Vigilance in Indian Administration.		
Unit-V	CORRUPTION AND ANTI-CORRUPTION INSTITUTIONS	(9)
Corruption – Ombudsman, Lok Pal & LokAyuktha.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	S.R. Maheswari : Indian Administration.
2	Khera. S.S : Administration in India.
3	Ramesh K. Arora : Indian Public Administration.
4	T.N. Chaturvedi : State administration in India.
5	Basu, D.D : Introduction to the Constitution of India.

COURSE OUTCOMES:

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

CO1:	Understand the evolution and constitutional framework of Indian administration and key constitutional authorities.
CO2:	Explain the roles of district administration and local government officials in governance and development.
CO3:	Analyze the features and impacts of the 73rd and 74th Constitutional Amendments on local self-government.
CO4:	Evaluate coalition politics, integrity, and vigilance in Indian administration.
CO5:	Assess anti-corruption mechanisms including Ombudsman, Lok Pal, and LokAyuktha.

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

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


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2418	PUBLIC POLICY ADMINISTRATION	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To introduce the concept and significance of Public Policy. • To familiarize students with various approaches to policy analysis. • To understand the policy-making process. • To explore the institutional and political framework of policy-making. • To provide insight into specific public policies.					

Unit-I	FOUNDATIONS OF PUBLIC POLICY	(9)
Meaning and Definition of Public Policy - Nature, Scope and Importance of public policy – Public policy relationship with social sciences especially with political science and Public Administration.		
Unit-II	APPROACHES TO POLICY ANALYSIS	(9)
Approaches in Policy Analysis - Institutional Approach – Incremental Approach and System's Approach – Dror's Optimal Model.		
Unit-III	STAGES OF THE POLICY-MAKING PROCESS	(9)
Major stages involved in Policy making Process – Policy Formulation – Policy Implementation – Policy Evaluation.		
Unit-IV	INSTITUTIONAL FRAMEWORK OF PUBLIC POLICY-MAKING	(9)
Institutional Framework of Policy making – Role of Bureaucracy – Role of Interest Groups and Role of Political Parties.		
Unit-V	INTRODUCTION TO KEY PUBLIC POLICIES IN INDIA	(9)
Introduction to the following Public Policies – New Economic Policy – Population Policy –Agriculture policy - Information Technology Policy.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Rajesh Chakrabarti&KaushikSanyal : Public Policy in India, Oxford University Press, 2016.
2	KuldeepMathur : Public Policy and Politics in India, Oxford University Press, 2016.
3	BidyutvChakrabarty: Public Policy: Concept, Theory and Practice, 2015.
4	PradeepSaxena : Public Policy Administration and Development
5	Sapru R.K. : Public Policy: Formulation, Implementation and Evaluation, Sterling Publishers, 2016.

COURSE OUTCOMES:

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

CO1:	Explain the meaning, nature, scope, and importance of public policy and its relationship with social sciences.
CO2:	Analyze various approaches to policy analysis including institutional, incremental, systems, and Dror's optimal model.
CO3:	Describe and evaluate the major stages in the public policy-making process—formulation, implementation, and evaluation.
CO4:	Examine the roles of bureaucracy, interest groups, and political parties in the institutional framework of policy-making.
CO5:	Demonstrate an understanding of key public policies in India, including economic, population, agriculture, and IT policies.

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	0	2	0							3	3	
CO2	3	3	2	0	0							3	3	
CO3	3	3	2	2	0							3	3	
CO4	3	3	0	2	2							3	3	
CO5	3	3	2	2	2							3	3	
Avg.	3	3	2	2	2							3	3	

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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2419	STATISTICS FOR MANAGEMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	To learn the applications of statistics in business decision making.					

Unit-I	INTRODUCTION	(9)
Basic definitions and rules for probability, Baye's theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.		
Unit-II	SAMPLING DISTRIBUTION AND ESTIMATION	(9)
Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.		
Unit-III	TESTING OF HYPOTHESIS - PARAMETIRC TESTS	(9)
Hypothesis testing: one sample and two sample tests for means of large samples (z-test), one sample and two sample tests for means of small samples (t-test), ANOVA one way.		
Unit-IV	NON-PARAMETRIC TESTS	(9)
Chi-square tests for independence of attributes and goodness of fit, Kolmogorov-Smirnov – test for goodness of fit, Mann – Whitney U test and Kruskal Wallis test.		
Unit-V	CORRELATION AND REGRESSION	(9)
Correlation –Rank Correlation – Regression – Estimation of Regression line – Method of Least Squares – Standard Error of estimate.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Richard I. Levin, David S. Rubin, Masood H. Siddiqui, Sanjay Rastogi, Statistics for Management, Pearson Education, 8th Edition, 2017.
2	Prem. S. Mann, Introductory Statistics, Wiley Publications, 9th Edition, 2015.
3	T N Srivastava and Shailaja Rego, Statistics for Management, Tata McGraw Hill, 3rd Edition 2017.
4	Ken Black, Applied Business Statistics, 7th Edition, Wiley India Edition, 2012.
5	David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Jeffrey D. Camm, James J. Cochran, Statistics for business and economics, 13th edition, Thomson (South – Western) Asia, Singapore, 2016.

COURSE OUTCOMES:

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

CO1:	To facilitate objective solutions in business decision making.
CO2:	To understand and solve business problems.
CO3:	To apply statistical techniques to data sets, and correctly interpret the results.
CO4:	To develop skill-set that is in demand in both the research and business environments.
CO5:	To enable the students to apply the statistical techniques in a work setting.

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	0							3	2	
CO2	3	3	3	1	0							3	3	
CO3	3	3	3	2	1							3	3	
CO4	3	3	3	2	1							2	3	
CO5	3	3	3	2	1							3	3	
Avg.	3	3	3	2	1							3	3	

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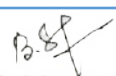
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Department	BME	Programme Code & Name				121-BE- BME	
Semester							
Course Code	Course Name		Hours/Week			Credit	Maximum Marks
UCMG2420	DATAMINING FOR BUSINESS INTELLIGENCE		L	T	P	C	100
			3	0	0	3	
Course Objectives	- To know how to derive meaning form huge volume of data and information. - To understand how knowledge discovering process is used in business decision making.						

Unit-I	INTRODUCTION	(9)
Data mining, Text mining, Web mining, Data ware house.		
Unit-II	DATA MINING PROCESS	(9)
Data mining process – KDD, CRISP-DM, SEMMA Prediction performance measures		
Unit-III	PREDICTION TECHNIQUES	(9)
Data visualization, Time series – ARIMA, Winter Holts,		
Unit-IV	CLASSIFICATION AND CLUSTERING TECHNIQUES	(9)
Classification, Association, Clustering.		
Unit-V	MACHINE LEARNING AND AI	(9)
Genetic algorithms, Neural network, Fuzzylogic, AntColony optimization, Particle Sparm optimization		
Total No of Periods to be Taught		45 periods

REFERENCES:	
1.	1. JaiweiHamandMichelineKamber, DataMiningconceptsand techniques, Kauffmann Publishers 2006
2.	Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
3.	W.H.Inmon, Building the Data Warehouse, fourth edition Wiley India pvt. Ltd. 2005.
4.	Ralph Kimball and Richard Merz, The data warehouse toolkit, John Wiley, 3rd edition,2013.
5.	Michel Berry and Gordon Linoff, Mastering Data mining, John Wiley and Sons Inc, 2nd Edition, 2011
6.	.Michel Berry and Gordon Linoff, Data mining techniques for Marketing, Sales and Customer support, John Wiley, 2011
7.	G. K. Gupta, Introduction to Data mining with Case Studies, Prentice hall of India, 2011


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COURSE OUTCOMES:

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

CO1:	Learn to apply various data mining techniques into various areas of different domains.
CO2:	Be able to interact competently on the topic of data mining for business intelligence.
CO3:	Apply various prediction techniques.
CO4:	Learn about supervised and unsupervised learning technique.


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
CMG2421	HUMAN RESOURCE ANALYTICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy. - To know the different types of HR metrics and understand their respective impact and application. - To understand the impact and use of HR metrics and their connection with HR analytics. - To understand common workforce issues and resolving them using people analytics.					

Unit-I	INTRODUCTION TO HR ANALYTICS	(9)
People Analytics - stages of maturity - Human Capital in the Value Chain : impact on business – HR metrics and KPIs.		
Unit-II	HR ANALYTICS I: RECRUITMENT	(9)
Recruitment Metrics : Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio- Quality of hire.		
Unit-III	HR ANALYTICS - TRAINING AND DEVELOPMENT	(9)
Training & Development Metrics : Percentage of employees trained- Internally and externally trained - Training hours and cost per employee - ROI		
Unit-IV	HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER	(9)
Employee Engagement Metrics : Talent Retention index - Voluntary and involuntary turnover- grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.		
Unit-V	HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT	(9)
Employee Engagement Metrics : Talent Retention index - Voluntary and involuntary turnover- grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	JacFitzenz , The New HR Analytics, AMACOM , 2010.
2	Edwards M. R., & Edwards K, Predictive HR Analytics: Mastering the HR Metric.London: Kogan Page.2016.
3	Human Resources kit for Dummies – 3 rd edition – Max Messmer, 2003
4	Dipak Kumar Bhattacharyya, HR Analytics ,Understanding Theories and Applications, SAGE Publications India ,2017.
5	Sesil, J. C. , Applying advanced analytics to HR management decisions: Methods fo selection, developing incentives, and improving collaboration. Upper Saddle River,New Jersey: Pearson Education,2014.
6	Pease, G., & Beresford, B, Developing Human Capital: Using Analytics to Plan and Optimize Your Learning and Development Investments. Wiley ,2014.

COURSE OUTCOMES:

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

CO1:	The learners will be conversant about HR metrics and ready to apply at work settings.
CO2:	The learners will be able to resolve HR issues using people analytics


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2422	MARKETING AND SOCIAL MEDIA WEB ANALYTICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	To showcase the opportunities that exist today to leverage the power of the web and social media.					

Unit-I	MARKETING ANALYTICS	(9)
Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis		
Unit-II	COMMUNITY BUILDING AND MANAGEMENT	(9)
History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages- Linking Social Media Accounts-The Viral Impact of Social Media.		
Unit-III	SOCIAL MEDIA POLICIES AND MEASUREMENTS	(9)
Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.		
Unit-IV	WEB ANALYTICS	(9)
Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.		
Unit-V	SEARCH ANALYTICS	(9)
Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization		
Total No of Periods to be Taught		45 periods

REFERENCES:

1	K. M. Shrivastava, SocialMedia inBusiness andGovernance, SterlingPublishers Private Limited, 2013
2	Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
3	Bittu Kumar, Social Networking, V & S Publishers, 2013

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4	AvinashKaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007
5	Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and Café Press 2004
6	Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

COURSE OUTCOMES:

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

CO1:	The Learners will understand social media, web and social media analytics and their potential impact.
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Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2423	OPERATION AND SUPPLY CHAIN ANALYTICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	To treat the subject in depth by emphasizing on the advanced quantitative models and methods in operations and supply chain management and its practical aspects and the latest developments in the field.					

Unit-I	INTRODUCTION	(9)
Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains–Basics, transforming supply chains.		
Unit-II	WAREHOUSING DECISIONS	(9)
P-Median Methods-Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods.		
Unit-III	INVENTORY MANAGEMENT	(9)
Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.		
Unit-IV	TRANSPORTATION NETWORK MODELS	(9)
Minimal Spanning Tree, Shortest Path Algorithms, Maximal Flow Problems, Transportation Problems, Set covering and Set Partitioning Problems, Travelling Sales man Problem, Scheduling Algorithms.		
Unit-V	MCDM MODELS	(9)
Analytic Hierarchy Process (AHP), Data Envelopment Analysis(DEA), Fuzzy Logic and Techniques, the analytical network process(ANP),TOPSIS.		
Total No of Periods to be Taught		45

REFERENCES:

1	Nada R. Sanders, Big data driven supply chain management: A frame work for implementing analytic and turning information into intelligence, Pearson Education, 2014.
2	Michael Watson, Sara Lewis, Peter Cacioppi, Jay Jaya raman, Supply Chain Network Design: Applying Optimization and Analytics to the Global Supply Chain, Pearson Education, 2013


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3	Anna Nagurney, Min Yu, Amir H. Masoumi, Ladimer S. Nagurney, Networks Against Time: Supply Chain Analytics for Perishable Products, Springer, 2013.
4	Muthu Mathirajan, Chandrasekharan Rajendran, Sowmyanarayanan Sadagopan, Arunachalam Ravindran, Parasuram Balasubramanian, Analytics in Operations/Supply Chain Management, I.K. International Publishing House Pvt. Ltd., 2016.
5	Gerhard J. Plenert, Supply Chain Optimization through Segmentation and Analytics, CRC Press, Taylor & Francis Group, 2014.

COURSE OUTCOMES:

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

CO1:	To Enable Quantitative Solutions in Business Decision Making Under Conditions Of certainty, risk and uncertainty.
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Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCMG2424	FINANCIAL ANALYTICS	L	T	P	C	100
		3	0	0	3	
Course Objectives	This course introduces a core set of modern analytical tools that specifically target finance applications.					

Unit-I	CORPORATE FINANCE ANALYSIS	(9)
Basic corporate financial predictive modelling- Project analysis- cash flow analysis- cost of capital, Financial Break even modelling, Capital Budget model-Payback, NPV, IRR.		
Unit-II	FINANCIAL MARKET ANALYSIS	(9)
Estimation and prediction of risk and return (bond investment and stock investment) –Time series-examining nature of data, Value at risk, ARMA, ARCH and GARCH.		
Unit-III	PORTFOLIO ANALYSIS	(9)
Portfolio Analysis – capital asset pricing model, Sharpe ratio, Option pricing models- binomial model for options, Black Scholes model and Option implied volatility.		
Unit-IV	TECHNICAL ANALYSIS	(9)
Prediction using charts and fundamentals – RSI, ROC, MACD, moving average and candle charts, simulating trading strategies. Prediction of share prices.		
Unit-V	CREDIT RISK ANALYSIS	(9)
Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.		
Total No of Periods to be Taught		45 periods

REFERENCES:

1	Financial analytics with R by Mark J. Bennett, Dirk L. Hugen, Cambridge university press.
2	Haskell Financial Data Modeling and Predictive Analytics Paperback – Import, 25 Oct 2013 by Pavel Ryzhov.
3	Quantitative Financial Analytics: The Path To Investment Profits Paperback – Import, 11 Sep 2017 by Edward E Williams (Author), John A Dobelman.
4	Python for Finance - Paperback – Import, 30 Jun 2017 by Yuxing Yan (Author).

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5	Mastering Python for Finance Paperback – Import, 29 Apr 2015 by James Ma Weiming.
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COURSE OUTCOMES:	
On completion of the course, the students will be able to	
CO1:	The learners should be able to perform financial analysis for decision making using excel, Python and R.


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VERTICAL5: ENVIRONMENT AND SUSTAINABILITY

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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCES2425	SUSTAINABLE INFRASTRUCTURE DEVELOPMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.					

Unit-I	SUSTAINABLE DEVELOPMENT GOALS	(9)
Definitions, principles and history of Sustainable Development - Sustainable development goals (SDG): global and Indian – Infrastructure Demand and Supply - Environment and Development linkages - societal and cultural demands – Sustainability indicators - Performance indicators of sustainability and Assessment mechanism - Policy frameworks and practices: global and Indian – Infrastructure Project finance – Infrastructure project life cycle - Constraints and barriers for sustainable development - future directions.		
Unit-II	SUSTAINABLE INFRASTRUCTURE PLANNING	(9)
Overview of Infrastructure projects: Housing sector, Power sector, Water supply, road, rail and port transportation sector, rural and urban infrastructure. Environmental Impact Assessment (EIA), Land acquisition -Legal aspects, Resettlement & Rehabilitation and Development - Cost effectiveness Analysis - Risk Management Framework for Infrastructure Projects, Economic, demand, political, socio-environmental and cultural risks. Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Negotiating with multiple Stakeholders on Infrastructure Projects. Use of ICT tools in planning – Integrated planning - Clash detection in construction - BIM (Building Information Modelling).		
Unit-III	SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES	(9)
Sustainability through lean construction approach - Enabling lean through information technology – Lean in planning and design - IPD (Integrated Project Delivery) - Location Based Management System - Geospatial Technologies for machine control, site management, precision control and real time progress monitoring - Role of logistics in achieving sustainable construction – Data management for integrated supply chains in construction - Resource efficiency benefits of effective logistics - Sustainability in geotechnical practice – Design considerations, Design Parameters and Procedures – Quality control and Assurance - Use of sustainable construction techniques: Precast concrete technology, Pre-engineered buildings.		


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Unit-IV	SUSTAINABLE CONSTRUCTION MATERIALS	(9)
Construction materials: Concrete, steel, glass, aluminium, timber and FRP- No/Low cement concrete - Recycled and manufactured aggregate- Role of QC and durability- Sustainable consumption – Eco-efficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility– Design for Environment Strategies, Practices, Guidelines, Methods, And Tools. Eco-design strategies –Design for Disassembly - Dematerialization, rematerialization, transmaterialization – Green procurement and green distribution - Analysis framework for reuse and recycling – Typical constraints on reuse and recycling - Communication of Life Cycle Information - Indian Eco mark scheme- Environmental product declarations – Environmental marketing- Life cycle Analysis (LCA), Advances in LCA: Hybrid LCA, Thermodynamic LCA - Extending LCA - economic dimension, social dimension - Life cycle costing (LCC) - Combining LCA and LCC – Case studies		
Unit-V	SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS	(9)
Case Studies - Sustainable projects in developed countries and developing nations - An Integrated Framework for Successful Infrastructure Planning and Management - Information Technology and Systems for Successful Infrastructure Management, - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management Systems and Future Directions. – Use of Emerging Technologies – IoT, Big Data Analytics and Cloud Computing, Artificial Intelligences, Machine and Deep Learning, Fifth Generation (5G) Network services for maintenance .		
Total No of Periods to be Taught		45 periods

REFERENCES:	
1	Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2	Steve Goodhew, Sustainable Construction Process, Wiley Blackwell, UK, 2016
3	Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
4	William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2016.
5	New Building Materials and Construction World magazine
6	Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher: Belhaven Press, ISBN: 1852930039.
7	Munier N, "Introduction to Sustainability", Springer 2005
8	Sharma, "Sustainable Smart Cities In India: Challenges And Future Perspectives", SPRINGER, 2022.
9	Ralph Horne, Tim Grant, Karli Verghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing, 2009


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10	European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. Luxembourg. European Union;2010
11	Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).

COURSE OUTCOMES:

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

CO1:	Understand the environment sustainability goals at global and Indian scenario.
CO2:	Understand risks in development of projects and suggest mitigation measures.
CO3:	Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.
CO4:	Explain Life Cycle Analysis and life cycle cost of construction materials.
CO5:	Explain the new technologies for maintenance of infrastructure projects.

Mapping of COs with POs and PSOs

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

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


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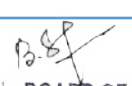


Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCES2426	SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	To educate the students about the issues of sustainability in agro eco systems, introduce the concepts and principles of agro ecology as applied to the design and management of sustainable agricultural systems for a changing world.					

Unit-I	AGROECOLOGY,AGROECOLOGY,ANDSUSTAINABLECONCEPTS	(9)
Ecosystem definition - Biotic V/s. a biotic factors in an ecosystem - Ecosystem processes -Ecological services and agriculture-Problems associated with industrial agriculture/food systems- Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems		
Unit-II	SOILHEALTH,NUTRIENTAND PESTMANAGEMENT	(9)
Soil health definition-Factors to consider(physical, chemical and biological)-Composition of healthy soils-Soil erosion and possible control measures- Techniques to build healthy soil- Management practices for improving soil nutrient-Ecologically sustainable strategies for pest and disease control		
Unit-III	WATER MANAGEMENT	(9)
Soil water storage and a vailability-Plant yield response to water -Reducing evaporation in agriculture-Earth works and tanks for rain water harvesting-Options for improving the productivity of water-Localized irrigation -Irrigation scheduling-Fertigation-Advanced irrigation systems and agricultural practices for sustainable water use		
Unit-IV	ENERGYAND WASTE MANAGEMENT	(9)
Types and sources of agricultural wastes-Composition of agricultural wastes-Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes-Renewable energy for sustainable agriculture		
Unit-V	EVALUATINGSUSTAINABILITY INAGROECOSYSTEMS	(9)
Indicators of sustainability in agriculture-On-farm evaluation of agro ecosystem sustainability- Alternative agriculture approaches/farming techniques for sustainable food production-Goals and components of a community food system-Case studies		
Total No of Periods to be Taught		45 periods


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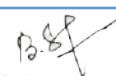
REFERENCES:

1	Approaches to Sustainable Agriculture–Exploring the Path ways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
2	Natural bio active products in sustainable agriculture, Singh, J. & Yadav, A. N., Springer, 2020
3	Organic Farming for Sustainable Agriculture, Nandwani, D., Springer, 2016
4	Principles of Agronomy for Sustainable Agriculture, Villalobos, F. J. & Fereres, E., Springer, 2016
5	Sustainable Agriculture for Food Security: A Global Perspective, Balkrishna, A., CRC Press, 2021

COURSE OUTCOMES:

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

CO1:	The student is expected to be able to Have a depth knowledge about the concepts, principles and advantages of sustainable agriculture
CO2:	Discuss the sustainable ways in managing soil health, nutrients, pests and diseases
CO3:	Suggest the ways to optimize the use of water in agriculture top roomteam ecological use of resources
CO4:	Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas
CO5:	Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the red sign of a conventional agro ecosystem


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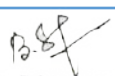


Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCES2427	SUSTAINABLE BIO MATERIALS	L	T	P	C	100
		3	0	0	3	
Course Objectives	● To Impart knowledge of bio materials and their properties ● To learn about Fundamentals aspects of Biopolymers and their applications ● To learn about bio ceramics and biopolymers ● To introduce the students about metals as biomaterials and their usage a simplants ● To make the students understand the significance of bio nanomaterials and its applications.					

Unit-I	INTRODUCTION TO BIOMATERIALS	(9)
Introduction: Definition of biomaterials, requirements & classification of biomaterials – Types of Biomaterials-Degradable and resorbable biomaterials- engineered natural materials- Biocompatibility-Hydrogels-pyrolitic carbon for long term medical implants-textured and porous materials-Bonding types-crystal structure-imperfection in crystalline structure-surface properties and adhesion of materials-strength of biological tissues-performance of implants-tissue response to implants- Impact and Future of Biomaterials		
Unit-II	BIO POLYMERS	(9)
Molecular structure of polymers-Molecular weight- Types of polymerization techniques-Types of polymerization reactions-Physical states of polymers-Common polymeric biomaterials- Polyethylene-Polymethylmeth crylate(PMMA-Polylactic acid(PLA)and polyglycolic acid(PGA)- Polycaprolactone (PCL)- Other bio degradable polymers-Polyurethan-reactions polymers for medical purposes-Collagens-Elastin-Cellulose and derivatives-Synthetic polymeric membranes and their biological applications		
Unit-III	BIO CERAMICS AND BIOCOMPOSITES	(9)
General properties-Bio ceramics-Silicate glass-Alumina (Al_2O_3)-Zirconia(ZrO_2)-Carbon- Calcium phosphates(CaP)-Resorbable Ceramics-surface reactive ceramics-Biomedical Composites-Polymer Matrix Composite (PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite(MMC)-glass ceramics- Ortho pedic implants-Tissue engineering scaffolds		
Unit-IV	METALS AS BIOMATERIALS	(9)
Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys-Titanium alloys-Tantalum-Nickel titanium alloy (Nitinol)-magnesium-based biodegradable alloys-surface properties of metal implants for osteo integration-medical application-corrosion of metallic implants-biological tolerance of implant metals		
Unit-V	NANOBIOMATERIALS	(9)


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Meatllc nano biomaterials–Nano polymers-Nano ceramics-Nano composites-Carbon based nano biomaterials - transport of nanoparticles- release rate-positive and negative effect of nano size-nano fibres-Nano and micro features and their importance in implant performance- Nano surface and coats- Applications nano anti biotics-Nano medicines-Biochips–Biomimetics- Bio NEMs-Biosensor- Bioimaging/Molecular Imaging-challenges and future perspective.

Total No of Periods to be Taught

45 periods

REFERENCES:

- 1 C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, GopinathMani “Introduction to Biomaterials Basic Theory with Engineering Applications” Cambridge University Press,2014.
- 2 Donglushi“Introductionto Biomaterials” Tsinghua University press, 2006
- 3 JoonPark,R.S.Lakes“BiomaterialsAn Introduction” third edition,Springer2007.
- 4 M.Jaffe, W.Hammond, P.Tolias and T.Arinzeh“Characterization of Biomaterials” Wood head publishing, 2013.
- 5 BuddyD.RatnerandAllanS.HoffmanBiomaterialsScience“AnIntroductiontoMaterialinMedicine” ThirdEdition,2013.
- 6 VasifHasirci,NesrinHasirci“Fundamentals of Bio materials”Springer, 2018
- 7 LeopoidoJavierRiosGonzalez.“HandbookofResearchonBioenergyandBiomaterials: Consolidated and greenprocess” Apple academicpress, 2021.
- 8 DevarajanThangadurai,JeyabalanSangeetha,RamPrasad“Functional Bio nanomaterials”springer, 2020.
- 9 Sujata.V.BhatBiomaterials;Narosa Publishinghouse,2002.

COURSE OUTCOMES:

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

- | | |
|------|--|
| CO1: | Students will gain familiarity with Bio materials and they will understand their importance. |
| CO2: | Students will get an overview of different biopolymers and their properties |
| CO3: | Students gain knowledge on some of the important Bio ceramics and Bio composite materials |
| CO4: | Students gain knowledge on metals as biomaterials |
| CO5: | Student gains knowledge on the importance of nanobio materials in biomedical applications. |


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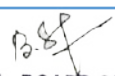


Department	BME	Programme Code & Name	121-BE- BME
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Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCES2428	MATERIALS FOR ENERGY SUSTAINABILITY	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To familiarize the students about the challenges and demands of energy sustainability • To provide fundamental knowledge about electrochemical devices and the materials used. • To introduce the students to various types of fuel cell • To enable students to appreciate novel materials and their usage in photovoltaic application • To introduce students to the basic principles of various types Super capacitors and the materials used					

Unit-I	SUSTAINABLE ENERGY SOURCES	(9)
Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy		
Unit-II	ELECTRO CHEMICAL DEVICES	(9)
Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O ₂ battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiatered hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO ₂ , LiFePO ₄ , LiMn ₂ O ₄) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)		
Unit-III	FUEL CELLS	(9)
Principle of operation of fuel cells – types of fuel cells (Proton exchange membrane fuel cells, alkaline fuel cell, direct methanol fuel cells, direct borohydride fuel cells, phosphoric acid fuel cells, solid oxide fuel cells, and molten carbonate fuel cells) – Thermodynamics of fuel cell – Fuel utilization – electrolyte membrane (proton conducting and anion conducting) – Catalysts (Platinum, Platinum alloys, carbon supported platinum systems and metal oxides supported platinum catalysts) – Anatomy of fuel cells (gas diffusion layer, catalyst layer, flow field plate, current conductors, bipolar plates and mono polar plates).		
Unit-IV	PHOTO VOLTAIS	(9)


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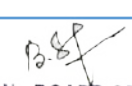
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Physicsofthesolarcell–Theoreticallimitsofphotovoltaicconversion–bulkcrystal growthofSi and wafering for photo voltaicapplication– Crystallinesiliconsolarcells–thinfilmsiliconsolarcells–multijunctionsolarcells–amorphoussiliconbasedsolarcells– photovoltaicconcentrators– Cu(InGa)Se2 solarcells–CadiumTelluridesolarcells–dyesensitizedsolarcells–Perovskitesolarcells– Measurementandcharacterizationofsolarcells–Materialsusedinsolarcells(metallicoxides,CNTfilms,graphene,OD fullerenes,single-multiwalledcarbonnanotubes,two-dimensional Graphene, organic orSmall molecule-basedsolarcellsmaterials-copper-phthalocyanineandperylene-tetracarboxylicbis-benzene–fullerenes-boronsubphthalocyanine– tin (II)phthalocyanine		
Unit-V	SUPER CAPACITORS	(9)
Super capacitor –typesofsuper capacitors (electro staticdouble-layercapacitors,pseudocapacitors and hybrid capacitors) - design of super capacitor-three and two electrode cell-parametersof super capacitor-Faradaicandnon-Faradaiccapacitance–electrode materials(transitionmetal oxides(MO),mixed metal oxides,conductingpolymers(CP),Mxenes,nanocarbons,non-noble metal,chalcogenides,hydroxidesand1D-3Dmetal-organic framework(MOF),activatedcarbon fibres (ACF)-Hydroxides-BasedMaterials– Poly aniline (PANI),aternary hybridcomposite- conductivepoly pyrrolehydro gels–Different typesofnanocomposites fortheSCElectrodes (carbon–carbon composites,carbon-MOs composites,carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides,andnitrides.		
Total No of Periods to be Taught		45 periods

REFERENCES:	
1	Functional materialsfor sustainable energy applications; John A. Kilner, StephenJ.Skinner,StuartJ.C. Irvineand Peter P.Edwards.
2	HandBookofFuelCells:FuelCellTechnologyandApplications,WolfVielstich,ArnoldLamm,Hubert AndreasGasteiger, Harumi Yokokawa,Wiley,London2003.
3	B.E.Conway,Electrochemicalsupercapacitors: scientific fundamentals andtechnological applications,KluwerAcademic/Plenumpublishers, NewYork,1999.
4	T.R.Crompton, Batteriesreference book,Newners,3rd Edition, 2002.
5	MaterialsforSupercapacitorapplications;B.Viswanathan. M.AuliceScibioh
6	Electrode Materials for Supercapacitors: A Review of Recent Advances, ParniaForouzandeh,VigneshKumaravel and Suresh C.Pillai,catalysts2022
7	Recentadvances,practical challenges,andperspectivesofintermediate temperaturesolid oxide fuel cell cathodesAmanda Ndubuisi,SaraAbouali,KalpanaSingh and VenkataramanThangadurai,J.Mater.Chem. A, 2022.
8	Reviewofnextgenerationphotovoltaicsolarcelltechnologyandcomparativematerialistic developmentNeerajKant, PushpendraSingh,MaterialsToday:Proceedings,2022


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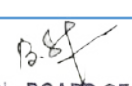
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COURSE OUTCOMES:

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

CO1:	Students will acquire knowledge about energy sustainability.
CO2:	Students understand the principles of different electrochemical devices.
CO3:	Students learn about the working of fuel cells and their application.
CO4:	Students will learn about various Photovoltaic applications and the materials used.
CO5:	The students gain knowledge on different types of super capacitors and the performance of various materials


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCES2429	GREEN TECHNOLOGY	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability. - To provide green engineering solutions to energy demand, reduced energy footprint.					

Unit-I	PRINCIPLES OF GREEN CHEMISTRY	(9)
Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.		
Unit-II	POLLUTION TYPES	(9)
Pollution-types, causes, effects, and abatement. Waste-sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.		
Unit-III	GREEN REAGENTS AND GREEN SYNTHESIS	(9)
Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions		
Unit-IV	DESIGNING GREEN PROCESSES	(9)
Safe design, process intensification, in process monitoring. Safe product and process design- Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention		
Unit-V	GREEN NANOTECHNOLOGY	(9)
Nano materials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology		
Total No of Periods to be Taught		45 periods

TEXT BOOK:

1	Green technology and design for the environment, Samir B. Billatos, Nadia A. Basaly, Taylor & Francis, Washington, DC, ©1997
2	Green Chemistry – An introductory text- M. Lancaster, RSC, 2016

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3	Greenchemistrymetrics- Alexi Lapkinanddavid Constable (Eds),Wileypublications,2008
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REFERENCES:

1	Environmental chemistry,StanleyE Manahan, Taylorand Francis,2017
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COURSE OUTCOMES:

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

CO1:	To understand the principles of green engineering and technology
CO2:	To learn about pollution using hazardous chemicals and solvents
CO3:	To modify processes and products to make them green and safe.
CO4:	To design processes and products using green technology
CO5:	To understand advanced technology in green synthesis


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCES2430	ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand and study the complexity of the environment in relation to pollutants generated due to industrial activity. - To analyze the quality of the environmental parameters and monitor the same for the purpose of environmental risk assessment.					

Unit-I	ENVIRONMENTAL MONITORING AND STANDARDS	(9)
Introduction- Environmental Standards-Classification of Environmental Standards- Global Environmental Standards- Environmental Standards in India-Ambient air quality standards-water quality standard-Environmental Monitoring-Need for environmental monitoring-Concepts of environmental monitoring-Techniques of Environmental Monitoring.		
Unit-II	MONITORING OF ENVIRONMENTAL PARAMETERS	(9)
Current Environmental Issues-Global Environmental monitoring programme-International conventions- Application of Environmental Monitoring-Atmospheric Monitoring-screening parameters – Significance of environmental sampling- sampling methods – water sampling - sampling of ambient air-sampling of flue gas.		
Unit-III	ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING	(9)
Classification of Instrumental Method-Analysis of Organic Pollutants by Spectrophotometric methods - Determination of nitrogen, phosphorus and chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)-Sampling techniques for air pollution measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulfur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis		
Unit-IV	ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISK ASSESSMENT	(9)
Water quality monitoring programme-national water quality monitoring-Parameters for National Water Quality Monitoring- monitoring protocol; Process of risk assessment-hazard identification-exposure assessment-dose-response assessment; risk characterization.		
Unit-V	AUTOMATED DATA ACQUISITION AND PROCESSING	(9)
Data Acquisition for Process Monitoring and Control-The Data Acquisition System- Online Data Acquisition, Monitoring, and Control-Implementation of a Data Management System-Review of Observational Networks-Sensors and transducers- classification of transducers-data acquisition system-types of data acquisition systems- data management and quality control; regulatory overview.		
Total No of Periods to be Taught		45 periods


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TEXT BOOK:

1	Environmental monitoring Handbook, FrankR. Burden, ©2002 by The McGraw-Hill Companies, Inc.
2	Handbook of environmental analysis: chemical pollutants in the air, water, soil, and solid wastes/Pradyot Patnaik, ©1997 by CRC Press, Inc

REFERENCES:

1	Environmental monitoring / edited by G. Bruce Wiersma, ©2004 by CRC Press LLC.
2	H.H. Willard, L. L. Merit, J. A. Dean and F. A. Settle, Instrumental Methods of Analysis, CBP Publishers and Distributors, New Delhi, 1988.
3	Heaslip, G. (1975) Environmental Data Handling. John Wiley & Sons. New York.

COURSE OUTCOMES:

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

CO1:	Basic concepts of environmental standards and monitoring.
CO2:	The ambient air quality and water quality standards;
CO3:	The various instrumental methods and their principles for environmental monitoring
CO4:	The significance of environmental standards in monitoring quality and sustainability of the environment.
CO5:	Know the standard research methods that are used worldwide for monitoring the environment.

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

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


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCES243 1	INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	• To create awareness on the energy scenario of India with respect to world • To understand the fundamentals of energy sources, energy efficiency and resulting environmental implications of energy utilization • Familiarisation on the concept of sustainable development and its benefits • Recognize the potential of renewable energy sources and its conversion technologies for attaining sustainable development • Acquainting with energy policies and energy planning for sustainable development					

Unit-I	ENERGY SCENARIO	(9)
Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T & D losses, energy demand, per capita energy consumption) – energy pricing – Energy security		
Unit-II	ENERGY AND ENVIRONMENT	(9)
Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls		
Unit-III	SUSTAINABLE DEVELOPMENT	(9)
Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG)- Social development: Poverty, conceptual issues and measures, impact of poverty. Globalization and Economic growth - Economic development: Economic inequalities, Income and growth.		
Unit-IV	RENEWABLE ENERGY TECHNOLOGY	(9)
Renewable Energy – Sources and Potential – Technologies for harnessing from Solar, Wind, Hydro, Biomass and Oceans – Principle of operation, relative merits and demerits		
Unit-V	ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT	(9)
National & State Energy Policy - National solar mission - Framework of Central Electricity Authority - National Hydrogen Mission - Energy and climate policy - State Energy Action Plan, RE integration, Roadmap for ethanol blending, Energy Efficiency and Energy Mix		
Total No of Periods to be Taught		45 periods


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REFERENCES:

1	Energy Manager Training Manual (4Volumes) available at http://www.em-ea.org/gbook1.asp , a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India. 2004
2	Robert Ristiri and Jack P. Kraushaar, "Energy and the environment", Wiley, 2005.
3	Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012
4	Twidell, J.W. & Weir A., "Renewable Energy Resources", EFN Spon Ltd., UK, 2015.
5	Dhandapani Alagiri, "Energy Security in India Current Scenario", The ICF AI University Press, 2006.

COURSE OUTCOMES:

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

CO1:	Understand the world and Indian energy scenario
CO2:	Analyse energy projects, its impact on environment and suggest control strategies
CO3:	Recognise the need of Sustainable development and its impact on human resource development
CO4:	Apply renewable energy technologies for sustainable development
CO5:	Fathom Energy policies and planning for sustainable development.


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

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
UCES2432	ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT	L	T	P	C	100
		3	0	0	3	
Course Objectives	- To understand the types of energy sources, energy efficiency and environmental implications of energy utilization - To create awareness on energy audit and its impacts - To acquaint the techniques adopted for performance evaluation of thermal utilities - To familiarize on the procedures adopted for performance evaluation of electrical utilities - To learn the concept of sustainable development and the implication of energy usage					

Unit-I	ENERGY AND ENVIRONMENT	(9)
Primary energy sources-Coal, Oil, Gas-India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP		
Unit-II	ENERGY AUDITING	(9)
Need and types of energy audit. Energy management (audit) approach-understanding energy costs, benchmarking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments		
Unit-III	ENERGY EFFICIENCY IN THERMAL UTILITIES	(9)
Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories-Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermo compression		
Unit-IV	ENERGY CONSERVATION IN ELECTRICAL UTILITIES	(9)
Demand side management-Power factor improvement-Energy efficient transformers-Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers		
Unit-V	SUSTAINABLE DEVELOPMENT	(9)
Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG). Globalization and Economic growth. Economic development: Economic inequalities, Income and growth. Social development: Poverty, conceptual issues and measures, impact of poverty,		
Total No of Periods to be Taught		45 periods

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1	Energy Manager Training Manual (4Volumes) available at http://www.em-ea.org/gbook1.asp , a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India. 2004
2	Eastop, T.D. & Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical, ISBN-0-582-03184, 1990
3	W.R. Murphy and G. McKay "Energy Management" Butterworths, London 1987
4	Pratap Bhattacharyya, "Climate Change and Greenhouse Gas Emission", New India Publishing Agency-Nipa, 2020
5	Matthew John Franchetti, Defne Apul "Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies" CRC Press, 2012
6	Robert A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, "Energy and the Environment", 4 th Edition, Wiley, 2022

COURSE OUTCOMES:

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

CO1:	Understand the prevailing energy scenario
CO2:	Familiarise on energy audits and its relevance
CO3:	Apply the concept of energy audit on thermal utilities
CO4:	Employ relevant techniques for energy improvement in electrical utilities
CO5:	Understand Sustainable development and its impact on human resource development


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