VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY [AUTONOMOUS]

[Approved by AICTE, Affiliated to Anna University, Chennai]

(Accredited by NAAC with 'A+' Grade)



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Accredited by NBA

REGULATIONS 2018 Ver. 4

BATCH 2021-2025

CHOICE BASED CREDIT SYSTEM

CURRICULUM AND SYLLABUS

VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY, ERODE-12. (AUTONOMOUS) DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To produce competent professionals for a globalized technological society by preparing them to become part of the industry and research organizations in the field of science and technology and orient them towards serving the society.

MISSION

M1. Strengthening the core competence in Computer Science and Engineering through analytical learning and Industry – Institute interaction.

M2. Providing exposure to latest tools and technologies in the core area to design solutions and conduct investigations.

M3. Promoting innovative research based projects / activities in the emerging areas of technology convergence.

M4. Inculcating professional behavior, strong ethical values, leadership abilities, entrepreneurship skills and commitment to lifelong learning.

PROGRAM EDUCATIONAL OBJECTIVES

Our graduates after few years of graduation will:

PEO1. **Preparation**: Develop professional skills for a successful professional career as an engineer, scientist, technocrat, administrator or an entrepreneur.

PEO2. **Core Competence**: Design and implement practical systems consisting of software and/or hardware components through the key principles and practices of computation, mathematics and basic principles of engineering.

PEO3. **Multidisciplinary:** Design and apply new ideas and technologies as the field evolves, to solve real world problems in related interdisciplinary areas.

PEO4. **Professional Environment:** Demonstrate professional attitude and ethics, effective communication, team work and managerial skills for societal, environmental and global context.

PEO5. Learning Environment: Engage in continuing education and training and acquire professional competence through lifelong learning.

PROGRAM OUTCOMES

Graduates will be able to

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3: **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems.

PO5: **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1. Apply a variety of programming skills to solve business problems

PSO2. Apply design principles in the construction of computing systems and expert systems of varying complexity.

	VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY	CREDIT SUMMARY
VCET	(Autonomous)	UG
		R – 2018 Ver 4
Department	Computer Science and Engineering (C	S)
Programme	B.E-CSE	

Semester/ Category	Ι	II	III	IV	V	VI	VII	VIII	Total	%	AICTE Norms (%)
HS	3	3					6		12	7.45	5% to 10%
BS	11	8	4	4					27	16.77	15% to 20%
ES	8	8	4	3	4				27	16.77	15% to 20%
PC			11	16	8	11	7		53	32.92	30% to 40%
PE					6	6	6		18	11.18	10% to 15%
OE					3	3	3		9	5.59	5% to 10%
PSI						3		12	15	9.32	10% to 15%
MC	\checkmark										
TOTAL	22	19	19	23	21	23	22	12	<u>161</u>		



VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)

CURRICULUM

UG

R - 2018

	Department					Computer Science and Engineering (CS)								
	Pr	ograr	nme				B.E-CSF	F						
	Semest	er		1										
SI.	egory		Cours	se Co	ode		Course Title	H	Iour Wee	s / k	redit	Μ	ax. Ma	arks
N0.	Cat							L	Т	Р	C	CA	SE	Tot.
							THEORY							
1	HS	21	EN	Т	1	1	Communicative English - I	3	0	0	3	40	60	100
2	BS	21	MA	Т	1	1	Engineering Mathematics - I	3	1	0	4	40	60	100
3	BS	21	PH	Т	1	1	Engineering Physics	3	0	0	3	40	60	100
4	BS	21	CY	Т	1	1	Engineering Chemistry	3	0	0	3	40	60	100
5	ES	21	CS	Т	1	3	Python Programming	3	0	0	3	40	60	100
6	ES	21	ME	С	1	1	Engineering Graphics	2	0	4	4	40	60	100
							PRACTICALS				1	1		
7	BS	21	PH	L	1	1	Physics and Chemistry Laboratory – I	0	0	2	1	60	40	100
8	ES	21	CS	L	1	3	Python Programming Laboratory	0	0	2	1	60	40	100
							MANDATORY						L	
9	MC	21	MC	L	1	1	Universal Human Values - 1	1	0	1	0	100	0	100
							Total Credits for Sem			1	22			
	Semest	er		2										
SI	ory			1				H	Iour	s /	lit	Μ	ax. Ma	arks
No.	Categ		Cours	se Co	ode		Course Title	L	T Wee	Р	Cre	CA	SE	Tot.
							THEORY	<u> </u>					<u> </u>	
1	ЦС	21	EN	т	2	1	Communicative English II	2	0	0	2	40	60	100
2	BS	21		Т	2	1	Engineering Mathematics	3	1	0	4	40	60	100
2	BS	21	PH	T	2	1	Physics for Information Sciences	3	1	0	4	40	60	100
4	ES	21	EE	T	1	1	Basics of Electrical and Electronics Engineering	3	0	0	3	40	60	100
5	ES	21	IT	Т	2	1	Programming in C	3	0	0	3	40	60	100
							PRACTICALS						<u> </u>	
6	BS	21	PH	L	2	1	Physics and Chemistry Laboratory – II	0	0	2	1	60	40	100
7	ES	21	IT	L	2	1	C Programming Laboratory	0	0	2	1	60	40	100
8	ES	21	EE	L	2	2	Engineering Practices Laboratory	0	0	2	1	100	0	100
							MANDATORY							
9	MC	21	MC	Т	0	2	Environmental Science and Engineering	2	0	0	0	100	0	100
		MC 21 MC T 0 2 Environmental Science and Enginee. Total Cr									19			

	Semest	er		3										
SI.	egory		Cours	e Co	ode		Course Title	H	Iour Wee	s / k	redit	М	ax. Ma	arks
INO.	Cat							L	Т	Р	C	CA	SE	Tot.
							THEORY							
1	BS	21	MA	Т	3	2	Discrete Mathematics	3	1	0	4	40	60	100
2	PC	21	CS	Т	3	3	Object Oriented Programming using Java	3	0	0	3	40	60	100
3	PC	21	CS	Т	3	2	Data Structures	3	0	0	3	40	60	100
4	ES	21	CS	С	3	1	Digital Principles and System Design	3	0	2	4	50	50	100
5	PC	21	IT	Т	3	2	Computer Architecture	3	0	0	3	40	60	100
							PRACTICALS							
6	PC	21	CS	L	3	1	Object Oriented Programming Laboratory	0	0	2	1	60	40	100
7	PC	21	CS	L	3	2	Data Structures Laboratory	0	0	2	1	60	40	100
	J	21 MC L 0 3			1	1	MANDATORY	1						1
8	MC	21	MC	L 0 3 1			Essential English for Professionals	0	0	2	0	100	0	100
						Total Credits for Sem	3			19				
	Somestor 4													
	Semest	er		4				_						
SI.	Semest	er	Cours	4 e Co	de		Course Title	H	Iour Wee	s / k	edit	М	ax. Ma	arks
Sl. No.	Semest Category	er	Cours	4 e Co	ode		Course Title	L L	Iour Wee T	s / k P	Credit	M CA	ax. Ma SE	urks Tot.
Sl. No.	Semest Category	er	Cours	4 e Co	ode		Course Title THEORY	H L	Iour Wee T	s / k P	Credit	M CA	ax. Ma SE	nrks Tot.
Sl. No.	Semest Category BS	er 21	Cours	4 e Co T	ode	5	Course Title THEORY Probability and Statistics	E L 3	Hour Wee T	s / k P 0	4 Credit	М СА 40	ax. Ma SE 60	Tot.
Sl. No.	Semest Category BS ES	er 21 21	Cours MA CS	4 e Co T T	de 4 4	5	Course Title THEORY Probability and Statistics Database Management Systems	E L 3 3	Hour Wee T	s / k P 0 0	Credit 3	M CA 40 40	ax. Ma SE 60 60	Tot. 100
Sl. No.	Semest Category BS ES PC	er 21 21 21	Cours MA CS CS	4 e Co T T T	de 4 4 4	5 1 2	Course Title THEORY Probability and Statistics Database Management Systems Software Engineering	E L 3 3 3	Iour Wee T 1 0 0	s / k P 0 0 0	Credit 3 3	M CA 40 40	ax. Ma SE 60 60 60	Tot. 100 100
Sl. No.	Semest Log Semest Category BS ES PC PC PC	er 21 21 21 21 21	Cours MA CS CS IT	4 e Co T T T T	bde 4 4 4 4 4	5 1 2 1	Course Title THEORY Probability and Statistics Database Management Systems Software Engineering Operating Systems	H L 3 3 3 3	Hour Wee T 1 0 0 0	s / k P 0 0 0 0 0	4 3 3 3	M CA 40 40 40 40	ax. Ma SE 60 60 60 60	rks Tot. 100 100 100 100
Sl. No.	Semest Log BS ES PC PC PC	er 21 21 21 21 21 21	Cours MA CS CS IT IT	4 e Co T T T T T	4 4 4 4 4	5 1 2 1 2	Course Title THEORY Probability and Statistics Database Management Systems Software Engineering Operating Systems Design and Analysis of Algorithms	F L 3 3 3 3 3 3	Hour Weee T 1 0 0 0 1	s / k P 0 0 0 0 0 0	4 3 3 4	M CA 40 40 40 40 40	ax. Ma SE 60 60 60 60 60	rks Tot. 100 100 100 100 100
Sl. No.	Semest Log BS ES PC PC PC PC PC	er 21 21 21 21 21 21 21 21	Cours MA CS CS IT IT CS	4 e Co T T T T T C	de 4 4 4 4 4 4 4	5 1 2 1 2 1	Course Title THEORY Probability and Statistics Database Management Systems Software Engineering Operating Systems Design and Analysis of Algorithms Object Oriented Analysis and Design	F L 3 3 3 3 3 3 3	Iour Weee T 1 0 0 1 0 0 0 1	s / k P 0 0 0 0 0 2	4 3 3 4 4 4	M CA 40 40 40 40 40 40	ax. Ma SE 60 60 60 60 60 60	rks Tot. 100 100 100 100 100 100
Sl. No.	Semest Log BS ES PC PC PC PC	er 21 21 21 21 21 21 21	Cours MA CS CS IT IT CS	4 e Co T T T T C	de 4 4 4 4 4 4 4	5 1 2 1 2 1	Course Title THEORY Probability and Statistics Database Management Systems Software Engineering Operating Systems Design and Analysis of Algorithms Object Oriented Analysis and Design PRACTICALS	H L 3 3 3 3 3 3 3	Hour Wee T 1 0 0 0 1 0	s / k P 0 0 0 0 0 2	4 3 3 4 4 4	M CA 40 40 40 40 40 40	ax. M a SE 60 60 60 60 60	rks Tot. 100 100 100 100 100
Sl. No.	Semest Log BS ES PC PC PC PC PC	er 21 21 21 21 21 21 21 21 21	Cours MA CS CS IT IT CS CS	4 e Co T T T T C	de 4 4 4 4 4 4 4 4 4 4	5 1 2 1 2 1	Course Title THEORY Probability and Statistics Database Management Systems Database Management Systems Software Engineering Operating Systems Design and Analysis of Algorithms Object Oriented Analysis and Design PRACTICALS Database Management Systems Laboratory	H 1 3 3 3 3 3 3 3 3 3 3 3 3 3 3 0	Hour Weee T 1 0 0 0 1 0 0	s / k P 0 0 0 0 0 2 2	4 3 3 4 4 1	M CA 40 40 40 40 40 40 60	ax. Ma SE 60 60 60 60 60 40	rks Tot. 100 100 100 100 100 100
Sl. No.	Semest Log BS ES PC PC PC PC PC PC PC	er 21 21 21 21 21 21 21 21 21 21	Cours MA CS CS IT IT CS CS IT	4 e Co T T T T T C L L	4 4 4 4 4 4 4 4 4 4 4 4 4	5 1 2 1 2 1 1 1 1	Course Title THEORY Probability and Statistics Database Management Systems Database Management Systems Software Engineering Operating Systems Design and Analysis of Algorithms Object Oriented Analysis and Design PRACTICALS Database Management Systems Laboratory Operating Systems Laboratory	I 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 0 0 0	Hour Wee T 1 0 0 0 1 0 0	s / k P 0 0 0 0 0 2 2 2 2	4 3 3 4 4 4 1 1	M CA 40 40 40 40 40 40 60 60	ax. Ma SE 60 60 60 60 60 40 40	rks Tot. 100 100 100 100 100 100 100
Sl. No.	Semest Log BS ES PC PC PC PC PC PC PC PC	er 21 21 21 21 21 21 21 21 21 21	Cours MA CS CS IT IT CS CS IT	4 e Co T T T T C L L	4 4 4 4 4 4 4 4 4 4	5 1 2 1 1 1 1	Course Title THEORY Probability and Statistics Database Management Systems Software Engineering Operating Systems Design and Analysis of Algorithms Object Oriented Analysis and Design Database Management Systems Laboratory Operating Systems Laboratory MANDATORY	L 3 3 3 3 3 3 3 3 0 0	Hour Weee T 1 0 0 0 1 0 0 0 0	s / k P 0 0 0 0 0 0 2 2 2 2 2	4 3 3 4 4 1 1	M CA 40 40 40 40 40 40 60 60	ax. Ma SE 60 60 60 60 40 40	rks Tot. 100 100 100 100 100 100 100
Sl. No.	Semest Logo BS ES PC PC PC PC PC PC PC MC	er 21 21 21 21 21 21 21 21 21 21 21	Cours MA CS CS IT IT CS CS IT	4 e Co T T T T T C L L L	4 4 4 4 4 4 4 4 4 0	5 1 2 1 1 1 1 4	Course TitleTHEORYProbability and StatisticsDatabase Management SystemsSoftware EngineeringOperating SystemsDesign and Analysis of AlgorithmsObject Oriented Analysis and DesignPRACTICALSDatabase Management Systems LaboratoryOperating Systems LaboratoryPreating Systems LaboratoryProfessional Communication	I 3 3 3 3 3 3 3 3 3 3 3 3 3 0 0 0 0 0	Hour Weee T 1 0 0 0 1 0 0 0 0	s / k P 0 0 0 0 0 0 2 2 2 2 2 2	Credit 0 Credit 0	M CA 40 40 40 40 40 40 60 60 60	ax. M a SE 60 60 60 60 60 40 40 40 0	rks Tot. 100 100 100 100 100 100 100 10

Semester				5										
SI.	egory		Cours	e Co	ode		Course Title	H	Iour Wee	s / k	edit.	Ma	ax. Ma	rks
No.	Cat							L	Т	Р	Cr	CA	SE	Tot.
							THEORY							
1	PC	21	CS	Т	5	1	Computer Networks	3	0	0	3	40	60	100
2	PC	21	CS	Т	5	2	Web Programming	3	0	0	3	40	60	100
3	ES	21	CS	Т	5	3	Theory of Computations	3	1	0	4	40	60	100
4	PE	21					Professional Elective-I	3	0	0	3	40	60	100
5	PE	21					Professional Elective-II	3	0	0	3	40	60	100
6	OE	21					Open Elective-I	3	0	0	3	40	60	100
							PRACTICALS							
7	PC	21	CS	L	5	1	Computer Networks Laboratory	0	0	2	1	60	40	100
8	PC	21	CS	L	5	2	Web Programming Laboratory	0	0	2	1	60	40	100
	-						MANDATORY				1		1	
9	MC	21	MC	Т	0	5	Aptitude and Logical Reasoning	2	0	0	0	100	0	100
10	10 MC 21 MC L 0 9 Corr				0	9	Communication Skills Laboratory	0	0	2	0	100	0	100
							Total Credits for Sem	5			22			
	Semest	er		6										
SI.	gory		~		_			Hours / Week			dit	М	ax. Ma	arks
No.	Cate		Cours	se Co	ode		Course Title	L	Т	Р	Cre	CA	SE	Tot.
							THEORY							1
1	PC	21	CS	Т	6	1	Artificial Intelligence	3	0	0	3	40	60	100
2	PC	21	CS	Т	6	2	Compiler Design	3	1	0	4	40	60	100
3	PC	21	IT	Т	6	1	Mobile Application Development	3	0	0	3	40	60	100
4	PE	21					Professional Elective-III	3	0	0	3	40	60	100
5	PE	21					Professional Elective-IV	3	0	0	3	40	60	100
6	OE	21					Open Elective-II	3	0	0	3	40	60	100
	-		1				PRACTICALS				1	1		
7	PC	21	IT	L	6	1	Mobile Application Development Laboratory	0	0	2	1	60	40	100
8	PSI	21	CS	L	6	1	Mini Project	0	0	6	3	40	60	100
		MANDATORY			1	1		1	1		1			
9	MC 21 MC T 0		7	Arithmetic and Analytical Ability	2	0	0	0	100	0	100			
	9 MC 21 MC			1	1	1	Total Credits for Sem	6		<u> </u>	23			

	Semest	er		7										
SI.	egory		Cours	e Co	ode		Course Title	H	Iour Wee	s / k	redit	М	ax. M	arks
NO.	Cat							L	Т	Р	C	CA	SE	Tot.
							THEORY							
1	HS	21	IT	Т	7	1	Economics and Management for Engineers	3	0	0	3	40	60	100
2	PC	21	CS	Т	7	1	Network Security	3	0	0	3	40	60	100
3	PC	21	CS	Т	7	2	Machine Learning	3	0	0	3	40	60	100
4	PE	21					Professional Elective - V	3	0	0	3	40	60	100
5	PE	21					Professional Elective - VI	3	0	0	3	40	60	100
6	OE	21					Open Elective - III	3	0	0	3	40	60	100
7	HS	21	HS	Т	7 1		Human Values and Professional Ethics	3	0	0	3	40	60	100
							PRACTICALS							
8	PC	21	CS	L	7	1	Network Security Laboratory	0	0	2	1	60	40	100
							MANDATORY							
9	MC	21	MC	Т	0	8	Indian Constitution and Traditional Knowledge	2	0	0	0	100	0	100
							Total Credits for Sem	7			22			
	Semest	er		8										
SI.	egory		Cours	e Co	nde		Course Title	ŀ	lour Wee	s/ k	edit	Μ	ax. M	arks
No.	Cate	Course Code Course Title L T						Р	\mathbf{Cr}	CA	SE	Tot.		
							PRACTICALS							
1	PSI	21	CS	L	7	2	Internship	-	-	-	2	100	0	100
2	PSI	21	CS	L	8	1	Project work	0	0	20	10	40	60	100
						•	Total Credits for Sem	8			12			
							Total Credits				162			

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	Vertical II Full Stack Development	Vertical III Cloud Computing and Data Processing Technologies	Vertical IV Emerging Technologies	Vertical V Artificial Intelligence and Machine Learning	Vertical VI Networking and Cyber Security
Exploratory Data Analysis	Cloud Computing	Cloud Computing	Augmented Reality / Virtual Reality	Knowledge Engineering	Ad-hoc and Wireless Sensors Networks
Text and Speech Analytics	NoSQL Database	Distributed Computing	Human Computer Interaction	Text and Speech Analytics	Mobile Communication
Social Network Analysis	Service Oriented Architecture	Edge and Fog Computing	Graphical User Interface	Social Network Analysis	Ethical Hacking
Information Retrieval	UI/UX Design	Security and Privacy in cloud	Robotics	Prompt Engineering	Security and Privacy in Cloud
Data Warehousing and Data Mining	Devops	Devops and Site Reliability Engineering	Fintech and Block chain Technologies	Computer Vision	Software Defined Networks
Business Intelligence	Software Testing and Automation	Cloud Services Management	Game Development	Natural Language Processing	Cyber Forensics
Image and Video Analytics	Programming with JavaScript	Information Storage Management	3D Printing and Design	Cognitive Science and Analytics	Internet of Things
Recommender Systems	Python Web Development	Virtualization	Deep Learning	Deep Learning	Information Security

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V to VII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI & VII.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2018 ver.4.

	P	ROFESSIONAL ELECTIVE COUL	RSES	: V	ER	RTI(CAI	Ĵ		
S.	Course	Course Title	tegory	Pe	erioc Wee	ls / k	edits	Ma	ax. Ma	arks
INO	Code		Cai	L	Т	Р	Cr	CA	SE	Tot.
		Vertical I : Verticals for Data	Sciend	e						
1	21CSE11	Exploratory Data Analysis	PE	3	0	0	3	40	60	100
2	21CSE12	Text and Speech Analytics	PE	3	0	0	3	40	60	100
3	21CSE13	Social Network Analysis	PE	3	0	0	3	40	60	100
4	21CSE14	Information Retrieval	PE	3	0	0	3	40	60	100
5	21CSE15	Data Warehousing and Data Mining	PE	3	0	0	3	40	60	100
6	21CSE16	Business Intelligence	PE	3	0	0	3	40	60	100
7	21CSE17	Image and Video Analytics	PE	3	0	0	3	40	60	100
8	21CSE18	Recommender Systems	PE	3	0	0	3	40	60	100
		Vertical II : Verticals for Full Stack	Devel	opn	ient	1	1	1	1	
1	21CSE21	Cloud Computing	PE	3	0	0	3	40	60	100
2	21CSE22	NoSQL Database	PE	3	0	0	3	40	60	100
3	21CSE23	Service Oriented Architecture	PE	3	0	0	3	40	60	100
4	21CSE24	UI/UX Design	PE	3	0	0	3	40	60	100
5	21CSE25	Devops	PE	3	0	0	3	40	60	100
6	21CSE26	Software Testing and Automation	PE	3	0	0	3	40	60	100
7	21CSE27	Programming with JavaScript	PE	3	0	0	3	40	60	100
8	21CSE28	Python Web Development	PE	3	0	0	3	40	60	100
	Verti	cal III : Verticals for Cloud Computing and D	ata P	roce	ssin	g Te	chno	logies	1	r
1	21CSE21	Cloud Computing	PE	3	0	0	3	40	60	100
2	21CSE31	Distributed Computing	PE	3	0	0	3	40	60	100
3	21CSE32	Edge and Fog Computing	PE	3	0	0	3	40	60	100
4	21CSE33	Security and Privacy in cloud	PE	3	0	0	3	40	60	100
5	21CSE34	Devops and Site Reliability Engineering	PE	3	0	0	3	40	60	100
6	21CSE35	Cloud Services Management	PE	3	0	0	3	40	60	100
7	21CSE36	Information Storage Management	PE	3	0	0	3	40	60	100
8	21CSE37	Virtualization	PE	3	0	0	3	40	60	100
		Vertical IV : Verticals for Emerging	Tech	nolo	gies		-			
1	21CSE41	Augmented Reality / Virtual Reality	PE	3	0	0	3	40	60	100
2	21CSE42	Cyber Security	PE	3	0	0	3	40	60	100
3	21CSE43	User Interface Design	PE	3	0	0	3	40	60	100
4	21CSE44	Robotics	PE	3	0	0	3	40	60	100
5	21CSE45	Block chain Technologies and Fintech	PE	3	0	0	3	40	60	100
6	21CSE46	Game Development	PE	3	0	0	3	40	60	100

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3	0	3	40	60	100
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3	0	3	40	60	100
3	0	3	40	60	100
3	0	3	40	60	100
3	0	3	40	60	100
y	curity	7			
3	0	3	40	60	100
3	0	3	40	60	100
3	0	3	40	60	100
3	0	3	40	60	100
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LIST OF OPEN ELECTIVES OFFERED BY THE DEPARTMENTS

SI.	gory	Course Code			J.		Course Title	F	Iour Wee	s / k	dit	Ma	ax. Ma	rks
No.	Cate		OFFERED 1 IT O 0 1				Course Title	L	Т	Р	Cre	CA	SE	Tot.
	1		()FFI	ERF	CD B	BY DEPARTMENT OF INFORMATION TEC	CHN	OL	OGY				1
1	OE	21	IT	0	0	1	Basics of Java Programming	3	0	0	3	40	60	100
2	OE	21	IT	0	0	2	Ethical Hacking	3	0	0	3	40	60	100
3	OE	21	IT	0	0	3	E-Commerce and Applications	3	0	0	3	40	60	100
4	OE	21	IT	0	0	4	Basics of Android Application Development	3	0	0	3	40	60	100
5	OE	21	IT	0	0	5	Principles of Data Science	3	0	0	3	40	60	100
				OFF	ER	ED I	BY DEPARTMENT OF BIO MEDICAL ENG	GINF	ER	ING				
1	OE	21	BM	0	0	1	Biotelemetry	3	0	0	3	40	60	100
2	OE	21	BM	0	0	2	Virtual Instrumentation	3	0	0	3	40	60	100
3	OE	21	BM	0	0	3	Biometric systems and their applications	3	0	0	3	40	60	100
4	OE	21	BM	0	0	4	Medical Robotics	3	0	0	3	40	60	100
5	OE	21	BM	0	0	5	Healthcare Management Systems	3	0	0	3	40	60	100
					OF	FER	RED BY DEPARTMENT OF CIVIL ENGINE	ERI	NG					
1	OE	21	CE	0	0	1	Civil and Infrastructure Engineering	3	0	0	3	40	60	100
2	OE	21	CE	0	0	2	Environmental Pollution and waste management	3	0	0	3	40	60	100
3	OE	21	CE	0	0	3	Disaster Management and Mitigation	3	0	0	3	40	60	100
4	OE	21	CE	0	0	4	Building Services	3	0	0	3	40	60	100
		(OFFEF	RED	BY	DE	PARTMENT OF COMPUTER SCIENCE AN	D E	NGI	NEE	RING			
1	OE	21	CS	0	0	1	Cyber Security	3	0	0	3	40	60	100
2	OE	21	CS	0	0	2	Web Designing	3	0	0	3	40	60	100
3	OE	21	CS	0	0	3	Knowledge Management	3	0	0	3	40	60	100
4	OE	21	CS	0	0	4	Green Computing	3	0	0	3	40	60	100
5	OE	21	CS	0	0	5	Principles of Artificial Intelligence	3	0	0	3	40	60	100
		OFF	ERED	BY	DEI	PAR	TMENT OF ELECTRICAL AND ELECTRO	ONIC	CS E	NGI	NEER	ING		
1	OE	21	EE	0	0	1	PLC and SCADA	3	0	0	3	40	60	100
2	OE	21	EE	0	0	2	Renewable Energy Sources	3	0	0	3	40	60	100
3	OE	21	EE	0	0	3	Embedded Real Time System	3	0	0	3	40	60	100
4	OE	21	EE	0	0	4	Energy Auditing and Conservation	3	0	0	3	40	60	100
5	OE	21	EE	0	0	5	Electric Vehicles	3	0	0	3	40	60	100
	0	FFER	ED BY	' DE	PAI	RTN	IENT OF ELECTRONICS AND COMMUNI	CAT	IOI	N EN	GINE	ERING	ſ	
1	OE	21	EC	0	0	1	Automotive Electronics	3	0	0	3	40	60	100
2	OE	21	EC	0	0	2	SCILAB for Engineers	3	0	0	3	40	60	100

SI.	Sl. Sl. Course Code						Course Title		Hours / Week		edit	Max. Marks		
No.	Cate		Course		ae		Course Thie	L	Т	Р	Cre	CA	SE	Tot.
3	OE	21	EC	0	0	3	Satellite Applications	3	0	0	3	40	60	100
4	OE	21	EC	0	0	4	Consumer Electronics	3	0	0	3	40	60	100
5	OE	21	EC	0	0	5	Principles of Communication Engineering	3	0	0	3	40	60	100
6	OE	21	EC	0	0	6	Microcontroller based System Design	3	0	0	3	40	60	100
	I	1	(OFF	ERI	ED I	BY DEPARTMENT OF MECHANICAL ENG	SINE	ER	ING			1	
1	OE	21	ME	0	0	1	Industrial Instrumentation	3	0	0	3	40	60	100
2	OE	21	ME	0	0	2	Product Design and Development	3	0	0	3	40	60	100
3	OE	21	ME	0	0	3	Sustainable Manufacturing	3	0	0	3	40	60	100
4	OE	21	ME	0	0	4	Entrepreneurship Development	3	0	0	3	40	60	100
5	OE	21	ME	0	0	5	Fundamentals of Ergonomics	3	0	0	3	40	60	100
6	OE	21	ME	0	0	6	Principles of Management and Industrial Psychology	3	0	0	3	40	60	100
7	OE	21	ME	0	0	7	Safety Measures for Engineers	3	0	0	3	40	60	100
	-	-	-	0	FFE	RE	D BY DEPARTMENT OF MEDICAL ELEC	ГRO	NIC	S			-	
1	OE	21	MD	0	0	1	Introduction to Medical Electronics	3	0	0	3	40	60	100
2	OE	21	MD	0	0	2	Hospital Waste Management	3	0	0	3	40	60	100
3	OE	21	MD	0	0	3	Hospital Information System	3	0	0	3	40	60	100
4	OE	21	MD	0	0	4	IoT Applications in Healthcare	3	0	0	3	40	60	100
							OFFERED BY DEPARTMENT OF S&H							
1	OE	21	GE	0	0	1	National Cadet Corps Studies – I	3	0	0	3	40	60	100
2	OE	21	GE	0	0	2	National Cadet Corps Studies – II	3	0	0	3	40	60	100

Sl.	egory		Cours	e Co	ode		Course Title			s / k	edit.	Max. Marks			
No.	Cat							L	Т	Р	C	CA	SE	Tot.	
	-	-	-				VALUE ADDED COURSES	-					-		
1	VAC	21	CS	v	0	1	R Programming	0	0	2	1	100	0	100	
2	VAC	21	CS	v	0	2	Go Lang	0	0	2	1	100	0	100	
3	VAC	21	CS	v	0	3	Type Script	0	0	2	1	100	0	100	
4	VAC	21	CS	v	0	4	Raspberry Pi	0	0	2	1	100	0	100	
5	VAC	21	CS	v	0	5	Practical Machine Learning with Tensorflow	0	0	2	1	100	0	100	
6	VAC	21	CS	v	0	6	Power BI	0	0	2	1	100	0	100	

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

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

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI
Fintech and Block Chain	Entrepreneurship	Public Administration	Business Data	Environmental	Artificial Intelligence
DIOCK Chain		rummstration	7 mary ties	Sustainability	Intelligence
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development	Introduction to Data Science
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Data mining for Business Intelligence	Sustainable Agriculture and Environmental Management	Principles of Artificial Intelligence
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials	Data Warehousing and Data Mining
Introduction to Blockchain and its Applications	Principles of Marketing Management For Business	Administrative Theories	Digital Marketing and Social Network Analytics	Materials for Energy Sustainability	Machine Learning Techniques
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Supply Chain Analytics	Green Technology	Expert Systems
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis	Cognitive Science
-	-	-	-	Integrated Energy Planning for Sustainable Development	Gamification
-	-	-	-	Energy Efficiency for Sustainable Development	-

		MINOR DEGREE COURSES: VEI	RTICA	LS						
S.	Course Code	Course Title	gory	H V	ours Veel	s / k	dits	Ma	ıx. Ma	arks
No	course coue		Cate	L	Т	Р	Cre	CA	SE	Tot.
		VERTICAL I- FINTECH AND BLOCK	CHAI	N						
1	21ITM11	Financial Management	PE	3	0	0	3	40	60	100
2	21ITM12	Fundamentals of Investment	PE	3	0	0	3	40	60	100
3	21ITM13	Banking, Financial Services and Insurance	PE	3	0	0	3	40	60	100
4	21ITM14	Introduction to Blockchain and its Applications	PE	3	0	0	3	40	60	100
5	21ITM15	Fintech Personal Finance and Payments	PE	3	0	0	3	40	60	100
6	21ITM16	Introduction to Fintech	PE	3	0	0	3	40	60	100
		VERTICAL II - ENTREPRENEUR	SHIP		1					
1	21MEM21	Foundations of Entrepreneurship	PE	3	0	0	3	40	60	100
2	21MEM22	Team Building & Leadership Management for Business	PE	3	0	0	3	40	60	100
3	21MEM23	Creativity & Innovation in Entrepreneurship	PE	3	0	0	3	40	60	100
4	21MEM24	Principles of Marketing Management for Business	PE	3	0	0	3	40	60	100
5	21MEM25	Human Resource Management for Entrepreneurs	PE	3	0	0	3	40	60	100
6	21MEM26	Financing New Business Ventures	PE	3	0	0	3	40	60	100
-		VERTICAL III – PUBLIC ADMINIST	RATIO	N	~					100
1	21ECM31	Principles of Public Administration	PE	3	0	0	3	40	60	100
2	21ECM32	Constitution of India	PE	3	0	0	3	40	60	100
3	21ECM33	Public Personnel Administration	PE	3	0	0	3	40	60	100
4	21ECM34	Administrative Theories	PE	3	0	0	3	40	60	100
5	21ECM35	Indian Administrative System	PE	3	0	0	3	40	60	100
6	21ECM36	Public Policy Administration	PE	3	0	0	3	40	60	100
		VERTICAL IV - BUSINESS DATA ANA	ALYTI	CS					1	
1	21CSM41	Statistics for Management	PE	3	0	0	3	40	60	100
2	21CSM42	Data mining for Business Intelligence	PE	3	0	0	3	40	60	100
3	21CSM43	Human Resource Analytics	PE	3	0	0	3	40	60	100
4	21CSM44	Digital Marketing and Social Network Analytics	PE	3	0	0	3	40	60	100
5	21CSM45	Supply Chain Analytics	PE	3	0	0	3	40	60	100
6	21CSM46	Financial Analytics	PE	3	0	0	3	40	60	100

		VERTICAL V - ENVIRONMENTAL AND SU	STAIN	ABII	JTY					
1	21CEM51	Sustainable infrastructure Development	PE	3	0	0	3	40	60	100
2	21CEM52	Sustainable Agriculture and Environmental Management	PE	3	0	0	3	40	60	100
3	21CEM53	Sustainable BioMaterials	PE	3	0	0	3	40	60	100
4	21CEM54	Materials for Energy Sustainability	PE	3	0	0	3	40	60	100
5	21CEM55	Green Technology	PE	3	0	0	3	40	60	100
6	21CEM56	Environmental Quality Monitoring and Analysis	PE	3	0	0	3	40	60	100
7	21CEM57	Integrated Energy Planning for Sustainable Development	PE	3	0	0	3	40	60	100
8	21CEM58	Energy Efficiency for Sustainable Development	PE	3	0	0	3	40	60	100
		VERTICAL VI - ARTIFICIAL INTEL	LIGEN	CE						
1	21CSM61	Introduction to Data Science	PE	3	0	0	3	40	60	100
2	21CSM62	Principles of Artificial Intelligence	PE	3	0	0	3	40	60	100
3	21CSM63	Data Warehousing and Data Mining	PE	3	0	0	3	40	60	100
4	21CSM64	Machine Learning Techniques	PE	3	0	0	3	40	60	100
5	21CSM65	Expert Systems	PE	3	0	0	3	40	60	100
6	21CSM66	Cognitive Science	PE	3	0	0	3	40	60	100
7	21CSM67	Gamification	PE	3	0	0	3	40	60	100

		VALUE ADDED COURSES	5							
s.	Course	Course Title	egory	Pe	eriod Weel	ls / k	edits	Ma	x. Ma	rks
No	Code		Cat	L	Т	Р	Cre	CA	SE	Tot.
1	21CSV01	RProgramming	VAC	0	0	2	1	100	0	100
2	21CSV02	GoLang	VAC	0	0	2	1	100	0	100
3	21CSV03	TypeScript	VAC	0	0	2	1	100	0	100
4	21CSV04	RaspberryPi	VAC	0	0	2	1	100	0	100
5	21CSV05	PracticalMachineLearningwithTensorflow	VAC	0	0	2	1	100	0	100
6	21CSV06	Power BI	VAC	0	0	2	1	100	0	100

		MANDATORY COURS	SES							
S.	Course	Course Title	tegory	Pe V	riod Vee	ls / k	edits	Ma	x. Ma	arks
INO	Code		Cat	L	Т	Р	Cr	CA	SE	Tot.
1	21MCL11	Universal Human Values - 1	MC	1	0	1	0	100	0	100
2	21MCT02	Environmental Science and Engineering	MC	2	0	0	0	100	0	100
3	21MCL03	Essential English for Professionals	MC	0	0	2	0	100	0	100
4	21MCL04	Professional Communication	MC	0	0	2	0	100	0	100
5	21MCT05	Aptitude and Logical Reasoning	MC	2	0	0	0	100	0	100
6	21MCL09	Communication Skills Laboratory	MC	0	0	2	0	100	0	100
7	21MCT07	Arithmetic and Analytical Ability	MC	2	0	0	0	100	0	100
8	21MCT08	Indian Constitution and Traditional Knowledge	MC	2	0	0	0	100	0	100

L - Lecture Period

T - Tutorial Period

P - Practical Period

CA - Continuous Assessment

SE - Semester Examination

Tot - Total Marks

Category	Credits	Minimum contact periods per week	1 Derived = 50
Theory	3	4	I Period = 50 Minutes duration
-	4	5	Windle's duration
Practical	1	3	

COMMUNICATIVE ENGLISH-I

(Common to all B.E / B.Tech.programmes in First Semester)

Preamble:

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Communicative English-I aims at developing Communication Skills in English essential for the learner to handle English language for a variety of everyday purposes through acquisition of basic grammar and vocabulary along with necessary listening, speaking, reading and writing skills.

Course Outcomes: Upon completion of the course, students will be able to :

- 1. Converse fluently with Business and British American vocabulary.
- 2. Write and edit given informal writing tasks without grammatical errors.
- 3. Write clear, coherent and organized informal passages adhering to the rules of different types of descriptive writing.
- 4. Identify without mistakes general and specific ideas while listening and reading a given excerpt.
- 5. Give extemporaneous clear, fluent descriptive and grammatically correct short informal narrations and actively participate in discussions with fellow members.

UNIT 1 VOCABULARY

Synonyms and Antonyms- Single Word Substitutes - Use of Abbreviations and Acronyms-Homonyms and Homophones- Business Vocabulary - Commonly Confused Words- Collocation - British and American Vocabulary-Word formation

UNIT 2 GRAMMAR

Comparative Adjectives- Modals -Phrasal Verbs -Tenses – Connectives-Impersonal Passive Voice -Types of Questions -Mechanics of Writing (Editing) -Direct and Indirect Speech- Numerical Adjectives - Gerunds and Infinitives-Expressions of Purpose- Conditional Sentences- Same Word Used as Different Parts of Speech – SubjectVerb Agreement

UNIT 3 INFORMAL WRITING

Letter Writing - Informal Letters - Dialogue Writing -Informal Dialogues – Essay Writing-Informal Essays Movie/Book Reviews

UNIT 4 LANGUAGE ENHANCEMENT THROUGH LISTENING& READING

Listening Comprehension -Listening for General Ideas- Listening to You Tube Documentaries - Listening for Specific Information- Listening for Details-Listening for Vocabulary-BBC Learn English Videos -Reading Comprehension-Understanding General and Specific Information -Sign Post Words-Jumbled Sentences - Finding Topic Sentences and Supporting Arguments - Reading for Vocabulary-Reading News Papers

UNIT 5 LANGUAGE ENHANCEMENT THROUGH SPEAKING

Introduction to IPA-Syllable, Stress, Intonation, etc., -Conversation Starters- Describing Places, People, Things and Pictures -Self Introduction - Narrating Personal Experiences and Incidents-Informal Group Discussions

TOTAL:45PERIODS

TEXT BOOKS:

- 1. Sanjay KumarandPushp Lata, "Communication Skills" 2nd Edition, Oxford University Press, New Delhi, 2017.
- Raman, Meenakshi and Sangeetha Sharma, "Technical Communication: English Skills for Engineers", 1st Edition, Oxford University Press, New Delhi. 2008.

REFERENCES:

- Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", 1st Edition, Orient Black Swan, Chennai. 2012
- 2. Dhanavel, S.P, "English and Communication Skills for Students of Science and Engineering", 1st Edition, Orient Black Swan, Chennai. 2011
- 3. Rizvi, Ashraf. M, "Effective Technical Communication", 2st Edition, Tata McGraw-Hill, New Delhi, 2018.

e-RESOURCES:

- 1. https://learnenglish.britishcouncil.org/intermediate-vocabulary
- 2. https://learnenglish.britishcouncil.org/intermediate-grammar http://www.usingenglish.com https://www.khanacademy.org/humanities/grammar
- 3 http://learnenglishteens.britishcouncil.org/skills/writing/advanced-c1-writing/informal-email-or-letter
- 4 http://learnenglishteens.britishcouncil.org/skills/reading
- 5 https://learnenglish.britishcouncil.org/speaking

6

LTPC

3 0 0 3

5

9

16

9

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	3	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO5	-	1	-	-	-	1	-	-	1	3	-	1	-	-

21MAT11

ENGINEERING MATHEMATICS I

Preamble:

The course aims at achieving conceptual understanding of topics such as Matrix Algebra and Calculus. The syllabus is designed to provide the skills for modeling engineering problems and understand the role of single variable and multivariables in the discipline of engineering and computer science.

Course Outcomes: Upon completion of the course, students will be able to:

- Evaluate Eigenvalues, eigenvectors and diagonalization of symmetric matrices. 1.
- 2. Use limit definition, understand differentiation and integration methods.
- 3. Compute curvature, centre of curvature, evolute and envelope of curves.
- 4. Express functions of two variables in Taylor's series and compute Jacobians, maximum and minimum values.

5. Apply multiple integrals to determine area in cartesian and polar coordinates and volume in cartesianco ordinates. 9+3

MATRICES UNIT 1

Characteristic equation - Eigen values and Eigenvectors of a real matrix - Properties of Eigenvalues and Eigenvectors – Statement and application of Cayley Hamilton Theorem – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT 2 CALCULUS

Representation of functions – Mathematical Models – New Functions from Old Functions – Graphing Calculators and Computers – The Limit of a Function – Calculating Limits Using the Limit Laws – Continuity – Exponential Growth and Decay – Hyperbolic Functions – Areas and Distances – The Definite Integral – The Fundamental Theorem of Calculus – Improper Integrals.

GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS UNIT 3

Curvature – Radius, Centre and Circle of curvature in Cartesian and Parametric form - Evolute – Envelope of family of curves with one and two parameters – Evolute as the envelope of normals – Properties of Evolute and Envelope.

FUNCTIONS OF SEVERAL VARIABLES UNIT 4

Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian- Properties – Taylor's series expansion for functions of two variables - constrained Maxima and Minima - Lagrange's multipliers with single constraint.

MULTIPLE INTEGRALS UNIT 5

Double integrals in Cartesian and Polar co ordinates- Change of order of Integration - Change of variables from Cartesian to Polar co ordinates – Area as a double integral in Cartesian and Polar form – Volume as a triple integral in Cartesian co ordinates

TEXT BOOKS:

- Grewal B.S., "Higher Engineering Mathematics" 43rd Edition, Khanna Publishers, New Delhi, 2014. 1.
- James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. 2. [Sections 1.1, 1.2, 1.3, 1.4, 2.2, 2.3, 2.5, 3.8, 3.11, 5.1, 5.2, 5.3 and 7.8].

REFERENCES:

- 1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 26th Reprint, New Delhi, 2016
- Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016. 2.
- 3. N.P.Bali, ManishGoyal, "Engineering Mathematics", Lakshmi Publications (PVT) Ltd, 4 th edition, 2014

e-RESOURCES:

- http://nptel.ac.in/courses/111105035/"Advanced Engineering Mathematics", Prof. PratimaPanigrahi, Indian 1. Institute of Technology, Kharagpur
- http://nptel.ac.in/courses/122104017/ "Mathematics-I", Prof. S.K. Ray, Indian Institute of Technology, Kanpur 2.

9+3

TOTAL : 60 PERIODS

9+3

9+3

9+3

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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	-	-

21PHT11

ENGINEERING PHYSICS

9

9

9

Preamble:

Ultrasonics forms the basis of Sonar and in the field of medicine for both diagnostics and therapeutic applications. Mechanical properties of Engineering materials are explored for industrial applications such as construction of bridges and railway wagons. Particle and wave nature of quantum particles form the basis of quantum computers . The virtues of lasers are explored in applications such as holography, computers, space satellites and medicines.

Course Outcomes: Upon completion of the course, students will be able to:

- Demonstrate the knowledge of wave optics in propagation of light waves in optical fibers in communications system. 1
- 2 Explain the production of Ultrasonics and its NDT techniques in scanning methods, medical applications.
- 3 Describe the Elastic property of solid materials and thermal conductivity of solids in industrial applications.
- 4 Explore the dual nature of light waves with quantum theory on Black body radiation and Schrodinger's wave equations.
- 5 Demonstrate the knowledge on Nd-YAG, CO₂, Semiconductor lasers in industrial applications of welding, heat treatment, cutting, medical treatment and holography.

UNIT 1 WAVES AND OPTICS

Classification of waves-wave equation-(qualitative)-Typical and General wave equation-qualitative analysis of phase and group velocities of waves-Differential equation of simple harmonic motion-Forced oscillations -analysis and classification of damped oscillations through differential equations-coherent sources and incoherent sources. Superposition principle of Waves- Illustrations-Principle and propagation of light in optical fibers-numerical aperture and acceptance angle-Types of optical fibers (material, refractive index, mode-Application of optical fibers.

UNIT 2 **ULTRASONICS**

Introduction – Production techniques – Magnetostriction effect – Piezoelectric effect - Piezoelectric generator- detection of ultrasonic waves - properties - cavitations - velocity measurement - acoustic grating - Industrial applications drilling, welding, soldering and cleaning – SONAR - non destructive testing – pulse echo system, through transmission and reflection modes - A,B and C scan - medical applications - sonograms. 9

MECHANICAL AND THERMAL PROPERTIES UNIT 3

Elasticity – Stress-strain diagram and its uses – factors affecting elastic modulus and tensile strength. Torsional stress and deformations – twisting couple – torsion pendulum: theory and experiment – bending of beams. Bending moment – cantilever, Young's Modulus by Uniform and non-uniform bending: theory and experiment – I-shaped girders. Modes of heat transfer -thermal conductivity- Specific heat-Newton's law of cooling - Forbe's and Lee's disc method: theory and experiment- thermal insulation - applications: heat exchangers, refrigerators, ovens and solar water heaters

UNIT 4 **MODERN PHYSICS**

Wave- particle duality, de-Broglie matter waves, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications, Black body radiation – Planck's theory (derivation) – deduction of Wien's displacement law and Rayleigh – Jeans' law from Planck's theory — Matter waves - concept of operator-Eigen value and Eigen function- Physical significance of wave function -Schrodinger's time independent wave equation — Particle in a one dimensional box ,qualitative explanation on wave equation and energy value in three dimensional box. 9

UNIT 5 LASER

Introduction – principle of spontaneous emission and stimulated emission, population inversion, pumping. Einstein's coefficients - derivation. Types of lasers- Nd-YAG-CO₂, Semiconductor lasers (homojunction&heterojunction) -

Industrial applications - lasers in welding, heat treatment, cutting- medical applications- holography-construction and reconstruction-Safety classes of laser. **TOTAL : 45 PERIODS**

TEXT BOOKS

Gaur R.K. and Gupta S.L., "Engineering Physics", 8th Edition, DhanpatRai publishers, 2009. 1.

Mani Naidu S., "Engineering Physics", 2nd Edition, Pearson Publishing, 2011. 2.

REFERENCES

- Serway and Jewett, "Physics for Scientists and Engineers with Modern Physics", 9th Edition, Thomson Brooks Cole, 2013 1.
- Young H.D., Freedman R.A. and Ford A.L., "Sears and Zemansky's University Physics with Modern Physics", 13th Edition, 2. Pearson India, 2013.
- Tipler P.A. and Mosca G.P., "Physics for Scientists and Engineers with Modern Physics", 6th Edition, W.H.Freeman, 2007. 3. e-RESOURCES:
- http://nptel.ac.in/courses/115101003, "Atomic and Molecular Physics" Dr. T. Kundu, IIT Bombay. 1.
- https://www.khanacademy.org/science/physics/quantum-physics 2.

COs/P Os	РО 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 0 1	PS O 2
CO1	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO2	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO3	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO4	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO5	3	2	1	1	1	1	1	-	-	1	1	1	-	-

21CYT11

ENGINEERING CHEMISTRY

Preamble:

The study of water technology enables engineers to acquire skills to make the simple design calculation of drinking water as well as industrial water treatment. Electrochemistry and corrosion explain the fundamentals, corrosion prevention, identification and implementation for solving electrochemical and corrosion problems. The study of energy storage devices exposes some of the most commonly used energy storage technologies. Instrumental methods and analysis describe basic concepts and promote to solve real analytical problems. Studies of Nanochemistry span many areas as assemblies significant new structures like nanowire, nanotube and lab-in-chip devices.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Evaluate the process to purify hardwater using ion-exchange, zeolite and reverse osmosis methods
- 2. Compare and contrast corrosion control methods and analyze the performance of alkaline, lead acid and fuel cells.
- 3. Analyze the metal ion concentration for solid and liquid samples with the aid of flamephotometry, colorimetry, UV and IR spectroscopy
- 4. Categorize different types of polymers to select injection or compression fabrication method
- 5. Analyze the synthesis of nanoparticles using top down and bottom up process

UNIT 1 WATER TECHNOLOGY

Hardness – types, estimation by EDTA method, Boiler troubles – scale, sludge, priming, foaming, caustic embrittlement and boiler corrosion, Internal conditioning - carbonate, phosphate and calgonconditioning, External conditioning – zeolite and demineralisation process, Desalination – reverse osmosis method.

UNIT 2 ELECROCHEMISTRY AND CORROSION

Electrochemistry –cell terminology, EMF series. Corrosion – chemical (corrosion by O_2 , H_2 and liquid-metal) and electrochemical corrosion (H_2 evolution and absorption of O_2), Corrosion control – sacrificial anode, Impressed current method and electroless plating. Application of electrochemistry-primary battery (alkaline battery), secondary battery (lead acid battery) and fuel cell (H_2 - O_2 fuel cell)

UNIT 3 INSTRUMENTAL METHODS AND ANALYSIS

Basic principles – Beer-lamberts law, instrumentation with block diagram and applications of calorimetry (estimation of Fe^{2+}), UV-Visible spectroscopy, infrared spectroscopy and flame photometry (estimation of sodium).

UNIT 4 HIGH POLYMERS

Polymers – classification (based on molecular forces-thermoplastics and thermosetting plastics), polymerisation – types, mechanism (Free radical only),Compounding and fabrication – compression, injection, Composites-definition, types, polymer matrix composites-FRP only.

Real time applications of thermoplastics (PVC, Teflon), thermosetting plastics (nylon, epoxy resin)

UNIT 5 NANOCHEMISTRY

Basics – distinction between molecules, nanoparticles and bulk materials, Nanoparticles – nano cluster, nano rod, nanotube (CNT) and nanowire, Synthesis – top down process (laser ablation and electro-deposition),bottom up process (thermolysis – hydrothermal, solvothermal), Nanoparticles – properties and applications.

TEXT BOOKS:

- 1. P.C Jain and Monika Jain, "Engineering Chemistry", 16thedition,DanpatRai publishing company (P) Ltd, New Delhi, 2015
- 2. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, "Engineering Chemistry", 3rd edition. PHI Learning PVT., LTD, New Delhi, 2014.

REFERENCES:

- 1. S.S.Dara, "A Text book of Engineering Chemistry", 12th Edition, S.Chand& Company Ltd., New Delhi, 2010.
- 2. "Engineering chemistry", 2nd edition, Wiley India private Ltd. New Delhi, 2014.
- 3. V.R.Gowariker, N.V.Viswanathan and Jayadevsreedhar, "Polymer Science" 2nd edition, New age International publishers, New Delhi, 2015.

e-RESOURCES:

- 1. http://nptel.ac.in/courses/113104061/, "Environmental Degradation of Materials" Dr.KallolMondal, Department of Metallurgy and Material Science, IIT Kanpur
- 2. http://nptel.ac.in/courses/113105028/, "Science and Technology of Polymers"- Prof.B.Adhikari, Department of Metallurgical & Materials Engineering,IITKharagpur

TOTAL: 45 PERIODS

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L T P C 3 0 0 3

COs/POs	PO	PO	PO	PO	PO	РО	PO	PO	PO	РО	РО	PO	PSO	PSO
003/103	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1	1	1	2	-	1	1	1	1	-	-
CO2	3	2	2	1	1	1	2	-	1	1	1	1	-	-
CO3	3	2	1	2	1	1	1	-	1	1	1	1	-	-
CO4	3	1	2	1	1	1	2	-	1	1	1	1	-	-
CO5	3	2	1	2	1	1	1	-	1	1	1	1	-	-

PYTHON PROGRAMMING Common to BE / B.Tech. BM, CS, EC, EE, IT & MDE

Preamble:

Python is easy to use, powerful, and versatile, making it a great choice for beginners and experts alike. Python's readability makes it a great first programming language — it allows you to think like a programmer and not waste time understanding the mysterious syntax that other programming languages can require. The syntax in Python helps the programmers to do coding in fewer steps. Python is widely used in bigger organizations because of its multiple programming paradigms.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Develop algorithms, flowcharts and write Python programs using decision control statements for solving given problems.
- 2. Apply list, set for solving a given problem using functions in python.
- 3. Develop modules and packages for solving problems using tuple and dictionary data structures in python.
- 4. Write python program using string handling features and object-oriented programming concepts
- 5. Identify the essential concepts involved in the design of a database and accessing, manipulating data in the file using SQL.

UNIT 1 COMPUTING & PYTHON PROGRAMMING

Introduction to digital computer - Problem Solving Strategies: Problem Analysis – Algorithms – Flowcharts – Examples of algorithms and flowcharts- Introduction to Python: Python Overview – Comments – Python Identifiers –Reserved Keywords –Variables – Standard Data Types – Operators – Statement and Expressions –Control Statements – Iteration – While statements

- Input from keyboard.

UNIT 2 FUNCTIONS, LIST AND SET

Introduction – Built-in functions – Composition of functions – User defined functions – Parameters and Arguments – Functioncalls – The return statement – Recursive functions – The anonymous functions. Lists-creating lists, traversing a list, Deleting elements from list, cloning list, list operations, list methods. Sets-creating sets, set operations.

UNIT 3 TUPLES, DICTIONARY, MODULES AND PACKAGES

Tuples- creating tuples, accessing values, tuple assignment, tuple as return values, operations on tuples, built-in tuple functions. Dictionary-creating, accessing, updating, Deleting elements from dictionary, operations and methods. Modules – Packages in Python – Standard library modules.

UNIT 4 STRINGS AND OOP Concepts

Strings: String Operations – Compound Data type – len function –String Slices – Strings are immutable – String Traversal – Escape Characters – String formatting operator – String formatting functions. Classes and objects: Overview of OOP – Class definition – creating objects – objects as arguments – objects as return values- Built-in class attributes – inheritance – method overriding – data encapsulation – data hiding.

UNIT 5 FILES AND BASIC DATABASE OPERATIONS

File: Types of files – opening, closing, reading and writing files. Purpose of database system - Data model - Creating DBmaking table - Adding Data - Querying DB - Database in the real world - Using SQL in Databases - Sorting – Getting unique item - updating records - Deleting records.

TEXT BOOKS:

- 1. E Balagurusamy," Problem Solving and Python Programming", McGraw Hill Education, 2018
- 2. Katie Cunningham, "Teach yourself python", Pearson Education, 2014

REFERENCES:

- 1. Reema Thareja, "Python Programming using Problem Solving Approach", Oxford University Press, 2017.
- 2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
- 3. Guido van Rossum and Fred L.Drake Jr, "An Introduction to Python Revised and updated for Python 3.2", Network theory ltd., 2011.
- 4. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press, 2013.
- 5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Interdisciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.

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TOTAL: 45 PERIODS

e-RESOURCES:

- 1. https://swayam.gov.in/course/4178-spoken-tutorial-python-english, "Introduction to Python", Prof. Prabhu Ramachandran, IIT Bombay.
- 2. https://onlinecourses.nptel.ac.in/noc18_cs21, "Programming, Data Structures and Algorithms Using Python", Prof. Madhavan Mukund, IIT-Bombay.

COs/P Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	-	-
CO2	3	2	2	2	1	-	-	-	-	-	-	1	-	-
CO3	3	2	2	2	1	-	I	-	-	-	-	1	-	-
CO4	3	2	2	2	1	-	-	-	-	-	-	1	-	-
CO5	3	2	2	2	1	-	-	-	-	-	-	1	-	-

Mapping of COs with POs and PSOs

21MEC11

ENGINEERING GRAPHICS

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Preamble:

The knowledge of Engineering graphics is essential for the Engineering graduates in proposing new product designs through drawings and interpreting data from existing drawings. Engineering Design inculcates into an Engineer the creativity and knowledge on various aspects to be considered while designing and realizing the functional products and processes. This course deals with Engineering curves, orthographic and pictorial projections, sectional views and development of surfaces.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Draw the various conic sections and Engineering curves.
- 2. Sketch the orthographic views from given pictorial views and projections of lines.
- 3. Draw the projections of planes and solids kept in various positions.
- 4. Sketch sectioned views of solids and development of surfaces.
- 5. Draw the isometric and perspective projections of simple solids.

UNIT 1 INTRODUCTION AND PLANE CURVES

Importance of graphics in Engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lines, lettering and dimensioning-Basic geometrical constructions. (PRACTICE ONLY AND NOT FOR EXAMINATIONS).

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 2 PROJECTION OF POINTS, LINES AND FREE HAND SKETCHING

Orthographic projection- principles-Principal planes-First angle projection- Projection of points in four quadrants - End point 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.

Visualization concepts- Free hand sketching – Conversion of Isometric view to orthographic views.

UNIT 3 PROJECTION OF PLANE SURFACES AND SOLIDS

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Projection of simple solids- Cube, prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane and parallel to the other by rotating object method.

UNIT 4 SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

Sectioning of above solids in simple vertical position when cut by a cutting plane which is inclined to one of the reference planes and perpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids in simple vertical position – Cube, prisms, pyramids, cylinder and cone.

UNIT 5 ISOMETRIC AND PERSPECTIVE PROJECTIONS

Principles of isometric projection – Isometric scale –Isometric projections of simple solids - Prisms, pyramids, cylinder and cone- Combination of two solid objects in simple vertical position.

Perspective projection of simple solids-Cube, prisms, pyramids, cylinder and cone, by visual ray method when axis is either parallel or perpendicular to ground plane.

TEXT BOOKS:

1 Venugopal K and Prabhu Raja V., "Engineering Graphics", New Age International (P) Ltd, 13th Edition, 2015.

2 Jeyapoovan T., "Engineering Graphics with AUTOCAD", Vikas Publishing House Pvt., Ltd., 7th Edition, 2015.

REFERENCES:

- 1 Bhatt N.D., Panchal, V.M. and Ingle P.R., "Engineering Drawing", Charotar Publishing House Pvt. Ltd., 53rd Edition, 2014.
- 2 Parthasarathy N.S. and Vela Murali, "Engineering Drawing", Oxford University Press, 1st Edition, Second Impression 2015.
- 3 LuzzaderW.J. and Duff J.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.

TOTAL : 60 PERIODS

e-RESOURCES:

- 1. http://nptel.ac.in/courses/105104148, "Engineering Graphics" Dr. NiharRanjanPatra , IIT Kanpur
- 2. http://cfd.annauniv.edu/webcontent.htm, "Engineering Graphics" Dr. Velamurali

Cos/POs	РО 1	PO 2	PO 3	PO 4	РО 5	PO 6	РО 7	PO 8	PO 9	PO 10	РО 11	PO 12	PS 0 1	PS O 2
CO 1	3	2	1	-	-	-	-	-	-	2	-	1	-	-
CO 2	3	2	1	-	-	-	-	-	-	2	-	1	-	-
CO 3	3	2	1	-	-	-	-	-	-	2	-	1	-	-
CO 4	3	2	1	-	-	-	-	-	-	3	-	2	-	-
CO 5	3	2	1	-	-	-	-	-	-	3	-	2	-	-

Mapping of COs with POs and PSOs

Preamble:

In the present course related to the lab, understanding of physics concepts applied in optics, thermal and properties of matter has been developed. The necessary practical skills in the determination of water quality parameters and strength of acid has been explored.

Course Outcomes:

- 1. Experiment and determine the physical characteristics of given solid materials.
- 2. Experiment and determine the velocity of ultrasonic waves through water medium.
- 3. Experiment and determine the optical property of light sources.
- 4. Experiment and estimate hydroxyl, carbonate and bicarbonate alkalinity using HCl in water sample.
- 5. Experiment and determine the amount of total, temporary, permanent hardness of water using EDTA by complexometric titration.
- 6. Experiment and determine the amount of iron content present in the given sample using potentiometer, spectrophotometer and strength of acid using conductivity meter.

PHYSICS LABORATORY – I (Any Five Experiments)

LIST OF EXPERIMENTS

- 1. (a) Determination of Wavelength, and particle size using Laser
- 2. (b) Determination of acceptance angle in an optical fiber.
- 3. Determination of velocity of sound and compressibility of liquid Ultrasonic interferometer.
- 4. Determination of wavelength of mercury spectrum spectrometer grating
- 5. Determination of thermal conductivity of a bad conductor Lee's Disc method.
- 6. Determination of Young's modulus by Non uniform bending method
- 7. Determination of Planck's constant by photocell method

CHEMISTRY LABORATORY – I

LIST OF EXPERIMENTS

- 1. Determination of alkalinity in water sample
- 2. Determination of total, temporary and permanent hardness of water by EDTA method.
- 3. Determination of iron content of the water sample using spectrophotometer (1,10-phenanthroline /thiocyanate method).
- 4. Determination of iron content of the given solution using a potentiometer
- 5. Determination of strength of acid using conductivity meter.

TOTAL: 30 PERIODS

• Laboratory classes on alternate weeks for Physics and Chemistry.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	-	3	-	1	1	-	1	1	1	1	-	-
CO2	2	2	-	3	-	1	1	-	1	1	1	1	-	-
CO3	2	2	-	3	-	1	1	-	1	1	1	1	-	-
CO4	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO5	2	1	-	3	-	1	1	-	1	1	1	1	-	-

21CSL13

PYTHON PROGRAMMING LABORATORY

Preamble:

Python is a dynamic and powerful programming language that focuses on code readability. The Python language has diversified application in the software development companies such as in gaming, web frameworks and applications, language development, prototyping, graphic design applications, etc. This provides the language a higher plethora over other programming languages used in the industry.

Course Outcomes: Upon completion of the course, students will be able to:

- Create documents, presentation slides and perform data manipulations using Libre Office packages.
 Design flowcharts using Raptor.
- 2. Develop programs using expressions and Control statements in Python.
- Apply suitable data structure in Python for a real-world problem.
- 4. Develop programs using functions, OOP concepts, modules and packages for a given problem.
- Create and manipulate files and database connectivity using Python.

LIST OF EXPERIMENTS

- 1. Creating document, presentation slides and performing mathematical calculations using Libre Office packages.
- 2. Design flowchart using Raptor for the following problems:
 - Solving problems using algorithm and flowchart.
 - To find if a given year is a leap year or not. Any year which is divisible by 4 and not by 100 are leap years. Otherwise, any year which is divisible by 400 is also a leap year.
 - To find the sum of numbers divisible by 4. The flowchart must allow the user to accept a number and add it to the sum if it is divisible by 4. It should continue accepting numbers as long as the user wants to provide an input and should display the final sum.
- 3. Write a python programs for solving the problems:
 - All decision control statements.
 - An organization has decided to provide salary hike to its employees based on their job level. Employees can be in job levels 3, 4 or 5. In case of invalid job level, consider hike percentage to be 0. Given the current salary and job level, write a python program to find and display the new salary for 10 employees in the organization. Hike percentage based on job levels are given below:

Job level	Hike Percentage
3	15
4	7
5	5

- 4. Write a python program to find the list of 'n' prime numbers using functions.
- 5. Write a python program to implement list, set, tuple and dictionary.
- 6. Write a python program by defining a user defined module leap. Import the module and find whether a given year is leap year or not.
- 7. Write a python program to perform the arithmetic operations using packages.
- 8. Write a python Program to implement string handling functions.
- 9. Write a python program to implement object-oriented concepts.
- 10. Write a python program to implement database connectivity.

TOTAL: 45 PERIODS

LTPC

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	-	-
CO2	3	2	2	2	1	-	-	-	-	-	-	1	-	-
CO3	3	2	2	2	1	-	-	-	-	-	-	1	-	-
CO4	3	2	2	2	1	-	-	-	-	-	-	1	-	-
CO5	3	2	2	2	1	-	-	-	-	-	-	1	-	-

TOTAL : 30 PERIODS

Preamble:

Universal Human Values is a life skill necessary for all to develop physical health and factors for strengthening life force. This course aims to expose the students in the areas of mediation and impart the knowledge on social virtues and morals.

Course Outcomes: Upon completion of the course, students will be able to:

- Demonstrate the knowledge on physical health 1.
- 2. Discuss the factors for strengthening life force
- Classify mind waves and explain the benefits of meditation 3.
- Explain individual and social virtues 4.
- Identify and explain the importance of morals. 5.

PHYSICAL HEALTH UNIT 1

SKY - Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for Youth Empowerment - Simplified Physical Exercises: Explanation - Hand, Leg, Breathing and Eye exercises – Kapalabathi, Makarasanam, Massaging, Acupressure and Relaxation practices – Yogasanas-Explanation – Benefits.

UNIT 2 **STRENGTHENING LIFE FORCES**

Reasons for Diseases: Natural Reasons (Hereditary, Planetary Position, Natural Calamities and Climatic changes) - Artificial Reasons (Food, Thought, Deed). Philosophy of Kayakalpa: Physical Body -Life Force – Biomagnetism – Mind. Maintaining Youthfulness – Postponing Aging – Transformation of Food into seven Body constituents.

WELLNESS OF MIND UNIT 3

Classification of Mind Waves - Beta, Alpha, Theeta, Delta - Agna Meditation - Benefits. Shanthi Mediation - Benefits. Thuriya Meditation - Benefits. Blessing and its Benefits: Auto Suggestion -Blessing the family and others – Blessings the World – Divine Protection. 6

UNIT 4 VIRTUES

Individual Virtues: Self Control – Self Confidence – Speaking Truth – Contentment – Humility – Mind Control. Tolerance - Adjustment - Sacrifice - Forgiveness. Cleanliness (Body, Dress, Surrounding)-External, Mental, Inner Cleanliness. Societal Virtues : Ahimsa - Services, Patriotism - Equality, Respecting the parents and elders – Caring for them – Respecting Teachers. Punctuality – Time Management.

UNIT 5 **MORALS**

Importance of introspection: I and Mine (Ego, Possessiveness), Six Temperaments: Greed - Anger -Miserliness – Immoral Sexual Passion – Inferior Superior complex – Vengeance. Maneuvering the Six Temperaments: Contentment - Tolerance - Charity - Chastity - Parity - Forgiveness. Five important Benefits of Meditation: Perspicacity – Magnanimity – Adaptability – Receptivity – Creativity. (Enhancing memory) (Effective Examination Preparation)

TEXT BOOKS:

- 1. "Yoga for Youth Empowerment" compiled by Vethathiri Maharishi Institute for Spiritual and Institutional Education, Aliyar, Pollachi, 1st Edition 2016.
- 2. "Yoga for Human Excellence", compiled by Vethathiri Maharishi Institute for Spiritual and Institutional Education, Aliyar, Pollachi 1st Edition 2009.

e-RESOURCE:

1. www.online.vethathiri.edu.in "online in (Virtual) Programme on Yoga and Human Excellence".

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COs/P Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2
CO1	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	2		-	-	-	-	-
CO4	-	-	-	-	-	3	-	2	2	-	-	-	-	_
CO5	-	-	-	-	-	3	-		2	-	-	-	-	I

Preamble:

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Communicative English-II aims at developing Communication Skills in English essential for expressing the ideas through speaking and writing in different social, academic and professional contexts.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Start, maintain and close a conversation in a variety of contexts including formal/informal and telephonic conversation.
- 2. Use structurally correct expressions and conversations.
- 3. Speak fluently using phrasal verbs and Idiomatic Expressions by recognizing and rectifying own pronunciation and intonation problems.
- 4. Speak fluently using a wide range of vocabulary.
- 5. Communicate effectively by using business correspondence structures.

UNIT 1 **EFFECTIVE SPEAKING -BASIC LANGUAGE CHUNKS**

Conversational Starters - Closing a Conversation - Greeting and Leave Taking - Introducing Oneself - Introducing Others - Making Request - Offering Help - Expressing Gratitude -Extending Invitation - - Conveying Wishes -Encouraging Words -Seeking Permission - Granting Permission-Making Complaints - Seeking Apology - Making Interruption - Expressing Possibility- Expressing Agreement and Disagreement - Expressing Hesitation -Asking for Directions and Giving Directions - Giving Instructions- Questions and Expressions with Time - Checking for Understanding -Showing Interest -Expressing Likes and Dislikes

EFFECTIVE SPEAKING -ADVANCED LANGUAGE CHUNKS UNIT 2

Expressing Personal Opinion - Expressing Feelings - Accepting Responsibility - Giving Clarifications - Tag Questions - Giving Comments - Giving Advice - Making Suggestions- - Making Comparisons - Analyzing Problems- Exploring Options - Making Classifications and Elaborations - Speaking Hypothetically-- Discussing Plans-Making Negotiations-Making Presentations-Telephone Etiquette - Telephone Conversation

UNIT 3 **EFFECTIVE SPEAKING - PHRASAL VERBS AND IDIOMATIC EXPRESSIONS**

Most useful Phrasal Verbs related to Self-Introduction-Idiomatic Expressions related to Person, Time and Action **UNIT 4 EFFECTIVE SPEAKING – VOCABULARY ENRICHMENT**

10 Talking about Abilities - Travel - Shopping - Climate - Commuting - Distance - Food - Occupation - Parties and Festivals – Daily Routine – Clothing – Hobbies – Favorites- Family – Buying and Selling- Schedules and Plans

NIT 5 **BUSINESS WRITING**

Writing Instructions - Recommendations - Checklist - Tour Itinerary -Writing Slogans - E- mail Writing - Single Line Definitions - Process Description - SMS - Transcoding Graphics - Bar Chart, Flow Chart, Pie Chart and Tables -Business Letters - Calling for Quotations, Placing Orders, Letter of Complaint, Letter of Clarification - Agenda and Meeting Minutes - Cover Letter with Résumé - Report Writing - Accident Report, Industrial Visit Report, Survey Report and Feasibility Report- Summary Writing.

TEXT BOOKS:

- Sanjay KumarandPushpLata, "Communication Skills" 2nd Edition, Oxford University Press, New Delhi.2017. 1.
- J.K.Gangal, "A Practical Course in Spoken English" 1st Edition PH1 Learning Private Limited, Delhi, 2014. 2.

REFERENCES:

- Dr K Elango, Dr. VeenaSelvam, Dr. SujathaPriyadarshini, "Resonance English for Engineers and 1. Technologists".Cambridge University Press, 1st Edition, Foundation Books, New Delhi, 2013.
- Dr.MahendraSarawat, "Speak English Fluently" UpkarPrakashan Publishers, 1st Edition, Agra, 2010. 2.
- 3. S.Sumant, Joyce Pereira, "Technical English", Vijay Nicole imprints Private Limited, 1st EditionChennai, 2017.

TOTAL : 45PERIODS

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e-RESOURCES:

1. https://www.fluentu.com/Blog/english/english-small-talk/

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2
CO1	-	1	-	-	-	1	-	-	-	3	-	-	-	I
CO2	-	1	-	-	-	1	-	-	1	3	-	1	-	I
CO3	-	1	-	-	-	1	-	-	-	3	-	-	-	-
CO4	-	1	-	-	-	1	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	3	-	-	-	3	-	-	-	I

Mapping of COs with POs and PSOs

ENGINEERING MATHEMATICS – II

9+3

9+3

9+3

9+3

Preamble:

Vector calculus is a form of mathematics that is focused on the integration of vector fields. An Engineer should know the Transformations of the Integrals, as Transformation of Line Integral to surface and then to volume integrals. Complex Integration approach is very useful to evaluate many improper integrals of a real variable. The Laplace transform method is a powerful method for solving linear ODEs and corresponding initial value problems as well as systems of ODEs arising in Engineering. The knowledge of transformations is to create a new domain in which it is easier to handle the problem that is being investigated.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Compute gradient, directional derivative by vector differentiation and determine line integrals, surface integrals and volume integrals by vector integration.
- 2. Construct analytic functions and transforms the analytic functions from one domain to another using conformal mapping.
- 3. Classify the singularities, find Laurent's series for analytic functions and compute complex integrals using Cauchy's integral theorem and Cauchy's Residue theorem.
- 4. Solve linear higher order differential equations with constant and variable coefficients
- 5. Solve linear second order ordinary differential equations with constant coefficients using the properties of Laplace Transforms.

UNIT 1 VECTOR CALCULUS

Vector Differentiation: Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration: Line, Surface and Volume Integrals -Green's theorem in a plane, Gauss Divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving squares, rectangles, cubes and rectangular parallelepipeds. 9+3

ANALYTIC FUNCTIONS UNIT 2

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions by Milne's method – Conformal mapping:

w = z+k, kz, 1/z and bilinear transformation. UNIT 3 **COMPLEX INTEGRATION**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proof) – Taylor's and Laurent's series expansions - Singularities - Residues - Cauchy's residue theorem(excluding proof) - Application of residue theorem to evaluate real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis)

UNIT 4 **ORDINARY DIFFERENTIAL EQUATIONS**

Linear higher order differential equations with constant coefficients – Method of variation of Parameters – Cauchy's and Legendre's linear differential equations – Simultaneous first order linear differential equations with constant coefficients.

UNIT 5 LAPLACE TRANSFORMS

Laplace transform: Sufficient conditions - Transform of elementary functions - Basic Properties - Transforms of derivatives and integrals of functions — Transform of periodic functions

Inverse Laplace transform: Standard results - Statement of Convolution theorem and its applications - Initial and final value theorems - Solution of linear second order ODE with constant coefficients using Laplace transformation techniques.

TEXT BOOKS:

- 1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, New Delhi, 2014.
- 2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 26th Reprint, New Delhi, 2016

REFERENCES:

- 1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
- Veerarajan T., "Engineering Mathematics (I Year)", 3 rd Edition, Tata McGraw Hill Publishing Company, Delhi, 12. 2.
- 3. P.Kandasamy, K.Thilagavathy, K.Gunavathy, "Higher Engineering Mathematics", S.Chand& Co Ltd, Chennai, 2016.

TOTAL : 60PERIODS

e-RESOURCES:

- 1. http://nptel.ac.in/courses/122107036/ "Mathematics-II", Prof. TanujaSrivastava, Department of Mathematics, Indian Institute of Technology, Roorkee.
- 2. http://nptel.ac.in/courses/122107037/ "Mathematics III", Prof. Dr. P. N. Agrawal, Indian Institute of Technology, Roorkee

COs/P Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2
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	-	-

Mapping of COs with POs and PSOs

PHYSICS FOR INFORMATION SCIENCES

Preamble:

Knowledge about the electronic structure of metals and semiconductors has manifested as a technology to design materials of desired properties. The knowledge of magnetic materials, superconductors and optical behavior of materials form the basis of solid state devices. Nanomaterials are envisioned in self-replicating robots at the molecular scale, in engines of creation.

Course Outcomes: Upon completion of the course, students will be able to:

- To understand the behaviour of conducting materials based on classical and Quantum theory. 1.
- 2. Gaining the knowledge on semiconductors with their carrier concentration and hall effect.
- 3. To understand the types of magnetic material and applications of superconducting materials.
- 4. Understanding the functioning of optical materials for optical data storage.
- Familiarize the synthesis of nanomaterials and their various characterization techniques, 5.

UNIT 1 **CONDUCTING MATERIALS**

Conductors – Classical free electron theory of metals – Electrical and thermal conductivity -Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory –Fermi distribution function – Effect of temperature on Fermi function – Density of energy states –Carrier concentration in metals.

UNIT 2 SEMICONDUCTING MATERIALS

Intrinsic semiconductor – Carrier concentration derivation – Fermi level – Variation of Fermi level

with temperature – Electrical conductivity – Band gap determination – Types of semiconductor- Derivation of carrier concentration in n-type and p-type semiconductor- Variation of Fermi level with temperature and impurity concentration — Hall effect – Determination of Hall coefficient – Applications. 9

UNIT 3 MAGNETIC AND SUPERCONDUCTING MATERIALS

Origin of magnetic moment - Bohr magneton - Comparison of dia, Para and Ferro magnetism - Domain theory -Hysteresis – Soft and hard magnetic materials – Antiferromagnetic materials.

Superconductivity Type I -BCS theory : Properties _ and type Π superconductors of superconductivity(qualitative) – High T_csuperconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT 4 **OPTICAL MATERIALS**

Classification of optical materials – Absorption in metals, insulators & Semiconductors (concept only)- carrier generation and recombination processes-LED's - Organic LED's - Polymer light emitting materials - Plasma light emitting devices— Laser diodes – Optical data storage techniques

UNIT 5 SYNTHESIS AND CHARACTERIZATION OF NANOMATERIALS

Nanomaterials: Introduction-properties –Classification of synthesis routes - Ball milling – Sol gels –Chemical Vapour Deposition (CVD) – Applications of Nanomaterials. Carbon nanotubes: Fabrication – Arc method – Pulsed Laser Deposition (PLD) - Chemical Vapour Deposition (CVD) - Properties and applications -Characterization technique - Powder X-ray diffractometer - Microscopic techniques: Introduction to Electron microscope – Scanning Electron Microscope (SEM) – Transmission Electron Microscope (TEM).

TOTAL : 45 PERIODS

TEXT BOOKS:

Palanisamy P.K, "Materials Science", 2ndEdition, Scitech publications (India) Pvt. Ltd., Chennai, 2007. 1.

S.O.Pillai "Solid State Physics",6thEdition,New Age International(P) Ltd,Publishers New Delhi,2010. 2.

REFERENCES:

- 1. Balasubramaniam R, "Callister's Materials Science and Engineering", 2ndEdition, Wiley-India 2014.
- 2. Charles P. Poole and Frank J.Owens, "Introduction to Nanotechnology", 1st Edition, Wiley, Delhi, 2007.
- Donald A.Neamen, "Semiconductor Physics and Devices: Basic Principles", 3rd Edition, Tata McGraw-Hill, 2012. 3.

e-RESOURCES:

- 1. http://nptel.ac.in/courses/122102008, "Materials Science" - Dr. S. K. Gupta, IIT Delhi
- 2. https://www.khanacademy.org/science/physics/magnetic-forces-and-magnetic-fields

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COs/P Os	РО 1	PO 2	PO 3	РО 4	РО 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2
CO1	3	2	-	-	-	1	1	-	-	1	1	1	-	-
CO2	3	2	-	-	-	1	1	-	-	1	1	1	-	-
CO3	3	2	-	-	-	1	1	-	-	1	1	1	-	-
CO4	3	2	-	-	-	1	1	-	-	1	1	1	-	-
CO5	3	2	-	-	-	1	1	-	-	1	1	1	-	-

21EET11 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Preamble:

The course covers the fundamentals of basic electrical circuit parameters of both ac and dc circuits and the characteristics of motors and generators. The basics of semiconductor devices and logic gates provides the necessary initiative for the students to acquire the knowledge in basic electronics.

COURSE OUTCOMES: Upon completion of the course, students will be able to:

- Analyze the various DC circuits and find the circuit parameters. 1
- Describe the principles of AC fundamentals. 2
- 3 Illustrate the construction and working principle of DC machines.
- 4 Explain the basics of semiconductor devices and its applications.
- 5 Explain the basics of Number systems and Logic gates.

UNIT 1 **ELECTRICAL CIRCUITS – DC**

Definition of Electrical Circuit Parameters - voltage – current - power and energy. Elements of DC Circuits - DC voltage / Current Sources. Calculation of Resistance and Current in series and parallel circuit- Star-Delta transformation of Resistance. Ohm's Law, Kirchhoff's Laws and its applications - Simple Problems in Mesh and Nodal analysis. Construction and working principle of Permanent Magnet Moving Coil Instruments. 9

UNIT 2 **ELECTRICAL CIRCUITS – AC**

AC Circuit Terminologies - RMS and Average value of Sinusoidal waveform - Form Factor - Peak Factor - Power Factor - Definition of impedance and admittance - Phasor diagram - Analysis of R, L, C, RL, RC, RLC circuits. Construction and working principle of Moving iron Instruments. Introduction to Three phase system - Star and Delta Connection.

UNIT 3 **ELECTRICAL MACHINES**

Review of Laws of Electromagnetic Induction - Fleming's Right and Left hand rules - Lenz's law. DC Generator -Construction - Working principle - Characteristics of DC Shunt Generator. DC Motor - Construction - Working principle - Characteristics and applications of DC Shunt Motor - AC transmission and distribution system (Single line diagram). 9

UNIT 4 SEMICONDUCTOR DEVICES AND APPLICATIONS

PN junction Diode and its Characteristics - Zener Diode and its Characteristics - Half and Full wave Rectifiers -Voltage regulation. Bipolar Junction Transistor - CE configuration and its characteristics – BJT as an amplifier. **DIGITAL ELECTRONICS** 9 UNIT 5

Boolean Algebra - Theorems and Laws - De-Morgan's theorem - Logic Gates - Universal Gates - Implementation of Boolean functions. Binary Arithmetic - Addition - Subtraction - Multiplication - Division - BCD addition - Half adder and Full adder circuits.

TOTAL : 45 PERIODS

TEXT BOOKS:

- Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering", McGraw Hill 1. Education, 1st Edition, 2014.
- Mittle V N and Aravind Mittal, "Basic Electrical engineering", McGraw Hill Education, 2nd Edition, 2006. 2. **REFERENCES:**
- V.K.Mehta and Rohit Mehta, "Principles of Electrical Engineering and Electronics", S.Chand& Company Ltd, 1. 2015.
- 2. SedhaR.S.,"Applied Electronics", S.Chand& Company Ltd, 2006.
- Thomas L.Floyd.,"DigitalFundamentals", PearsonEducation, PrenticeHall, Tenth Edition, 2010. 3.

E-RESOURCES:

- NPTEL, http://nptel.ac.in/courses/117106101/, "Basic Electrical Circuits", Prof. NagendraKrishnapura, IIT, 1. Madras.
- NPTEL, http://nptel.ac.in/downloads/108105053/, "Basic Electrical Technology", Prof. Dr. L. Umanand, IIS, 2. Bangalore.

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LTPC 3003

- NPTEL, http://nptel.ac.in/courses/117103063/, "Basic Electronics", Dr. ChitralekhaMahanta, IIT, Guwahati. 3.

COs/PO s	РО 1	PO 2	PO 3	PO 4	РО 5	PO 6	РО 7	PO 8	PO 9	PO 10	РО 11	PO 12	PS O 1	PS O 2
CO1	2	3	2	-	-	-	1	-	-	-	-	1	-	-
CO2	2	3	2	-	-	-	1	-	-	-	-	1	-	-
CO3	2	3	2	-	-	-	1	-	-	-	-	1	-	-
CO4	2	3	2	-	-	-	1	-	-	-	-	1	-	-
CO5	2	3	2	-	-	-	1	-	-	-	-	1	-	-

21ITT21

PROGRAMMING IN C

LTPC 3 0 0 3

(Common to B.E/B.Tech. – CS & IT Programmes)

Preamble:

This course aims at giving adequate exposure to students on the principles of procedural programming language. The course introduces the computational thinking and make the students develop C programs using basic programming constructs to solve Engineering problems.

Course Outcomes: Upon completion of the course, students will be able to:

- Develop C programs for a given problem statement using decision control statements. 1.
- Analyze linear, binary searching algorithms and bubble sorting algorithm for a given problem statement 2. using arrays.
- Build modules for a given problem and synthesize a complete program in C language using functions and 3. pointers.
- Compare and contrast structure, union and enumerated datatypes for a program using C language. 4.
- 5. Develop C programs to store and process the given data using files.

BASICS OF C PROGRAMMING UNIT 1

Introduction to Programming – Introduction to C - Structure of C program – Compilation and Execution - C Tokens -Keywords, Variables, Constants - Data Types - Input/output statements - Operators: Precedence and Associativity - Expressions – Type Conversion and Typecasting - Decision control and Looping statements.

UNIT 2 **ARRAYS AND STRINGS**

Introduction to Arrays: Declaration, Initialization - One dimensional array -Linear Search, Binary Search, Bubble Sort. Two dimensional arrays – Matrix Operations (Addition, Multiplication and Transpose) – Strings - String operations: length, compare, concatenate, copy, reverse – Array of Strings.

FUNCTIONS AND POINTERS UNIT 3

Introduction to functions – User-defined functions - Function prototype, function definition, function call – Parameter passing: Pass by value, Pass by reference - Recursion. Pointers - Declaration - Pointer expression and Pointer arithmetic – Arrays and pointers –Function Pointers.

STRUCTURES, UNION AND ENUMERATED DATA TYPES UNIT 4

Structure - Nested structures - Pointer and Structures - Array of structures - Structure and Functions - Union - Example Programs using structures and Unions – Enumerated Data types.

UNIT 5 FILE PROCESSING

Introduction to Files – Using Files in C – Reading and writing Files using fscanf and fprintf – Functions for selecting a record - Command line arguments - Storage classes - Pre-processor directives - Dynamic memory allocation.

TEXT BOOKS:

- 1. ReemaThareja, "Programming in C", Oxford University Press, SecondEdition, 2016.
- 2. PradipDey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 3rd Edition, Oxford University Press, 2013.

REFERENCES:

- 1. YashavantP.Kanetkar, "Let Us C", 13thedition, BPBPublications, NewDelhi, 2011.
- Herbert Schildt, "C: The Complete Reference", 4th edition, McGraw Hill, New Delhi,2000. 2.
- Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, TataMcGraw-Hill, 2006. 3.

TOTAL: 45 PERIODS

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e-RESOURCES:

- 1. http://nptel.ac.in/courses/106104128/,"Introduction to Programming", Prof.SatyadevNandakumar, IIT-Kanpur.
- 2. http://www.nptel.ac.in/courses/106102066/, "Introduction to Problem Solving and Programming", Dr. S.ArunKumar, IIT- Delhi.

P.	8													
COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	2	-	-	-	-	-	-	-	2	2	1
CO2	3	2	1	2	-	-	-	-	-	-	-	2	2	1
CO3	3	2	1	2	-	-	I	-	-	-	-	2	2	1
CO4	3	2	1	2	-	-	-	-	-	-	-	2	2	1
CO5	3	2	1	2	-	_	-	-	_	_	-	2	2	1

Mapping of COs with POs and PSOs

21PHL21

PHYSICS AND CHEMISTRY LABORATORY- II

Preamble :

The understanding of characteristics of solids and liquids and properties of semiconducting materials has been explored. The practical skills in the instrumental methods for quantitative estimation of metal ions content has been the main focus.

Course Outcomes:

- 1. Experiment and determine the physical characteristics of given solid material.
- 2. Experiment and determine the Energy band gap of the given semiconducting materials.
- 3. Experiment and determine the physical characteristics of given liquid.
- 4. Experiment and estimate dissolved oxygen content using alkali iodide solution by Winkler's method, amount of copper content using EDTA by complexometric titration.
- 5. Experiment and test chloride content present in the waste water by titrating against silver nitrate using Mohr's method.
- 6. Experiment and determine the concentration of metals and ions present in the wastewater with the aid of flame photometer and pH meter

PHYSICS LABORATORY II (Any Five Experiments)

LIST OF EXPERIMENTS

- 1. Determination of Young's modulus by uniform bending method.
- 2. Determination of band gap of a semiconductor.
- 3. Determination of coefficient of viscosity of a liquid Poiseuille's method.
- 4. Determination of thickness of a thin wire Air wedge method.
- 5. Determination of rigidity modulus Torsion pendulum.
- 6. Determination of Hysteresis of a ferromagnetic material –Deflection magnetometer

CHEMISTRY LABORATORY II

LIST OF EXPERIMENTS

- 1. Determination of Dissolved Oxygen content of waste water sample by Winkler's method
- 2. Determination of chloride content of wastewater sample by Argentometric method.
- 3. Determination of acid strength in waste water using pH meter.
- 4. Estimation of dissolved metal ions present in wastewater using flame photometer.
- 5. Estimation of dissolved metal ions(copper) present in wastewater byEDTA method.

TOTAL : 30 PERIODS

• Laboratory classes on alternate weeks for Physics and Chemistry.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	-	3	-	1	1	-	1	1	1	1	-	-
CO2	2	2	-	3	-	1	1	-	1	1	1	1	-	-
CO3	2	2	-	3	-	1	1	-	1	1	1	1	-	-
CO4	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO5	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO6	2	1	-	3	-	1	1	-	1	1	1	1	-	-

C PROGRAMMING LABORATORY

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Preamble:

This laboratory course is intended to provide students with opportunities to get hands on training to solve Engineering problems using C programming language.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Develop and test the C program to solve a given problem statement using suitable datatypes, decision making and control statements.
- 2. Develop and test the C program to process the given list or table of data and reproduce the array according to the expected result.
- 3. Develop and test the C program for the given problem statement using structure, union and functions.
- 4. Develop and test the C programs using pointers to access arrays, functions and allocate memory using dynamic memory management functions.
- 5. Develop and test the C programs to store and process the given data using files.

LIST OF EXPERIMENTS

- 1. C programs that involve basic data types, looping and decision statements.
- 2. C programs using one dimensional and two dimensional arrays.
- 3. C programs for String manipulation operations.
- 4. C programs using Functions
 - Parameter passing
 - Library functions
 - Math functions
 - Recursion
- 5. C programs using structures and union.
- 6. C programs using Pointers
 - Pointer arithmetic
 - Arrays and functions using pointers.
- 7. C programs for basic file operations.
- 8. C programs using dynamic memory allocation.
- 9. Developing applications using C
 - Payroll Processing
 - Banking Application
 - Quiz software

TOTAL : 45 PERIODS

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	3	2	3	2	-	-	-	1	-	-	-	2	1
CO2	1	3	2	3	2	-	-	-	1	-	-	-	2	1
CO3	1	3	2	3	2	-	-	-	1	-	-	-	2	1
CO4	1	3	2	3	2	-	-	-	1	-	-	-	2	1
CO5	1	3	2	3	2	-	-	-	1	-	-	-	2	1

ENGINEERING PRACTICES LABORATORY

LTPC

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Preamble:

The students are given the introduction upon the basics of computer which comprises of the study of Motherboard and interfacing components and operating system. They were given the practice for assembling a PC, assembling RAM in a motherboard, assembling hard disk drive in a cabinet, assembling CD/DVD ROM in a cabinet, establishing data connection and fixing wires. The basic knowledge of electrical and electronics is mandatory and it is practiced with the wiring experiments and by verification of the basic logic gates.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Study the basics of personal computer and also its interfacing components.
- 2. Install and update windows and Linux operating systems.
- 3. Explain basics of Computer assembly and configuration and also system installation with different software's.
- 4. Construct various types of domestic wiring and measure the various electrical parameters.
- 5. Develop and test circuits with active elements and verify truth table of logic gates.

LIST OF EXPERIMENTS

COMPUTER

- 1) Study and identification of standard desktop personal computer.
- 2) Study of Motherboard and interfacing components.
- 3) Install, upgrade and configure Windows operating systems.
- 4) Install, upgrade and configure Linux operating systems.
- 5) Computer Assembly and Configuration : Steps for assembling a PC, assembling RAM in a motherboard, assembling hard disk drive in a cabinet, assembling CD/DVD ROM in a cabinet, establishing data connection and fixing wires.
- 6) System Installation: Steps for installing different software's (including antivirus software, printer and scanner software).

ELECTRICAL AND ELECTRONICS

ELECTRICAL

- 7) Residential house wiring using switches, fuse, indicator and lamps.
- 8) Fluorescent lamp wiring.
- 9) Stair case wiring.
- 10) Reading of voltage, current, power, energy and other parameters with 1 phase digital energy meter
- 11) Measurement of earth resistance

ELECTRONICS

- 12) Identification and Study of Electronic components and equipments Resistors, capacitors, inductors, colour coding and measurement.
- 13) Measurement of AC signal parameters (peak-peak, RMS value, period, frequency) using CRO.
- 14) Verification of the truth tables of logic gates: AND, OR, XOR and NOT.
- 15) Construction of Half Wave and Full Wave Rectifiers and study their output waveforms.
- 16) Soldering practice Using general purpose PCB.

TOTAL : 45PERIODS

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	3	1	1	2	-	1	1	1	-	-	-	-	-
CO2	1	3	1	1	2	-	1	1	1	-	-	-	-	-
CO3	1	3	1	1	2	-	1	1	1	-	-	-	-	-
CO4	1	3	2	1	2	-	1	1	1	-	-	-	-	-
CO5	1	3	2	1	2	-	1	1	1	-	-	-	-	-

21MCT02

ENVIRONMENTAL SCIENCE AND ENGINEERING

Preamble:

The study of biodiversity reflects the extent of the interest of a nation in its natural resources and heritage, which is considered as a crucial portion of the national wealth. Since India is one of the twelve mega-diversity center of the earth, much emphasis should be put on understanding, preserving and utilizing the biodiversity of our biotic resources. Environmental protection is an important issue for society today as scientific research provides evidence of increasing global warming, ozone depletion and higher levels of pollution. Engineers should learn how to design, develop and evaluate structures, equipment and systems to provide practical solutions to problems caused by pollution, exploitation of natural resources and population explosion.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Compare and contrast structure and function of forest and marine ecosystem to conserve biodiversity
- 2. Analyze the sources, effects, control measures of air and water, solid waste management to maintain green environment.
- 3. Describe overexploitation of forest, overutilization of water and environmental impacts related to food resources to preserve environment.
- 4. Explain human health, environment and disaster management through information technology.
- 5. Discuss air and water act to solve environmental issues of climatic change.

UNIT 1 ECOSYSTEM AND BIODIVERSITY MANAGEMENT

Importance of environmental studies-Ecosystem-Definition, Characteristics, structure and functions of Forest and Ocean ecosystem.Biodiversity-Definition, Significance, Values of biodiversity, Threats to biodiversity-Habitat loss and poaching, Biodiversity conservation-In-situ (Biosphere and National park), Ex-situ (Gene bank and Seed bank)

UNIT 2 ENVIRONMENTAL POLLUTION

Pollution- Definition causes and effects of Air and Water. Control strategies-Air pollution- (Catalytic converter,Cyclone separator). Water pollution-waste water treatment (Primary, Secondary and Tertiary Treatment). Solid waste-Source and generation of solid waste, Methods of disposal- Sanitary land fill, Incineration and composting.

UNIT 3 NATURAL RESOURCES

Forest Resources: Functions of forest, deforestation-causes, consequences and steps to prevent deforestation. Water Resources: over-exploitation of surface and ground water, Benefits and problems of dams on forests and tribal people. Food Resources: Environmental impacts related to food resources –Effects of modern agriculture (fertilizer and pesticide problems), water logging and salinity.

UNIT 4 ROLE OF IT AND DISASTER MANAGEMENT

Role of IT in environment-Remote Sensing and GIS application, Global positioning system, Environmental data base. Role of IT in human health – EHR, Medical Transcription, Endoscopy, Automated dispensing machine (ADM), Teleconference, Picture achieving and Communication System (PACS) method.Disaster management-Cause, effects and mitigation of Flood, Cyclone, Earthquake, Tsunami

UNIT 5 SOCIAL ISSUES AND ENVIRONMENTAL LEGISLATION

Social Issues: Climate change- Global warming, Ozone layer depletion ,Water conservation-Rain water harvesting (Roof top method). Legislation- Function of State and Central pollution control Board (Air and Water).

TOTAL : 30PERIODS

TEXT BOOKS:

- 1. Dr.Arun Luiz T, 'Environmental Science and Engineering', 1st edition (2017), VK publications.
- 2. P. Yugananth&Dr. R. Kumaravelan, 'Environmental Science and Engineering', 2ndedition, reprint (2017), Scitech Publication (India) Pvt. Ltd., Chennai.

REFERENCES:

- 1. Benny Joseph, 'Environmental Science and Engineering', 3rdreprint (2015), McGraw Hill Education(India) PvtLtd. Delhi.
- 2. Gilbert M.Masters, 'Introduction to 'Environmental Engineering and Science', 2nd edition (2004), Prentice Hall of IndiaPvt. Ltd.

e-RESOURCES:

- 1. https://nptel.ac.in/courses/105104099/4 " Types and forms of Air Pollutants" Prof. Mukesh Sharma, Department of Civil Engineering, IIT Kanpur.
- 2. https://nptel.ac.in/courses/105104183/8 -"Introduction to natural hazards(Flood and Tsunami)- Prof.Javed Malik, Department of Civil Engineering,IIT Kanpur

Mapping of COs with POs and PSOs

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	1	1	2	3	1	1	1	1	2	-	-
CO2	3	2	1	1	1	3	3	1	1	1	1	2	-	-
CO3	3	2	1	1	1	3	3	2	1	1	1	2	-	-
CO4	3	2	1	1	1	3	3	2	1	1	1	2	-	-
CO5	2	2	1	1	1	3	3	1	1	1	1	2	-	-

21MAT32

DISCRETE MATHEMATICSL T P C(B.E.-Computer Science and Engineering in Third Semester)3 1 0 4

Preamble:

Discrete Mathematics is a branch of mathematics involving discrete elements that uses algebra and arithmetic. Propositional calculus is a formal system whose expressions represent formal objects which can be used in the design of combinational digital circuits. The predicate logic is a part of artificial intelligence which is applicable in the field of robotics, medicine and in intelligent database Combinatorics is a fundamental mathematical discipline which provides a foundation in counting techniques that can be applied to algorithm analysis. Graph is a formal way to represent a network. Many problems in computer system can be analyzed using models based on graphs. Concepts of Groups provide the background essential to the study of finite state machines, switching theory and logic design.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Construct and check the validity of mathematical arguments using propositional calculus
- 2. Compute the logical structures of ordinary language statements using predicate calculus.
- 3. Compute combinatorial problems by applying Pigeonhole Principle, Permutations and Combinations and solve Linear Recurrence Relations using Generating functions
- 4. Determine whether the graphs are Hamiltonian and/or Eulerian and check Isomorphism between graphs
- 5. Classify the given set as Semigroup, Monoid or Group by using the properties of groups.

UNIT 1 PROPOSITIONAL CALCULUS

Propositions – Logical connectives–Compound propositions-Conditional and biconditional propositions

- Truth tables-Tautologies and contradictions-Contra positive-Logical equivalences and implications

-Normal forms-Principal conjunctive and disjunctive normal forms-Rules of inference.

UNIT 2 PREDICATE CALCULUS

Predicates–Statement functions –Variables-Free and bound variables–Quantifiers –Universe of discourse– Logical equivalences and implications for quantified statements–Theory of inference –The rules of universal specification and generalization.

UNIT 3 COMBINATORICS

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 4 GRAPHS

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT 5 GROUP THEORY

Groups – Subgroups – Permutation groups –Normal subgroup and cosets – Lagrange's theorem – Homomorphism –First fundamental theorem of homomorphism- -Cayley's Theorem.

TOTAL (L:45+T:15): 60 PERIODS

TEXT BOOKS:

- 1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 7th Edition, Tata Mc Graw Hill Private Limited, New Delhi, Special Indian Edition, 2014.
- 2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata Mc Graw Hill Pub. Co. Ltd, New Delhi, 47th Reprint, 2015.

REFERENCES:

- 1. Ralph.P.Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education(Singapore) Private Limited, New Delhi, 8th Impression 2016.
- 2. Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Academic Press, UK, Reprinted 2014.

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- 3. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", PHI Learning Private Limited, Delhi, 2016.
- 4. Bernard Kolman, Robert Busby, Sharon C. Ross "Discrete Mathematical Structures" 6th Edition, Pearson Education(Singapore) Private Limited, New Delhi, 2014.

e-RESOURCES:

- 1. <u>http://nptel.ac.in/courses/106106094/1</u>, "Propositional Logic", http://nptel.ac.in/courses/106106094/3, "Predicate Calculus" and <u>https://nptel.ac.in/courses/106106094/40</u> "Lattices" Dr.Kamala Krithivasan, Department of Computer Science and Engineering, Indian Institute of Technology, Madras.
- http://nptel.ac.in/courses/111107058/20, "Graph Theory", and http://nptel.ac.in/courses/111107058/38, "Inroduction to Recurrence Relations", Dr.Sugata Gangopadhyay, Department of Mathematics, Indian Institute of Technology, Roorkee.

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	<mark>3</mark>	<mark>3</mark>	1	1	-	-	-	-	-	-	-	1	-	-
CO2	<mark>3</mark>	<mark>3</mark>	1	1	-	-	-	-	I	-	-	1	-	-
CO3	<mark>3</mark>	<mark>3</mark>	1	1	-	-	-	-	I	-	-	1	-	-
CO4	<mark>3</mark>	<mark>3</mark>	1	1	-	-	-	-	I	-	-	1	-	-
CO5	<mark>3</mark>	<mark>3</mark>	1	1	_	-	-	_	-	_	_	1	_	_

OBJECT ORIENTED PROGRAMMING USING JAVA

Preamble:

18 CST33

Java is an object oriented programming language with a higher level of security and portability. Platform independent feature of java makes it a write once, run anywhere language. Java multithreading feature makes it possible to write program that can do many tasks simultaneously. It uses a strong memory management, an automatic garbage collection, exception handling and also type checking mechanism which makes it a popular programming language.

Course Outcomes: Upon completion of the course, students will be able to:

- Write a Java program for the given problem statement using operator, arrays, classes and methods. 1.
- 2. Develop solution for a given problem using Inheritance and Packages to achieve reusability and implement exception handling code to handle the run time errors.
- Develop a Java code for the given problem statement using String handling functions and I/O 3. streams.
- 4. Develop Java program for the given problem statement using Wrapper classes and Collection APIs.
- 5. Develop Java application using Stream API and JDBC for a given problem statement.

UNIT 1 OVERVIEW OF JAVA

Concepts of Object Oriented Programming - An Overview of Java - Data types, Variables and Arrays -Operators - Control statements - Classes - Methods.

UNIT 2 INHERITANCE AND EXCEPTION HANDLING

Inheritance: Basics – Super keyword – Method Overriding – Dynamic Method dispatch – Abstract classes - final keyword. Packages and Interfaces: Packages - Access protection - Importing Packages -Interfaces - Exception Handling.

UNIT 3 STRING HANDLING AND I/O

Multithreading - String Handling: String Constructors - Special String Operations - Character Extraction - String comparison - Searching and Modifying a String - StringBuffer - StringTokenizer. Input/Output: The Stream Classes – The Byte Streams – The Character Streams – Serialization.

UNIT 4 COLLECTIONS

Collections: List - ArrayList - Set - HashSet - TreeSet- Queue - PriorityQueue - Map - HashMap -Iterator - Enumerator- Wrapper Classes- Autoboxing and Unboxing- Regular Expressions.

UNIT 5 STREAM API AND JDBC

Lambda Expression - Lambda Parameters - Functional Interfaces - Creating Thread- Stream API -Creating Java streams - Intermediate Operations: map - filter - sort - Terminal Operations: Collect reduce - foreach - try with resources. Java Database Connectivity - Manipulating Databases with JDBC.

TOTAL : 45 PERIODS

TEXT BOOKS:

- Herbert Schildt, "Java The Complete Reference", Ninth Edition, McGraw-Hill Education, 2014. 1.
- Rajkumar Buyya, S Thamarai Selvi, Xingchen Chu, "Object Oriented Programming with Java -2. Essentials and Applications", McGraw-Hill Education, 2009.
- Paul Deitel, Harvey Deitel, "Java How to Program", Prentice Hall, Tenth Edition, 2014 3.

REFERENCES:

- Kathy Sierra, Bert Bates, "Head First Java", Second Edition, O'Reilly Media, 2005. 1.
- "Java 6 Programming Black Book", Kogent Learning Solutions Inc., 2007 2.
- Cay S.Horstmann, Gray Cornell, "Core Java Volume I Fundamentals", Ninthth Edition, Pearson 3. Education, 2013.

e-RESOURCES:

- http://www.nptelvideos.com/video.php?id=1471&c=15. 1.
- http://nptel.ac.in/courses/106105084/30, Java Programming, Prof. Indranil Sengupta, IIT 2. Kharagpur.

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UNIT 5

UNIT 4

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	2	1	-	-	-	-	-	-	1	3	-
CO2	1	2	2	2	1	-	-	-	-	-	-	1	3	-
CO3	1	2	2	2	1	-	-	-	-	-	-	1	3	-
CO4	1	2	1	2	1	-	-	-	-	-	-	1	3	-
CO5	1	2	2	2	2	-	-	-	-	-	-	1	3	-

21CST32

DATA STRUCTURES

LT PC 3003

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(Common to B.E/B.Tech. – CS & IT Programmes)

Preamble:

A data structure is an arrangement of data in computer's memory in such a way that it could make the data quickly available to the processor for required calculations. A data structure should be seen as a logical concept that must address two fundamental concerns. Lists, arrays, stacks, queues, heaps, trees, and graphs are the more commonly used data structures.

Course Outcomes: Upon completion of the course, students will be able to:

- Develop list ADT for a given list or table using array and linked list implementation by ensuring the 1. ordering of data elements.
- 2. Create stack and queue ADT for a given list using array and linked list implementation and apply specific ADT for a given application.
- Construct a tree for a given list of data by ensuring tree properties and analyze inorder, preorder, postorder 3. traversal for a constructed tree.
- 4. Implement a suitable shortest path algorithm for a given graph such that the sum of the edges weights is minimum.
- 5. Apply a suitable searching and hashing algorithms for a given list of data considering the size and ordering of data.

UNIT 1 LISTS

Abstract Data Types (ADT) – List ADT – Array-Based Implementation – Linked List Implementation– Singly Linked Lists - Circularly Linked Lists - Doubly-Linked Lists - Applications of Lists.

UNIT 2 **STACKS AND QUEUES**

Stack ADT – Queue ADT – Circular Queue – Applications of Stacks and Queues.

UNIT 3 TREES

Preliminaries - Binary Trees - Binary Tree Traversal - Binary Search Trees- Expression Trees - AVL. Trees-Binary Heap - Heap Sort.

UNIT 4 GRAPHS

Definitions - Graph Traversal - Topological Sort - Shortest-Path Algorithms: Unweighted Shortest Paths -Dijikstra's Algorithm - Minimum Spanning Tree - Prim's and Kruskal's Algorithms - Undirected Graphs. 7

SEARCHING AND HASHING UNIT 5

Searching: Linear Search - Binary Search. Hashing - General idea - Hash Function - Separate Chaining - Open Addressing: Linear Probing - Quadratic Probing - Double Hashing.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2015.
- Richard F. Gilberg, and Behrouz A. Forouzan, "Data Structures A Pseudocode Approach with C", Second 2. Edition, Thomson Brooks/cole, 2011.

REFERENCES:

- 1. Reema Thareja, "Data Structures Using C", First Edition, Oxford University Press, 2011.
- ISRD Group, "Data Structures Using C", First Edition, McGraw Hill Education (India) Private Limited, 2. New Delhi, 2007.
- Data Structures through C, Yashwant Kanetkar, BPB Publications. 3.

e-RESOURCES:

- 1. http://www.nptel.ac.in/courses/106102064, Introduction to data structure, Mr. Varma, IIT Bombay.
- http://nptel.ac.in/courses/106102064, Video Lectures, Data Structures and Algorithms, IIT Delhi. 2.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	-	-	-	-	-	1	-	1	3	_
CO2	3	2	2	1	-	-	-	-	-	1	-	1	3	-
CO3	3	2	2	1	-	-	-	-	-	1	-	1	3	-
CO4	3	2	2	1	-	-	-	-	-	1	-	1	3	-
CO5	3	2	2	1	-	-	-	-	-	1	-	1	3	-

21CSC31

DIGITAL PRINCIPLES AND SYSTEM DESIGN

(Common to B.E/B.Tech. – CS & IT Programmes)

Preamble :

This course aims at giving adequate exposure to students on the design and analysis of logic circuits. The course is intended to understand different kinds of number representation and its conversion. It helps the student to acquire knowledge on the concepts of combinational and sequential logic circuits and simulate digital logic circuits using Verilog HDL.

Course Outcomes: Upon completion of the course, students will be able to:

- Represent a number in bases like Binary, Decimal, Octal and Hexadecimal and convert a numeral from one base to 1. another base.
- Design logic circuits by reducing the Boolean expression using K-map and Tabulation minimization techniques and 2. implement them using Universal logic gates.
- Design Adders, Subtractor, Code Converters, Encoder, Decoder, Multiplexer and Demultiplexer by deriving logical 3. expressions using K-Map.
- Design sequential logic circuits to implement shift registers and counters using Flipflops. 4.
- Design combinational and sequential circuits using PROM, PLA and PAL and simulate digital circuits using Verilog 5. HDL.

UNIT 1 NUMBER SYSTEMS AND LOGIC GATES

Number Systems – binary, decimal, octal and hexadecimal number systems. Number Base conversions- Binary Arithmetic - Binary Codes - Classification of binary codes - Logic Gates.

UNIT 2 **BOOLEAN ALGEBRA**

Boolean Algebra -Basic Theorems and properties – De-Morgan's Theorem – Principle of Duality – Truth tables and Boolean expression - Minimization of Boolean expressions using Boolean Theorems - Minterm - Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Simplification of Boolean Functions using Karnaugh Map and Tabulation Methods (Two, Three, Four and Five variables) – Don't care conditions - NAND and NOR Implementations.

COMBINATIONAL LOGIC CIRCUITS UNIT 3

Combinational circuits - Design procedure -Half Adder and Full Adder- Half Subtractor and Full Subtractor - Parallel adder/ Subtractor- Code converters-Binary to gray code convertor- Gray to binary code convertor-BCD to Excess-3 code convertor- Encoder - Decoder- Multiplexer- Demultiplexer.

UNIT 4 SEQUENTIAL LOGIC CIRCUITS

Sequential circuits – Latches - Flip flops – Realization of one flip flop using other flip flop - Analysis and design of clocked sequential circuits - State reduction and State assignment - Shift registers - Counters-Design of Counters.

UNIT 5 **MEMORIES AND HDL**

RAM and ROM - Programmable logic devices (PLDs) - PROM - PLA - PAL - Introduction to Verilog Hardware Description Language (HDL) – Verilog HDL for combinational circuits, Verilog HDL for Sequential Circuits.

List of Experiments

1. Verification of De-Morgan's theorems using digital logic gates.

- 2. Design and implementation of Half Adder, Full Adder and binary to grav code converter.
- 3. Design and implementation of multiplexers/ Demultiplexers.
- 4. Design and implementation of Synchronous counters.
- 5. Simulation of combinational and sequential circuits using Verilog HDL.

TEXT BOOKS:

1. Morris Mano M. and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson Education, NewDelhi, 2013.

Charles H. Roth Jr, "Fundamentals of Logic Design", 7th Edition, Jaico Publishing House, Mumbai, 2014. 2.

REFERENCES:

- Thomas. C. Bartee, "Digital Computer Fundamentals", 6th Edition, Tata McGraw-Hill, New Delhi, 2011. 1.
- Anil K. Maini, "Digital Electronis: Principles and Integrated Circuits", 1st Edition, Wiley-India, New Delhi, 2008. 2.
- Kharate G. K., "Digital Electronics", Oxford University Press, 2010 3.
- Donald D. Givone, "Digital Principles and Design", First Edition, Tata McGraw Hill, New Delhi, 2011. 4.

TOTAL : (L:45+P:15) 60 PERIODS

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LTPC 3024

e-RESOURCES:

- 1. http://nptel.iitm.ac.in/courses/117106086, "Digital Circuits and Systems-video", Prof.S.Srinivasan, IIT -Madras.
- 2. http://www.satishkashyap.com/2012/02/digital-electronic-circuits-by-shouri.html, "Digital Electronics", Dr.Shouri Chatterjee, IIT- Delhi.

COs/P Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2
CO1	2	3	2	2	-	-	-	-	-	1	-	1	-	2
CO2	2	3	2	2	-	-	-	-	-	1	-	1	-	2
CO3	2	3	2	2	-	-	-	-	-	1	-	1	-	2
CO4	2	3	2	2	-	-	-	-	-	1	-	1	-	2
CO5	2	3	2	2	1	-	-	-	-	1	-	1	-	2

Mapping of COs with POs and PSOs

21ITT32

COMPUTER ARCHITECTURE

(Common to B.E/B.Tech. – CS & IT Programmes)

L T P C 3003

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Preamble:

Computer Architecture equips students' knowledge on principles of computer design, instruction set design concepts, performance enhancements, performance comparisons and design and implementation of high performance computing systems. It imparts the concept of parallelism and different memory technologies in hierarchical memory systems.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Analyze the performance and describe the instruction set using different addressing modes for a given computer architecture and organization.
- 2. Describe the arithmetic operations involving addition, subtraction, division, multiplication and floating point number operations for a given computer organization.
- 3. Construct the datapath and describe the effect of data hazard, control hazard for a given pipeline processor.
- 4. Describe the memory hierarchy and analyze the operation of cache memory for a given computer organization.
- 5. Compare the standard I/O interfaces and data transfer techniques to access I/O devices for the given computer system.

UNIT 1 BASIC STRUCTURE OF COMPUTERS

Functional Units – Basic Operational Concepts– Bus Structures - Instruction Set Architecture–RISC – CISC – Instructions and Instruction Sequencing– Addressing modes– Performance and Metrics.

UNIT 2 ARITHMETIC OPERATIONS

Addition and Subtraction – Design of Fast Adders – Signed operand Multiplication – Fast Multiplication - Integer Division – Floating Point Numbers and Operations.

UNIT 3 PROCESSOR AND CONTROL UNIT

Basic concepts –Role of Cache Memory – Pipelining Performance – Types of Hazards- Data hazards – Instruction Hazards (prediction) – Data path and Control Considerations.

UNIT 4 MEMORY SYSTEMS

Memory hierarchy – Speed, Size and Cost – Semiconductor RAM – ROM–Cache Memory – Mapping FUNCTIONS – Replacement Algorithms – Measuring Cache Performance.

UNIT 5 I/O ORGANIZATION

Accessing I/O devices – Programmed Input / Output – Interrupts – Direct Memory Access –Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

TOTAL : 45 PERIODS

TEXT BOOKS:

 V.CarlHamacher, ZvonkoVaranesic and SafwatZaky, "Computer Organization", 5thEdition, McGraw-Hill Inc, 2012.

REFERENCES:

- 1. David A. Patterson and John L. Hennessey, "Computer organization and design', Morgan Kauffman/ Elsevier, 5th Edition, 2014.
- 2. M. Morris Mano, "Computer System Architecture", 3rd Edition Pearson Education, 2017
- 3. William Stallings "Computer Organization and Architecture", 10th Edition, Pearson Education, 2015.

e-RESOURCES:

- 1. http://nptel.ac.in/courses/106102062/1, "Computer Architecture", Prof. Anshul Kumar, IIT- Delhi.
- 2. http://nptel.ac.in/courses/106105033/6, "High Performance Computer Architecture", Prof. Ajit Pal, IIT-Kharagpur.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	2	-	-	-	-	-	-	-	-	1	2
CO2	3	3	1	2	-	-	-	-	-	-	-	-	1	2
CO3	3	3	2	2	-	1	-	-	-	-	-	1	2	2
CO4	2	3	-	2	-	-	-	-	-	-	-	1	1	2
CO5	2	3	-	2	-	1	-	-	-	-	-	-	1	2

18CSL31OBJECT ORIENTED PROGRAMMING LABORATORYL T P C

Preamble:

This laboratory course is intended to provide students with opportunities to get hands on training to solve the given problem statements using Java programming language.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Develop simple Java programs using classes and objects for the given problem.
- 2. Implement various Java features like inheritance, interface, polymorphism, packages, exception handling and multithreading to solve the business problems.
- 3. Develop a Java code for the given problem statement using String handling functions.
- 4. Develop Java applications using an applet for a given scenario to embed dynamic content in the web page.
- 5. Develop Java application to access the backend Database using JDBC.

LIST OF EXPERIMENTS

- 1. Programs to work with Java Classes and Objects
- 2. Programs to implement Overloading & Overriding concepts
- 3. Programs to implement Inheritance.
- 4. Programs using Interfaces.
- 5. Programs to handle Exceptions.
- 6. Programs for Strings handling.
- 7. Programs to work with package.
- 8. Programs to implement java applets.
- 9. Program to implement AWT event handling.
- 10. Implement the following using JDBC connectivity.
 - Payroll processing
 - Banking system
 - Library Information system

TOTAL : 45 PERIODS

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	3	3	1	-	-	-	1	-	-	1	3	-
CO2	1	2	3	3	1	-	-	-	1	-	-	1	3	-
CO3	1	2	3	3	1	-	-	-	1	-	-	1	3	-
CO4	1	2	3	3	1	-	-	-	1	-	-	1	3	-
CO5	1	3	3	2	1	-	-	-	1	-	-	1	3	-

Preamble:

This laboratory course is intended to provide students with opportunities to get hands on training to implement various data structures like lists, arrays, stacks, queues, heaps, trees, and graphs using C programming language.

Course Outcomes: Upon completion of the course, students will be able to:

- Implement and test array and linked list to perform insertion, deletion and searching operations using list ADT.
- 2. Demonstrate the programming skills in design and implementation of non linear data structures.
- 3. Design an algorithm to search an element for the given data using linear data structure.
- 4. Develop a solution to the arrange values for a given problem using heap.
- 5. Design a solution using non-linear data structures for a given real world problems.

LIST OF EXPERIMENTS

- 1. There are lists where insertion should ensure the ordering of data elements. Since the elements are in ascending order the search can terminate once equal or greater element is found. Implement a singly linked list of ordered integers (ascending/descending) with insert, search and display operations.
- 2. Program to simulate Stack using array and linked list.
- 3. Program to simulate Queue using array and linked list.
- 4. Write a recursive C program, for traversing a binary tree in preorder, in-order and post-order.
- 5. Write a C program to insert, delete and search for a node in a binary search tree.
- 6. Write a C program for graph traversals by applying: (a) Breadth First Search. (b) Depth First Search.
- 7. Consider the motor racing game in which there are n participants. Get the points scored by each participant. Write a program to sort the positions of players in ascending order based on points scored using heap sort and print the highest score.
- 8. Use linear search technique to search for a character in a given message.
- 9. A person has registered for voter id, he received a voter number and he need to check whether it exist in the voter list or not. Use binary search in a recursive way to find whether the voter number exist in the list or not.
- 10. For the given route map with cost of transportation between different cities, find the shortest route from a source to all the other cities using Dijkstra's Algorithm.

COs/P Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS 0 2
CO1	3	2	2	2	1	-	-	-	-	-	-	-	2	-
CO2	3	2	2	2	1	-	-	-	-	-	-	-	2	-
CO3	3	2	2	2	1	-	-	-	-	-	-	-	2	-
CO4	3	2	2	2	1	-	-	-	-	-	-	-	2	-
CO5	3	2	2	2	1	-	-	-	-	-	-	-	2	-

Mapping of COs with POs and PSOs

Preamble:

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Essential English for Professionals aims at enabling the learners to communicate effectively and appropriately in professional contexts by exposing them to LSRW tasks.

COURSE OUTCOMES: After the completion of this course, students will be able to

- Analyze the given listening material and answer the questions correctly employing listening techniques.
- 2. Analyze the given reading material and answer the questions correctly employing reading techniques.
- 3. Write within the stipulated time syntactically and semantically correct sentences to present ideas in the form of paragraphs and letters.
- 4. Give well-structured effective time sensitive presentations extemporaneously or after careful preparation.
- 5. Identify within the stipulated time syntactically and semantically correct sentences for a variety of language exercises.

UNIT 1 LISTENING

Listening to Casual Conversation and TED Talks

UNIT 2 READING

Poem – Robert Frost – Road not Taken Essays - Bacon's Essays

UNIT 3 WRITING

Letter Writing – Letters Seeking Permission and Letters Seeking Apology and Letters Requesting Certificates and Paragraph Writing

UNIT 4 PRESENTATION

Watching Presentations - Presentation Techniques - JAM and Three Minute Presentation

UNIT 5 VERBAL ABILITY

Verbal Analogy - Cloze Test- Idioms and Phrases- Sentence Completion – Concord – Common Errors

REFERENCES:

- 1. Rizvi, Ashraf. M, "Effective Technical Communication", 2st Edition, Tata McGraw-Hill, New Delhi,2018.
- 2. Raman, Meenakshi and Sangeetha Sharma, "Technical Communication: English Skills for Engineers", 1st Edition, Oxford University Press, New Delhi. 2008.

e-RESOURCES:

- 1. https://agendaweb.org/listening/audio-books-mp3.html
- 2. https://www.ndtv.com/world-news
- 3. https://www.naukri.com/blog/self-introduction-for-interview/
- 4. http://learnenglishteens.britishcouncil.org/skills/reading
- 5. https://www.bbc.com/bitesize/guides/zphc9j6/revision/1

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TOTAL: 30 PERIODS

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	3	-	-	3	3	-	1	-	-
CO4	-	1	-	-	-	3	-	-	-	3	-	1	-	-
CO5	-	-	-	-	-	3	-	-	-	3	-	1	-	-

21MAT45

PROBABILITY AND STATISTICS

(B.E.CSE programme in Fourth Semester)

Preamble:

Probability theory is an important foundation for computer science field such as machine learning, artificial intelligence, computer graphics and randomized algorithms. Statistics is the language of the uncertainties in the modern information age. It's descriptive and inferential roles not only formulate the basis of the growth of almost all the disciplines of the contemporary world, but also provide an array of non-traditional employment avenues ranging from that of sport analysis to business analysis.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Compute moments and moment generating functions of one dimensional random variables and solve the problems involving discrete and continuous distributions.
- 2. Measure the degree of relationship between the two dimensional random variables using correlation and regression.
- 3. Test the hypothesis for given small and large samples and determine the Goodness of fit of the sample using Chi-square test
- 4. Analyze the given samples based on their variance
- 5. Design, use and interpret control charts for variables and attributes.

UNIT 1 RANDOM VARIABLES AND PROBABILITY DISTIRBUTIONS

Random variables - Discrete and continuous random variables – Moments – Moment generating functions – Distributions: Discrete distributions – Binomial, Poisson – Continuous distributions –Uniform, Exponential and Normal distributions.

UNIT 2 TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression

UNIT 3 TESTING OF HYPOTHESIS

Large sample test based on Normal distribution for single mean and difference of means – Small sample tests based on t distributions for testing of means and F distributions for testing of variances – χ^2 test – Contingency table (Test for Independency) – Goodness of fit.

UNIT 4 ANALYSIS OF VARIANCE

Assumptions, One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.

UNIT 5 STATISTICAL QUALITY CONTROL

Control charts for measurements (X and R charts) – Control charts for attributes(p,c and np charts)-Tolerance limits – Acceptance sampling . TOTAL : 60 PERIODS

- 1. Ibe O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 2nd Edition 2014.
- 2. Walpole R.E., Myers R.H., Myers S.L., and Ye K., "Probability and Statistics for Engineers and scientists", 9th Edition, Pearson Education India,2012.

REFERENCES:

TEXT BOOKS:

- 1. Johnson R.A., 'Miller and Freund's Probability and Statistics for Engineers," 8th Edition, Pearson Education India, 2011.
- 2. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill, 4th Edition, New Delhi, 2002.
- 3. Veerarajan T., "Probability, Statistics and Random Processes with Queueing theory and Queueing Networks", 4th Edition, Tata McGraw Hill Edition, New Delhi, 2015.

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e-RESOURCES:

- 1. <u>http://nptel.ac.in/courses/111104075/13</u>, "Analysis of Variance and Design of Experiments, Module-III,Dr.Shalabh,Department of Mathematics and Statistics, Indian Institute of Technology,Kanpur.
- 2. <u>http://nptel.ac.in/courses/111105041/40/</u>, "Probability and Statistics", Prof. Dr. Somesh Kumar, Department of Mathematics, Indian Institute of Technology, Kharagpur.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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	-	-

Mapping of COs with POs and PSOs

21CST41

DATABASE MANAGEMENT SYSTEMS

(Common to B.E/B.Tech. – CS & IT Programmes)

Preamble:

The course aims to provide an understanding about the fundamentals of database, database system architecture and various database design technique. It also helps to familiarize SQL standards and various SQL operations. An overview of normalization, query optimization and transaction management is also provided. Course Outcomes: Upon completion of the course, students will be able to:

- 1. Compare File processing system with Database systems in terms of performance, scalability and data storage for efficient access of data.
- 2. Design a database schema using E-R model, Relational model and apply relational algebra operations like selection, projection, join and Cartesian product to solve the given problem.
- 3. Develop SOL queries using aggregate functions, nested sub queries, joins and views for the given problem.
- Apply suitable normalization and query optimization techniques to normalize the give relation and to 4. optimize the query for efficient access of data.
- 5. Discuss serialization and concurrency control mechanisms to avoid deadlock problem in transaction processing.

UNIT 1 **DATABASE SYSTEMS**

Overview of File processing system- Purpose of Database System-Views of data-Data Models-Database Languages—Database System Architecture–Database users and Administrator.

DATABASE DESIGN UNIT 2

Database design & E-R Model: Entity-Relationship model (E-R model)-E-R Diagrams-Constraints-Extended E-R features. Introduction to Relational Model: Database schema-Keys- Schema Diagrams - Relational Query languages - Relational Operations.

UNIT 3 SOL

SQL Standards-Data types-structure of SQL queries-additional basic operations-set operations-null valuesaggregate functions-nested sub queries-modification of the database. Intermediate SOL: Joins-Views-Transactions-Integrity constraints-Authorization. Advanced SQL.

UNIT 4 NORMALIZATION AND QUERY OPTIMIZATION

Relational database design: Functional Dependencies -Normalization and its normal forms- Denormalization-Data Storage: RAID - Tertiary Storage - File organization - Organization of records in files. Query Processing -Query optimization.

TRANSACTION MANAGEMENT UNIT 5

Transaction concepts- Transaction recovery-Properties of Transaction-Serializability-Concurrency Control -Locking Mechanisms-Two Phase Commit Protocol-Dead lock. Case study: Database connectivity using SQL.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.

REFERENCES:

- C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006. 1.
- RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson / 2. Addisionwesley, 2007.
 - Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.

3. e-RESOURCES:

http://www.nptelvideos.in/2012/11/database-management-system.html, Database Management Systems, 1. Dr.S.Srinath, IIT Madras.

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TOTAL : 45 PERIODS

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LTPC 3003
COs/	/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CC	D1	3	3	2	-	1	-	-	-	-	-	-	1	2	-
CC	02	3	3	2	1	1	-	-	-	-	-	-	1	2	2
CC	03	3	3	2	1	1	-	-	-	-	-	-	1	2	-
CC	04	3	3	2	1	1	-	-	-	-	-	-	1	2	-
CC)5	3	3	2	1	1	-	-	-	-	-	-	1	2	-

21CST42

Preamble:

Software Engineering is the application of engineering to the development of software in a systematic method. Starting with basic life cycle model concepts, it would discuss requirements specification, design, and testing issues. Large scale software development poses special challenges. This course targets to expose the students to the challenges of large scale software development and would expose the students as to how to overcome those.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Develop software product using suitable software process models for the given specification.
- 2. Analyze the requirements for real-time problem specification and devise a SRS pertaining to industry standards.
- 3. Design a system model using the appropriate design engineering procedure for a given SRS.
- 4. Test the software model using black box testing, white box testing, unit testing and integration testing to produce error free product.
- 5. Estimate the development cost, schedule a risk free work plan for a given project model using appropriate tool.

UNIT 1 SOFTWARE PROCESS AND AGILE DEVELOPMENT

Software Process -Software Process models- Waterfall Model-Incremental Process Models -Evolutionary Process Models- Prototyping-Spiral Model- Introduction to Agility-Agile process.

UNIT 2 REQUIREMENTS ANALYSIS AND SPECIFICATION

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis - Data Dictionary.

UNIT 3 SOFTWARE DESIGN

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design - User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT 4 SOFTWARE TESTING

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging.

UNIT 5 PROJECT MANAGEMENT

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Roger S. Pressman, Software Engineering – A Practitioners Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010.

2. Ian Sommerville, Software Engineering, 9th Edition, Pearson Education Asia, 2011.

REFERENCES:

- 1. Rajib Mall, Fundamentals of Software Engineering, Third Edition, PHI Learning PrivateLimited, 2009.
- 2. Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010.
- 3. Kelkar S.A., Software Engineering, Prentice Hall of India Pvt Ltd, 2007.

e-RESOURCES:

- 1. https://nptel.ac.in/courses/106101061/,
- 2. https://nptel.ac.in/downloads/106105087/,

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	-	-	-	-	-	-	-	3	1	-	2
CO2	2	3	2	-	-	-	-	-	-	-	3	1	-	2
CO3	2	3	2	-	-	-	-	-	-	-	3	1	-	2
CO4	3	3	2	-	-	-	-	-	-	-	3	1	-	2
CO5	2	3	2	-	1	-	-	-	-	-	3	1	-	2

OPERATING SYSTEMS

(Common to B.E/B.Tech. – CS & IT Programmes)

21ITT41

The main aim of this course is to introduce the concepts of operating system abstractions, mechanisms and implementations. The course makes the students to develop the optimal solution for CPU scheduling, synchronization problems and deadlocks. This course will enable the students to apply the appropriate memory, file and disk management technique for effective resource utilization.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Outline the structure and functions of Operating Systems for multiuser environment considering Linux process and thread management as a case study.
- 2. Evaluate the FIFO, SJF, Priority scheduling, Round Robin process scheduling algorithms for a given set of process considering the arrival time, burst time and resources.
- 3. Analyze the memory allocation techniques and page replacement algorithms for a given reference strings with minimum page fault.
- 4. Analyze file allocation methods for efficient file organization considering Linux virtual file system as a case study.
- 5. Evaluate the FIFO, SSTF, SCAN, CSCAN, LOOK, CLOOK disk scheduling algorithms with minimum seek time for a given disk request and analyze the architecture of iOS and Android Mobile Operating Systems.

OPERATING SYSTEMS AND PROCESS MANAGEMENT UNIT 1

Operating System Overview: Objectives and Functions - Evolution of Operating Systems - Computer Organization -Operating System Operations - Services - System Calls - System Programs - Operating System Structure - OS Generation - System Boot. Processes: Process concept - Process scheduling - Operations on processes - Inter process communication - Threads: Overview - Multicore Programming - Multithreading Models. Case Study: Linux Process and Thread Management.

UNIT 2 PROCESS SCHEDULING AND SYNCHRONIZATION

CPU Scheduling: Concepts - Scheduling criteria - Scheduling algorithms. Process Synchronization: The criticalsection problem - Synchronization hardware - Semaphores - Classic problems of synchronization - Monitors. Deadlocks: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance - Deadlock detection - Recovery from deadlock. Case Study: Linux Scheduling.

MEMORY MANAGEMENT UNIT 3

Main Memory: Background – Swapping – Contiguous memory allocation – Paging – Segmentation. Virtual Memory: Background – Demand paging – Page replacement – Allocation of frames – Thrashing. Case Study: Linux Memory Management. 9

UNIT 4 FILE SYSTEMS

File-System Interface: File concept – Access methods – Directory and disk structure – File-system mounting – Sharing and Protection. File-System Implementation: Structure and Implementation – Directory implementation – Allocation methods - Free-space management. Case Study: Linux Virtual File System.

UNIT 5 **I/O SYSTEMS**

I/O Systems: I/O Hardware - Mass Storage Structure: Overview, Disk Structure and Attachment - Disk Scheduling and Management – Swap-space management – RAID. Mobile OS: iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2013.

2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.

REFERENCES:

- 1. Andrew S. Tanenbaum, "Modern Operating Systems", Third Edition, Pearson Education, 2009.
- 2. Harvey M. Deital, "Operating Systems", Third Edition, Pearson Education, 2004.
- 3. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", 3rd Edition, Tata McGraw-Hill Education, 2007.

e-RESOURCES:

- 1. http://nptel.ac.in/courses/106108101/ "Introduction to operating system", Prof P.C.P. Bhatt, IISc-Bangalore.
- https://nptel.ac.in/courses/106106144/2/ "Introduction to operating system", Prof Chester Rebeiro, IIT-Madras. 2.

TOTAL: 45 PERIODS

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COs/P Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2
CO1	2	3	2	-	-	2	-	-	-	-	-	1	1	2
CO2	2	3	2	2	-	2	-	-	-	-	-	1	1	2
CO3	2	3	2	2	-	2	-	-	-	-	-	1	1	2
CO4	3	3	2	2	-	2	-	-	-	-	-	1	1	2
CO5	2	3	2	2	-	2	-	-	-	-	-	1	1	2

DESIGN AND ANALYSIS OF ALGORITHMS (Common to B.E/B.Tech. – CS & IT Programmes)

LTPC 3 1 0 4

Preamble:

This course enables the student to understand various algorithm design techniques, and know how to applythose techniques to various problems. The analysis of various algorithms can be performed and select the best algorithm for solving a problem.

Course Outcomes: Upon completion of the course, students will be able to:

- Differentiate recursive and non-recursive algorithms using asymptotic notations. 1.
- 2.
- 3.
- 4.
- Evaluate recursive and non-recursive algorithms using asymptotic notations. Evaluate the performance of Selection sort, Bubble sort, Merge sort, Quick sort, Insertion sort, Heap sortconsidering input data set properties, running time and code size. Analyze the efficiency of Prim's algorithm, Kruskal's algorithm, Dijkstra's algorithm, Huffman trees,Fractional knapsack problem for a given problem using greedy technique. CategorizeWarshall's and Floyd's algorithms, optimal binary search trees, Knapsack problem for a givenproblem using dynamic programming technique. Illustrate the design strategies for n-Queens problem, Hamiltonian circuit problem,subset sum problem,Knapsack problem, Traveling salesman problem using Backtracking and Branch & Bound technique. 5. 9+3

UNIT 1 ALGORITHM ANALYSIS

Introduction - Notion of Algorithm - Fundamentals of Algorithmic problem Solving - Important Problem types- Fundamentals of the Analysis of Algorithm Efficiency - Analysis Framework - Asymptotic notations and Basic Efficiency Classes - Mathematical Analysis of Recursive and Non-recursive algorithms-Empirical analysis of Algorithms-Algorithm Visualization.

UNIT 2 ANALYSIS OF SORTING AND SEARCHING ALGORITHMS

Brute Force - Selection Sort and Bubble Sort - Divide and conquer - Merge sort - Quick Sort-Strassen's Matrix Multiplication -Decrease and Conquer - Insertion Sort-Transform and Conquer-Heaps and Heap sort- Analysis of Linear Search and Binary search techniques.

UNIT 3 GREEDY TECHNIQUE

Introduction to greedy technique - Prim's algorithm - Kruskal's algorithm - Dijkstra's algorithm- Huffman Trees-Fractional Knapsack Problem- Job Sequencing with Deadlines.

UNIT 4 DYNAMIC PROGRAMMING

Introduction to Dynamic Programming-Computing a Binomial Coefficient-Warshall's and Floyd's Algorithms - Optimal Binary search trees -0/1 Knapsack Problem and Memory functions-Matrix-chain multiplication.

UNIT 5 BACKTRACKING & BRANCH AND BOUND

Backtracking- n-Queens problem - Hamiltonian Circuit Problem - Subset Sum problem - Branch and Bound – 0/1 Knapsack problem - Traveling Salesman Problem-Introduction to P, NP and NP-complete Problems.

TEXT BOOKS:

- 1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
- 2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.

REFERENCES:

- Ellis Horowitz, Sartaj Sahni, SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", 1. Secondedition, Galgotia Publications, New Delhi, 2010.
- 2. Donald E. Knuth, "The Art of Computer Programming", Pearson Education, 2009.
- 3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", PearsonEducation, Reprint 2006.

TOTAL :45+15=60 PERIODS

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e. RESOURCES :

- 1. https://nptel.ac.in/courses/106101060/ "Design and analysis of algorithms", Prof. Abhiram Ranade, IIT-Bombay.
- 2. http://nptel.ac.in/courses/106106131/, "Design and analysis of algorithms", Prof.Madhavan Mukund, IIT-Madras.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	2	-	-	-	-	-	-	-	1	3	2
CO2	2	3	2	2	-	-	-	-	-	-	-	1	3	2
CO3	2	3	2	2	-	-	-	-	-	-	-	1	3	2
CO4	3	3	2	2	-	-	-	-	-	-	-	1	3	2
CO5	2	3	2	2	-	-	-	-	-	-	-	1	3	2

Mapping of COs with POs and PSOs

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Preamble :

This course aims at facilitating the student to learn the object orientation on real world problems; analyze and design the problem domain using the principles and practices followed in object oriented problem solving by applying object technology with UML modeling.

Course Outcomes: Upon completion of the course, students will be able to:

- Analyze and document the requirements for a software system using UseCase 1. driven approach.
- Use class diagrams to create domain and design model for a given application. 2.
- Apply interaction and state transition notations to create dynamic model of a given 3. application.
- Identify a suitable design pattern for given applications using object oriented design 4. methodologies
- 5. Develop a software model using StarUML for a given problem.

UNIT 1 **OOAD BASICS**

Introduction - Overview of Object Oriented system development - Object Basics - OO Themes - Evidence for usefulness of OO Development - OO Modeling - OO History - UML Diagrams - Inception- Use case Modeling -Relating Use cases - include, extend and generalization - The NextGen POS system - The Monopoly Game system. 9

STATIC MODELING UNIT 2

Elaboration - Domain models - Finding conceptual classes and description classes - Associations - Attributes -Domain model refinement - Finding conceptual class hierarchies- Aggregation and composition - UML class diagrams - Relationship - Inheritance - Abstract classes - Polymorphism - UML activity diagrams and modeling

UNIT 3 **DYNAMIC MODELING**

System Sequence diagrams - Communication diagrams - Relationship between sequence diagrams and use cases -Logical architecture and UML package diagram – Logical architecture refinement - UML state machine diagrams and modeling - Operation contracts. 9

DESIGN PATTERNS UNIT 4

Object oriented design methodology - Common base class - GRASP: Designing objects with responsibilities -Patterns - Creator - Information expert - Low coupling - Controller - High cohesion - Designing for visibility -Applying GoF design patterns – Adapter – Singleton – Factory – Strategy – Composite - Facade and observer patterns. 9

UNIT 5 **IMPLEMENTATION AND APPLICATION**

Mapping design to code - Forward Engineering - Reverse Engineering - Test driven development - Refactoring -UML tools and UML as blueprint - UML deployment and component diagrams - Testing: Issues in OO Testing -Types of Testing.

List of Experiments

Develop a problem statement and SRS document. Identify Use Cases and develop the different UML diagrams.

- 1. Library management system
- 2. Banking application
- 3. Passport automation system
- 4. Online reservation system
- 5. Exam registration

TOTAL : (L:45+P:15) 60 PERIODS

TEXT BOOKS:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005

REFERENCES:

1. Micheal Blaha, James Rambaugh, "Object-Oriented Modeling and Design with UML", Second Edition,

^{1.} Prentice Hall of India Private Limited, 2007.

- 2. Mike O'Docherty, "Object-Oriented Analysis & Design: Understanding System Development with UML 2.0", John Wiley & Sons, 2005.
- 3. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable objectoriented software", Addison-Wesley, 1995

e-RESOURCES:

1. http://argouml.tigris.org/

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	3	2	1	-	1	-	-	1	-	1	2	2
CO2	1	2	3	2	1	-	1	-	-	1	-	1	2	2
CO3	1	2	3	2	1	-	1	-	-	1	-	1	2	2
CO4	1	3	3	2	1	-	1	-	-	1	-	1	2	2
CO5	1	2	3	2	1	-	1	-	1	1	-	1	2	2

Mapping of COs with POs and PSOs

Preamble:

This laboratory course is intended to provide students with opportunities to get hands on training to create database with SQL queries, Joins, Aggregate functions, Triggers and Exception Handling using Oracle /MySQL. **Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Work with DDL and DML commands to store and manipulate information in the database.
- 2. Apply the concept of views, indexes, sequences, joins and aggregate functions to perform analysis on data in the database.
- 3. Develop simple programs using PL/SQL for the given problem.
- 4. Work with procedure, trigger, exception handling and function to provide solutions for the given problem.
- 5. Develop real time applications (Banking system, Payroll processing and Library Information system) using SQL.

LIST OF EXPERIMENTS

- 1. Create a database and work with SQL queries to retrieve information from the database.
- 2. Create an Employee database to set various constraints.
- 3. Work with Joins, aggregate functions
- 4. Creation of database objects: Synonyms, Sequences, Views, Indexes and save point.
- 5. Study of PL/SQL block.
- 6. Develop simple programs using PL/SQL.
- 7. Creation of Procedures.
- 8. Creation of Functions.
- 9. Work with Triggers and Exception handling
- 10. Mini project (Application Development using Oracle / MySQL)
 - Payroll processing.
 - Banking System.
 - Library Information System

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	2	-	-	-	1	1	-	-	2	-
CO2	2	2	2	3	2	-	-	-	1	1	-	-	2	-
CO3	2	2	2	3	2	-	-	-	1	1	-	-	2	-
CO4	2	2	2	3	2	-	-	-	1	1	-	-	2	-
CO5	2	2	2	3	2	-	-	-	1	1	-	-	2	-

Preamble:

The main aim of this course is to implement the concepts of operating system mechanisms and policies. The course makes the students to implement the program that provide the optimal solution for CPU scheduling, synchronization problems and deadlocks. This course will also enable the students to apply the designed module to appropriate memory, file and disk management technique for effective resource utilization.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Develop the suitable shell commands to establish user interface with UNIX kernel.
- 2. Develop C Program to implement CPU scheduling algorithms, deadlock avoidance algorithms and page replacement algorithms for a given set of processes considering arrival time, burst time and resources.
- 3. Develop C program to implement thread, process synchronization and Inter Process Communication for a given set of processes by using semaphore and shared memory mechanisms
- 4. Construct a C program to implement file allocation and organization techniques for a given set of files by using sequential, indexed and linked file allocation methods.
- 5. Develop C Program for memory management by using paging technique.

LIST OF EXPERIMENTS

- 1. Study and execute the basic commands of UNIX operating system for resource management.
- 2. Write a C program to implement FCFS, SJF and Round Robin (time quantum=2) CPU schedulingalgorithms for process Scheduling.
- 3. Write a C program to implement the file allocation strategies such as a) Sequential b) Indexed c)Linked for 'n' number of files.
- 4. Write a C program to implement the process synchronization for producer consumer problem using semaphore.
- 5. Write a C program to implement single and two-level directory structure for effective file organization.
- 6. Write a C program to implement the Bankers Algorithm for deadlock avoidance and detection.
- 7. Write a C program to implement the FIFO and LRU page replacement algorithm for the following reference string:1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6.
- 8. Write a C program to implement shared memory between the two-process using Inter Process communication (IPC) primitives.
- 9. OS uses a paging system with 2Kbytes pages. A given processes uses a virtual address space of 8Kbytes and it is assigned 8Kbytes of physical memory. Write a C program to create page table and implement Paging Technique to find out physical address for the above scenario.
- 10. Write a C program to create 2 threads named Th1 and Th2 and establish synchronization between two threads using mutex lock.

SOFTWARE

- Linux :Ubuntu / OpenSUSE / Fedora / Red Hat / Debian / Mint OS
- GCC compiler

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	-	-	2	-	-	-	-	-	1	3	2
CO2	2	3	2	2	-	2	-	-	-	-	-	1	3	2
CO3	2	3	2	2	-	2	-	-	-	-	-	1	3	2
CO4	2	3	2	2	-	2	-	-	-	-	-	1	3	2
CO5	2	3	2	2	-	2	-	-	-	-	-	1	3	2

21MCL04

Preamble:

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Professional Communication aims at enabling the learners to communicate effectively and appropriately in professional contexts by exposing them to LSRW tasks.

COURSE OUTCOMES - After the completion of this course, students will be able to

- Analyze the given listening material and answer the questions correctly, employing listening
 techniques.
- 2. Take part effectively in group discussions, conforming to professional norms
- 3. Analyze the given reading material and answer the questions correctly, employing reading techniques
- 4. Write within the stipulated time, syntactically and semantically correct sentences to present ideas in the form of an essay.
- 5. Identify within the stipulated time syntactically and semantically correct sentences for a variety of language exercises

UNIT 1 LISTENING

Listening to News Bulletins and Documentaries

UNIT 2 GROUP DISCUSSION	8
Watching Group Discussion videos – Do's and Don'ts of GD – Mock GD	
UNIT 3 READING	6
Letters to Editor Column - Reading News Articles - Biographies of Famous Personalities	
UNIT 4 WRITING	6
IELTS Essay Writing	
UNIT 5 VERBAL ABILITY	4

Verbal analogy - Cloze Test- Idioms and Phrases- Sentence Completion -Error Spotting

TOTAL: 30 PERIODS

6

REFERENCES:

- 1. Raman, Meenakshi and Sangeetha Sharma, "Technical Communication: English Skills for Engineers", 1st Edition, Oxford University Press, New Delhi. 2008.
- 2. Rizvi, Ashraf. M, "Effective Technical Communication", 2st Edition, Tata McGraw-Hill, New Delhi,2018

e-RESOURCES:

- 1. http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
- 2. https://www.bbc.com/bitesize/guides/zphc9j6/revision/1
- 3. https://www.fresherslive.com/online-test/verbal-ability-test/questions-and-answers

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO2	-	1	-	-	-	3	-	-	3	3	-	1	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	_	-	_	-	_	_	-	_	-	3	-	1	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	1	-	-

21CST51

COMPUTER NETWORKS (Common to B.E / B.Tech. – CS& IT Programmes)

Preamble:

The course aims to provide an understanding of computer networks architecture, various technologies available to build a network and protocols in use at different levels of network layers stack. An overview of global Internet, Internet applications and types of protocols used for mail transfer is also provided.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Interpret the importance of layering, addressing and annotate the protocol stack of OSI and TCP/IP model.
- 2. Annotate MAC protocols (Ethernet, Token Ring and Wi-Fi) supported by Data Link layer to ensure hop-to-hop reliable communication.
- 3. Use IP addressing and routing protocols to find shortest route to achieve reliable network-layer data transmission.
- 4. Classify the transport layer protocols and explain the congestion control or congestion avoidance techniques to ensure quality of service.
- 5. Analyze the functions and services provided by the application layer protocols (HTTP, SMTP and DNS).

UNIT 1 DATA COMMUNICATIONS

Data Communication– Networks–The OSI Model– Layers in the OSI Model – TCP/IP Protocol Suite – Addressing – Transmission Media

UNIT 2 DATA LINK LAYER

Framing – Error Detection and Correction– IEEE Standards (802.3,802.5,802.11)– MAC protocols and types

UNIT 3 NETWORK LAYER

Internetworking: Switching and Bridging – Basic Internetworking-IPv4 - IPv6 – Routing Techniques: Distance vector (RIP) – Link state (OSPF) — Interdomain Routing (BGP).

UNIT 4 TRANSPORT LAYER

Congestion Control and Resource Allocation: TCP Congestion Control – Congestion Avoidance Mechanisms – Quality of Service: Integrated Services – Differentiated Services.

UNIT 5 APPLICATION LAYER

Domain Name System - File Transfer – Web Services and SNMP - HTTP - Electronic Mail (SMTP, POP3, IMAP, MIME).

TEXT BOOKS:

- 1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.
- 2. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, Tata McGraw Hill, Reprint 2012.

REFERENCES:

- 1. William Stallings, "Data Communication and Networks", Pearson Education, Tenth edition, 2014.
- 2. James.F. Kurouse& W. Rouse, "Computer Networking: A Topdown Approach Featuring", Sixth edition, Pearson Education, 2013.
- 3. William Stallings, "Data Communication and Networks", Pearson Education, Tenth edition, 2014.

e-RESOURCES:

- 1. http://www.nptel.ac.in/downloads/106105080, "Computer Networks", Prof.Sujoy Ghosh, IIT Kharagpur.
- 2. https://www.elsevier.com/journals/subjects/computer-science

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TOTAL : 45 PERIODS

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	-	-	-	1	-	-	-	-	1	-	2
CO2	2	3	2	-	-	-	1	-	-	-	-	1	-	2
CO3	2	3	2	-	-	-	1	-	-	-	-	1	-	2
CO4	2	3	2	-	-	-	1	-	-	-	-	1	-	2
CO5	2	3	1	-	-	-	1	-	-	-	-	1	-	2

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21CST52

Preamble:

Web programming refers to the writing, mark-up and coding involved in Web development, which includes Web content, Web client and server scripting and network security. This course deals with most common web programming technologies such as HTML, CSS, Java Script and XML. It would further discuss creation of interactive web application using AJAX and Web services architectures.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Design a static web page with appropriate user interface using HTML and CSS.
- 2. Construct a static web page with necessary user interface and validation using Java Script objects by applying event handling mechanisms.
- 3. Develop a dynamic webpage with suitable user interface using Angular JS.
- 4. Write a valid and well-formed XML document for a given scenario using XML schemas and DTD.
- 5. Create an interactive web application for business processing for a given scenario using Web Services WSDL and SOAP.

UNIT 1 WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0

Web Essentials: Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements - Audio - CSS3 - Inline, embedded and external style sheets - Rule cascading -Backgrounds - Border Images - Colors - Shadows - Text - Transformations - Transitions.

CLIENT SIDE PROGRAMMING UNIT 2

Java Script: An introduction to JavaScript-JavaScript DOM Model - Functions - Objects - Built-In Objects - Regular Expressions - DOM Event Handling- DHTML with JavaScript.

CLIENT SIDE WEB FRAMEWORK UNIT 3

Angular JS: Introduction – Modules – Directives – Data binding – Scope – Filters – Services – Events -HTTP - Tables - SQL - Forms ; Server web framework Django - Integrating with databases and applications. 9

UNIT 4 **XML**

XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT 5 **INTRODUCTION TO AJAX and WEB SERVICES**

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

TEXT BOOKS:

- 1. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
- 2. Brad Green and Shyam Seshadri, "Angular JS", O'Reilly Publications, First edition, 2013.

REFERENCES:

- 1. Deitel and Deitel and Nieto, "Internet and World Wide Web How to Program", Prentice Hall, 5th Edition, 2011.
- 2. UttamK.Roy, "Web Technologies", Oxford University Press, 2011.

e-RESOURCES:

- 1. https://nptel.ac.in/courses/106105084/11, "Internet Technology", Prof. I. Sengupta, IIT-Kanpur.
- 2. ps://nptel.ac.in/courses/106106156/3, "Introduction to Modern Application Development", Prof. Gaurav Raina, IIT-Madras.
- 3. ps://en.wikipedia.org/wiki/Web_development.

LTPC 3 0 0 3

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TOTAL : 45PERIODS

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	3	3	1	1	-	-	-	-	-	I	1	3	-
CO2	1	3	3	1	1	-	-	-	-	-	I	1	3	-
CO3	1	3	3	1	2	-	-	-	-	-	I	1	3	-
CO4	1	3	3	1	2	-	-	-	-	-	-	1	3	-
CO5	1	3	3	1	2	-	-	-	-	-	-	1	3	-

21CST53

THEORY OF COMPUTATIONS

L T P C 31 04

Preamble:

The course aims to familiarize the various Computing models like Finite State Machine, Pushdown Automata and Turing Machine and impart the knowledge in types of grammars.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Translate the given FA into deterministic and non-deterministic finite automata using Minimization Techniques.
- 2. Examine the given language is regular or not using Pumping Lemma and Minimization technique.
- 3. Formulate Chomsky and Greibach Normal form for the given regular expression using simplification Techniques.
- 4. Construct pushdown automata for the given Context Free Grammar or Context Free Language using Pumping Lemma technique.
- 5. Apply programming techniques involved in turing machine to solve decidable and undecidable problems to achieve efficiency.

UNIT 1 AUTOMATA

Formal proof – Additional forms of proof – Inductive proofs –Finite Automata (FA) –Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions.

UNIT 2 REGULAR EXPRESSIONS AND LANGUAGES

Regular Expression – FA and Regular Expressions – Moore machine and Mealy machine-Closure properties of regular languages – Equivalence and minimization of Automata - Pumping Lemma for Regular sets .

UNIT 3 GRAMMARS

Grammar Introduction– Types of Grammar - Context Free Grammars and Languages– Parse Trees – Ambiguity in grammars and languages - Relationship between derivation and derivation trees – Normal forms for CFG : Elimination of Useless symbols - Unit productions - Null productions – Chomsky normal form- Greibach Normal form .

UNIT 4 PUSHDOWN AUTOMATA AND TURING MACHINES

Pushdown automata – Languages of a Pushdown Automata – Equivalence of Pushdown automata and CFG– Deterministic Pushdown Automata -Pumping Lemma for CFL–Closure properties of CFL – Turing Machines – Programming Techniques for TM.

UNIT 5 DECIDABILITY AND UNDECIDABILITY

A Language that is not recursively enumerable(RE)- An undecidable program that is RE-UndecidableProblems about Turing Machines- Post's Correspondence Problem-The classes Pand NP. Case Study:Pattern matching for mobilephone, gmail.

TEXT BOOK:

- 1. Hopcroft J.E., Motwani.R and Ullman. J.D., "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2012.
- 2. Harry R Lewis and Christos H Papadimitriou, "Elements of the Theory of Computation",
- ^{2.} Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2015.

REFERENCES:

- 1. MichealSipser, "Introduction of the Theory and Computation", Third Edition, Cengage Learning India Private Limited, 1997.
- 2. Mishra K.L.P and Chandrasekaran N, "Theory of Computer Science Automata, Languages and Computation", Third Edition, Prentice Hall of India Learning India Private Limited,2009.
- 3. Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, 2011.

10+3

9+3

7+3

10+3

9+3

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TOTAL(L:45+T:15): 60 PERIODS

e-RESOURCES:

- 1. http://nptel.ac.in/courses/ 106104148, Theory of Computation, RaghunathTewari, IIT Kanpur.
- 2. Handouts: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-
- 2. 045jautomata-computability-and-complexity-spring-2011/lecture-notes/

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	-	I	-	-	I	-	-	-	1	1	2
CO2	2	3	2	-	-	-	-	-	-	-	-	1	-	2
CO3	2	3	2	-	I	-	-	1	-	-	-	1	I	2
CO4	2	3	2	-	I	-	-	I	-	-	-	1	-	2
CO5	2	3	2	-	-	-	-	-	-	-	-	1	-	2

Mapping of COs with POs and PSOs

21CSL51

Preamble:

The course aims to provide a development of socket programming, simulation of Stop & Wait, Go back-N, Selective Repeat protocols and Distance Vector Routing algorithm along with the simulation of point-to-point and local area network using Cisco packet tracer.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Simulate the network topologies using NS2 for data communication.
- 2. Experiment Automatic Repeat Request protocols (Stop and Wait, Go back-N and Selective Repeat) using the appropriate elements and packages in Socket programming.
- 3. Develop a java program to find shortest path using Distance Vector for a given scenario.
- 4. Write a java socket program for simulating TCP communication and UDP communication.
- 5. Create a Point-to-Point Network and Local Area Network using CISCO Packet Tracer.

LIST OF EXPERIMENTS

- 1. Study of Network simulator 2 (NS2).
- 2. Implementation of Various Topologies using NS2 Simulator.
- 3. Bit Stuffing and CRC computation.
- 4. Program to simulate Stop & Wait protocol.
- 5. Implementation of Sliding Window Protocol.
- 6. Program to simulate Distance Vector Routing algorithm.
- 7. Socket program to implement echoclientandechoserver using TCP
- 8. Socket program to contact a given DNS server to resolve a given host name using UDP
- 9. Case Study using Cisco Packet Tracer.

Establishing a Local Area Network (LAN):The main objective is to set up a Local AreaNetwork, concepts involved in this network are IP addressing and the Address ResolutionProtocol (ARP). The required equipment's are 192.168.1.1,192.168.1.2, 192.168.1.3,Host AHost B Host C, Switch/HUB, three PC's equipped with at least one NIC, one HUB or Switchand the necessary cables. Once the physical LAN is set up the hosts need to be configured using the ipconfig command. To verify communication among the machines the ping command isused. Next, to manipulate the routing tables at the hosts to understand how machines know where to send packets. Since the ipconfig command places a default route into the routing tablesthis route must be deleted to 'blindfold' the machine. The ping command is used again to showthat communication is no longer available. To re-establish communication the routes are putback into the routing table one host at a time. Communication is once again verified using theping command.

10. Establish a LAN in Cisco Packet Tracer and perform traffic analysis for FTP using TrafficGenerator.

TOTAL:45 PERIODS

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	3	3	-	-	-	1	-	-	1	3	3
CO2	3	3	2	3	3	-	-	-	1	-	-	1	3	1
CO3	3	3	2	3	3	-	-	-	1	-	-	1	3	1
CO4	3	3	2	3	3	-	-	-	1	-	-	1	3	1
CO5	3	3	2	3	3	-	-	-	1	-	-	1	3	3

21CSL52 WEB PROGRAMMING LABORATORY

Preamble:

Web development is the work involved in developing a web site for the Internet. This course deals with various internet technologies like HTML, CSS, Java Script and XML for creating interactive websites. This course further discusses AJAX and Web services for creating web applications.

Course Outcomes: Upon completion of the course, students will be able to:

1. Design and test static web pages for the given application using HTML and CSS.

- 2. Implement and test client side programming for validating a given registration form using Java script.
- 3. Implement and test client side web framework for creating dynamic web pages using Angular JS.
- 4. Construct well-formed web browser-based documents that can be used to validate XML documents by utilizing XML Document Type Definitions and XML Schema documents.
- 5. Develop and test web services for an airline service and travel agent using database connectivity.

LIST OF EXPERIMENTS

- 1. Create a web page with the following using HTML.
 - a. To embed a map in a web page.
 - b. To fix the hot spots in that map.
 - c. Show all the related information when the hot spots are clicked.
- 2. Create a web page with the following.
 - a. Cascading style sheets.
 - b. Embedded style sheets.
- c. Inline style sheets. Use our college information for the web pages.
- 3. Create a registration form with the following fields.
 - Name (Text field).
 - Password (Password field).
 - Email id (Text field).
 - Phone Number (Text field).
 - Date of birth (3 select boxes).
 - Languages known (check boxes English, Tamil, Hindi, Telugu).
 - Address (Text area).

Write JavaScript to validate the following fields.

- Name should contain alphabets and the length should not be less than 15 characters.
- Password should not be less than 8 characters.
- Email-Id should not contain any invalid characters and must follow the standard pattern (name@domain.com).
- Phone number should contain 10 digits only.

4. Write an HTML page including required JavaScript that takes a number from one text field in the range of 0 to 999 and shows it in a another text field in words. If the number is out of range, it should show "out of range" and if it is not a number, it should show "not a number" message in the result box.

5. Write an Angular JS framework that allows users to design a order form with a total price updated in real time.

6.Write an Angular JS framework that allows users to switching between different layout modes (grid or list) with a click of a button.

7. Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document.

8. Write a DTD for an XML document that declares an address book containing contacts. Each contact has a name and address. An address should contain attributes for street name, state and

phone number. Also write an XML document and validate it against this DTD.

9. Design a form using Ajax that contains a text field and a pushbutton. The user should enter a customer ID and press the button, and should see (in the same page) either:

- A bulleted list of the id, first name, last name, and balance of the person with that ID.
- An error message for an unknown/missing id.

10. Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Data base.

SOFTWARE REQUIRED:

Dream Weaver or Equivalent, AngularUI or Equivalent, MySQL or Equivalent, WAMP/XAMPP.

TOTAL:45 PERIODS

COs/POs	PO 1	PO 2	PO 3	PO 4	РО 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	2	3	1	-	-	-	1	1	-	-	3	-
CO2	1	1	2	3	1	-	-	-	1	1	-	-	3	-
CO3	1	1	2	3	2	-	-	-	1	1	-	-	3	-
CO4	1	1	2	3	2	-	I	-	1	1	-	-	3	-
CO5	1	1	2	3	2	-	-	-	1	1	-	-	3	-

Mapping of COs with POs and PSOs

Preamble:

Aptitude tests are used to determine an individual's ability/potential to succeed in a certain task, with no prior knowledge or training and are frequently used as part of a pre-employment assessment. Aptitude tests are a proven tool used to identify those who are best equipped to carry out any given role. A logical reasoning test is a form of testing that is widely used by corporate employers to help assess candidates during their recruitment process.

Course Outcomes :Upon completion of the course, students will be able to

- 1. Solve the given equation using appropriate simplification methods.
- 2. Apply aptitude method of ratio and proportion to solve the given scenario.
- 3. Calculate time, speed, distance by applying suitable aptitude method for the given problem statement.
- 4. Calculate percentage and profit & loss for the given problem statement.
- 5. Compute simple interest, compound interest and predict relationship for the given problem/scenario.

UNIT 1	6
Number System, Simple Equation, Sequence and Series	
UNIT 2	6
Ratio and Proportion, Problems on Ages, Partnership	
UNIT 3	6
Time and Distance, Problems on Trains, Boats and Streams	
UNIT 4	6
Percentage, Profit and Loss, Directions Sense	
UNIT 5	6
Simple Interest and Compound Interest, Blood Relations	

TOTAL : 30 PERIODS

REFERENCES:

- Dr.R.S.Aggarwal, "Quantitative Aptitude for Competitive Examination", S.Chand Publications, 2017
- Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S.Chand Publications, 2018

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	-	1	-	-	-	-	-	-	-	1	-	-
CO2	2	3	-	1	-	-	-	-	-	-	-	1	-	-
CO3	2	3	-	1	-	-	-	-	-	-	-	1	-	-
CO4	2	3	-	1	-	-	-	-	-	-	-	1	-	-
CO5	2	3	-	1	-	-	-	-	-	-	-	1	-	-

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21MCL09

Preamble:

Communication Skill is a life skill necessary for all students of Engineering and Technology. The course Communicative Skills Laboratory aims at developing effective oral and written communication to facilitate their success in competitive examinations, and recruitment screening thereby ensuring professional success and progress.

COMMUNICATION SKILLS LABORATORY

Course Outcomes: Upon completion of the course, students will be able to

- 1. Respond quickly and correctly to questions from different types of scripts, exhibiting good comprehension and analyzing skills
- Participate effectively in formal group discussions and prepare professional e-mails, persuasive and 2 expository paragraphs to establish and meet organizational needs and goals.
- Fare well in IELTS and other English language assessment segments of competitive examinations 3. within the stipulated time.
- 4. Write effectiveresumes and face interviews with communicative competence and confidence, with a good knowledge of career skills.
- 5. Select appropriate vocabulary and idiomatic expressions, identify errors in syntax, arrange sentences to make meaningful paragraphs, without any aid.

RECEPTIVE SKILLS UNIT 1

LISTENING & READING – Developing Listening & Reading Skills - Comprehension and Analysis – Listening & Reading for Main Idea - Specific Information - Sequence-Vocabulary - Cultural Interest-Attitude and Opinion- Functional language.

PRODUCTIVE SKILLS UNIT 2

SPEAKING - Group Discussion skills - Structure- Types- Techniques - Keywords - Vital qualities - Tips to improve performance. WRITING - Emails and Paragraph Writing - Expository and Persuasive **ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS** UNIT 3

Orientation to International English Language Testing System (IELTS), Public Service Commission Exams (TNPSC, UPSC)

CAREER SKILLS UNIT 4

Different types of Interview formats - Answering Questions - FAQ's - Mock Interviews - Body Language - Preparation of Résumé and Job Application Letter - Team Work - Managing Time - Managing Stress -Negotiation Skills - Networking Professionally - Social Protocols – Upskilling

UNIT 5 **VERBAL ABILITY**

Synonyms and Antonyms - Verbal Analogy - Cloze Test- Idioms and Phrases - Sentence Completion -Jumbled Sentences - Error Spotting - Theme Detection - Sentence Arrangement

RECOMMENDED SOFTWARE: Globerena

REFERENCES:

- 1. Rizvi M. Ashraf, "Effective Technical Communication", MC Graw Hill Education, New Delhi, 2005.
- 2. KoneruAruna,"Professional Communication", MC Graw Hill Education, Chennai, 2008.
- 3. Upadhyay Meenakshi & Arun Sharma, "Comprehension Interpersonal & Communication Skills for General Studies Civil Services Preliminary Examination", MC Graw Hill Education, New Delhi, 2012.

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30 PERIODS

TOTAL :

WEB SOURCES:

- 1. http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
- 2. https://www.teachingenglish.org.uk/article/email-writing
- 3. https://www.naukri.com/blog/frequently-asked-hr-interview-questions-and-answers/
- 4. http://www.oxforddictionaries.com/words/writing-job-applications
- 5. https://www.fresherslive.com/online-test/verbal-ability-test/questions-and-answers

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	3	-	I	I	I	3	I	-	-	-
CO2	-	1	-	-	-	-	-	-	3	3	-	1	-	-
CO3	-	-	-	-	-	3	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	3	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	3	-	-	-	3	-	1	-	-

Mapping of COs with POs and PSOs

21CST61

Preamble

Artificial Intelligence refers to the simulation of human intelligence in machines that are programmed to think like humans. The course aims to provide the application of uninformed and informed search methods for AI problems, infer the rules using first order logic for the knowledge representation, implementation of Bayesian theory for uncertainty along with fuzzy logic and applications of AI in Natural Language Processing and Robotics.

ARTIFICIAL INTELLIGENCE

Course Outcomes: Upon completion of the course, students will be able to:

- Select a suitable set of production rules or apply constraint satisfaction technique to solve a given problem 1. in AL
- Apply appropriate search strategy to find an optimal solution for a given AI problem. 2.
- Apply resolution procedure to derive conclusion from the given set of statements in knowledge 3. representation.
- Apply Bayesian theory, Bayesian networks, Dempster Shafer theory for probabilistic reasoning to handle 4. uncertainty.
- Discuss the ability of AI to solve problems in the areas of Natural Language Processing and Robotics. 5.

UNIT 1 **INTELLIGENT AGENTS**

Introduction- What is AI-Why AI? -Foundation of AI- History of AI- Intelligent Agents: Agents and Environments - Characteristics-Structure of Agents. Problem formulation-Production systems-Problem characteristics-Production system characteristics- Constraints Satisfaction Problems.

PROBLEM SOLVING METHODS UNIT 2

Search Strategies- Uninformed Search strategies: BFS-Uniform-cost search-DFS-Iterative Deepening DFS-Bidirectional Search. Informed Search strategies: Greedy BFS-A* search- Local Search Algorithms and **Optimization Problems.**

UNIT 3 **KNOWLEDGE REPRESENTATION**

Knowledge Representation -Using Predicate logic:Representing simple facts-Representing instance and ISA re lationships-Computable functions and predicates- Resolution – Forward chaining - Backward chaining

UNIT 4 UNCERTAINITY AND PROBABLISTIC REASONING

Uncertainty: Acting under Uncertainty-Inference using Full Joint Distributions -Bayes' rule. Probabilistic Reasoning: Semantics of Bayesian networks-Exact Inference- Dempster- Shafer theory-Fuzzy set and fuzzy logic. 9

UNIT 5 **AI APPLICATIONS**

Natural Language Processing: Information Retrieval- Information Extraction-Speech Recognition .Robotics : Hardware - Perception - Planning - Moving.

TOTAL(L) : 45 PERIODS

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TEXT BOOKS:

Stuart Russel and Peter Norvig "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson 1. Education.

Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", 3rd Edition, McGraw Hill- 2008. 2. **REFERENCES:**

- 1. Deepak Khemani, "A First Course in Artificial Intelligence", Tata Mc Graw Hill Education 2013.
- 2. Nils J. Nilsson, —The Quest for Artificial Intelligencel, Cambridge University Press, 2009.
- M. Tim Jones, -Artificial Intelligence: A Systems Approach(Computer Science), Jones and Bartlett 3. Publishers, Inc.; First Edition, 2008.

LTPC 3003

e-RESOURCES:

- 1. http://nptel.ac.in/courses/106106126/1,"Introduction, State space search, Heuristic search, problem decomposition, Planning, Constraint satisfaction", Prof. Deepak Khemani, Department of Computer Science and Engineering, IIT, Madras.
- 2. http://nptel.ac.in/courses/106105077, "Introduction, knowledge representation, problem solving, learning methods", Prof. Sudeshna Sarkar, Department of Computer Science and Engineering, IIT-Kharagpur.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	-	-	1	1	-	-	-	-	1	-	2
CO2	2	2	2	1	-	1	1	-	-	-	-	1	-	3
CO3	2	3	2	1	-	1	1	-	-	-	-	1	-	2
CO4	2	3	2	1	-	1	1	-	-	-	-	1	-	2
CO5	2	2	2	-	-	1	1	-	-	-	-	1	-	3

Mapping of COs with POs and PSOs

COMPILER DESIGN

Preamble:

21CST62

The course aims to provide Understanding of the Phases of compiler, grouping of phases, familiarize the computing models of finite automata, parsing techniques, and impart the knowledge in design principles of a Compiler, optimization techniques, generation of machine codes.

Course Outcomes: Upon completion of the course, students will be able to:

- Explain the phases of compiler for a given input and write context free grammars, regular expressions for a given 1. language using LEX tool.
- Determine NFA, DFA for a given regular expression using subset construction algorithm, Thompson's algorithm 2. and Minimization algorithm.
- Construct parsing tables for a given CFG grammar using appropriate bottom up and top down parsing techniques 3. and parse a given input string using YACC tool.
- Write the syntax directed translation schemes for the Context Free Grammar to form an intermediate languages. 4.
- Apply suitable optimization technique and code generation algorithm for a given code snippet to generate efficient 5. and optimized code.

INTRODUCTION TO COMPILERS UNIT 1

Translators - Compilation and Interpretation - Language processors - The Phases of Compiler - Errors Encountered in Different Phases- Cousins of compiler - The Grouping of Phases-Compiler Construction Tools -Need and Role of Lexical Analyzer - Input Buffering.

UNIT 2 LEXICAL ANALYSIS

Specification and Recognition of Tokens -Lexical Errors - Finite automata- Regular Expression - Converting Regular Expression to DFA- Minimization of DFA - Language for Specifying Lexical Analyzers- Optimization of DFA based Pattern Matchers - LEX - Design of Lexical Analyzer for a sample Language.

UNIT 3 SYNTAX ANALYSIS

Need and Role of the Parser - Context Free Grammars -Top Down Parsing -General Strategies-Recursive Descent Parser - Predictive Parser - Bottom up parsing-Shift Reduce Parser - LR Parser-SLR Parser - Canonical LR Parser - LALR Parser - Error Handling and Recovery in Syntax Analyzer- YACC-Design of a syntax Analyzer for a Sample Language.

UNIT 4 **INTERMEDIATE CODE GENERATION**

Syntax directed Definitions-Construction of Syntax Tree - Intermediate languages-Declarations- Assignment statements - Boolean expressions- Case statements - Back patching - Procedure calls.

CODE OPTIMIZATION AND CODE GENERATION UNIT 5

Runtime Storage management - Principal Sources of Optimization - DAG - Basic Blocks and Optimization-Loop Optimization-Flow Graphs - Next use Information - Issues in Design of a Code Generator - The target machine - A Simple Code Generator.

TEXT BOOK:

- Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers Principles, Techniques and 1. Tools", 2nd Edition, Pearson Education, 2007.
- Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: ADependence-based 2. Approach", 1st Edition, Morgan Kaufmann Publishers, 2002.

REFERENCES:

- Steven S. Muchnick, "Advanced Compiler Design and Implementation," 1st Edition, Morgan Kaufmann 1. Publishers - Elsevier Science, India, Indian Reprint 2003.
- Keith D Cooper and Linda Torczon, "Engineering a Compiler", 1st Edition, Morgan Kaufmann Publishers 2. Elsevier Science, 2004.
- Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", 1st Edition, 3. PearsonEducation.2008.

LTPC 3 1 0 4

TOTAL(L:45+T:15) : 60 PERIODS

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e-RESOURCES:

- 1. http://nptel.ac.in/courses/106108113/2, Principles of Compiler Design, Y.N. Srikant, IISc Bangalore.
- 2. http://nptel.ac.in/courses/106104072/ui/Course_home-2.htm, Compiler Design ,Prof. Sanjeev K Aggarwal, IIT Kanpur.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	1	-	-	-	-	1	-	1	-	3
CO2	3	2	2	2	1	-	-	-	-	1	-	1	1	3
CO3	3	2	2	2	1	-	-	-	-	1	-	1	1	3
CO4	3	2	2	2	1	-	-	-	-	1	-	1	-	3
CO5	3	2	2	2	1	-	-	-	-	1	-	1	1	3

Mapping of COs with POs and PSOs

(Common to B.E / B.Tech. – CS& IT Programmes)

Preamble:

Mobile Application Development is designed to impart the knowledge on application development framework and tools for creating android applications. It also equips the students to design, implement and deploy applications in mobile devices.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Develop mobile application for the given user requirement using android development framework and tools.
- 2. Create android applications using views, layouts, intents and SMS Manager API to send SMS and E-mails.
- 3. Create menu, notifications and multimedia features for the applications using android Notification Manager and Multimedia APIs.
- 4. Create databases for the applications to store and retrieve data using SQLite and Firebase.
- 5. Create mobile applications using standard web technologies such as HTML5, CSS3 and JavaScript for android and iOS platforms.

UNIT 1 GETTING STARTED WITH ANDROID

Android – Evolution of Android - Android architecture – Features- Core building blocks – Anatomy of android application – Android activity life cycle. Android Toast. Android Widgets: Button – TextView – EditText– RadioGroup -ToggleButton – CheckBox – Spinner –DatePicker - Progress Bar –DialogBox.

UNIT 2 INTENTS, LAYOUTS AND TELEPHONY

Intent – Types of Intent - Launching Activities using Intents. Layout: Relative Layout - Table Layout – Linear Layout – ListView – GridView – CardView. Android Telephony: Phone call –send Mail- Send SMS.

UNIT 3 MENUS, NOTIFICATION AND MULTIMEDIA

Menus – Option Menu – Adding and Updating menu items – Handling menu items. Android Notification. Multimedia in Android: Android camera – Android Audio player – Android Video player.

UNIT 4 DATABASE AND CONTENT PROVIDERS

Storage types in Android - Android SQLite Database - Firebase Login – Firebase authentication. Parsing in android – Android JSON parser – Connecting Android with MySQL using API - Android Google Map – Finding Current location.

UNIT 5 HYBRID APP DEVELOPMENT

Apache Cordova– Architecture of Apache Cordova– Building simple App using Apache Cordova- Publish the app on app store: Monetizing, promoting and distributing applications. React Native: Overview and its features.

TEXT BOOKS:

- 1. Reto Meier, "Professional Android 4 Application Development", Wiley India Pvt. Ltd, New Delhi 2014.
- 2. John M. Wargo, "Apache Cordova API Cookbook", Pearson Education 2015.

REFERENCES:

- 1. ZiguardMedneiks, Laird Dornin G, Blake Meike and Masumi Nakamura, "Programming Android", O'Reily,2013.
- 2. Anubhav Pradhan and Anil V Deshpande, "Composing Mobile Apps", First Edition, Wiley India Pvt. Ltd, 2014.
- 3. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", Manning Publications, 2012.

e-RESOURCES:

- 1. https://nptel.ac.in/courses/106/106/106106147/, "Mobile Computing Starting Android Programming", Professor Pushpendra Singh, IIT- Madras.
- https://nptel.ac.in/courses/106/106/106106222/, "Introduction to Modern Application Development", Prof. Madhavan Mukund, Prof. AbhijatVichare and Prof. Aamod Sane, IIT- Madras.

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45 PERIODS

TOTAL :

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	3	2	1	-	1	-	-	-	-	2	3	-
CO2	1	2	3	2	1	-	1	-	-	-	-	2	3	-
CO3	1	2	3	2	1	-	1	-	-	-	-	2	3	-
CO4	1	2	3	2	1	-	1	-	-	-	-	2	3	-
CO5	1	2	3	2	1	-	1	-	-	-	-	2	3	-

21ITL61

MOBILE APPLICATION DEVELOPMENT LABORATORY

(Common to B.E / B.Tech. – CS& IT Programmes)

Preamble:

Mobile Application Development equips the students to design, implement and deploy various applications in mobile devices. Students can design and develop useful applications for android platforms with interactive user interfaces using application frameworks and inbuilt APIs.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Develop mobile applications using android widgets, layout managers, event listeners, listview, menus, activities and intents for the given problem statements.
- 2. Implement an android application to track the current location of a mobile user using GPS.
- 3. Develop an android application for storing and updating data using SQLite and Firebase database.
- 4. Create an application to extract information from the given JSON message using JSON objects.
- 5. Develop an application to send and receive messages using SMS Manager.

LIST OF EXPERIMENTS

- 1. Setting up Android Platform, Android Virtual Device and create application to display Welcome message.
- 2. Build a score keeper app that gives a user the ability to keep track of the score of two different teams playing a game of choice. Include different Buttons which can be clicked for different events in the game to add points.
- 3. Create a Musical Structure App to store and present the user with the library of songs available in different categories of classical and Melodies. Write code to play the song chosen by the user from the library of music.
- 4. Create an application to calculate the electricity bill and create an appropriate alert message as well as send the value to the given mobile number using SMS.
- 5. Write an android program to demonstrate a Menu 'File' with New and Open as menu items. Give toast messages on click of each menu item.
- 6. Create an application to fetch the current Location information (Latitude and longitude) and display it in the alert message.
- 7. Write an android program to implement the following operations using SQLite Database.
 - Create the SQLite Database Object.
 - Execute the CRUD Operations required for the application
 - Close the database.
- 8. Develop an application to implement phone number Verification by OTP using Firebase in Android
- 9. Create an application to extract employee information from the JSON message and load it in UI.
- 10. Develop the following mobile application using android
 - Education Quiz App
 - Tour Guide App
 - News Feed App

TOTAL: 45 PERIODS
COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	3	1	-	1	-	1	-	-	-	3	2
CO2	2	2	3	3	1	-	1	-	1	-	-	-	3	2
CO3	2	2	3	3	1	-	1	-	1	-	-	-	3	2
CO4	2	2	3	3	1	-	1	-	1	-	-	-	3	2
CO5	2	2	3	3	1	-	1	-	1	-	-	-	3	2

21CSL621

MINI PROJECT

Preamble:

This course enhances the knowledge acquired in computer science and engineering to do a mini project, which allows the students to come up with new innovative techniques or algorithms and programs expressing their ideas in a novel way. It helps the students in preparing mini project reports and to face reviews and viva voce examination.

Course Outcomes :Upon completion of the course, students will be able to

- 1. Apply engineering fundamentals to analyze domain specific Issues to identify problem statement with objective and scope.
- 2. Investigate the identified problem and review state of the art literature survey to synthesis system requirements
- 3. Identify the risk/impact/technique and interpret the suitable standards related to the problem statement and design appropriate procedures/methods.
- 4. Develop modules using discipline specific tools and implement the modules to achieve valid conclusion.
- 5. Prepare documents related to their findings for detailed presentation, Defend the findings and conclude with oral / written presentation.

Note:

To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design and develop computer code. Demonstrate the novelty of the project through the results and outputs.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	2	2	2	3	3	3	3	3	3
CO2	2	3	3	3	2	2	2	2	3	3	3	3	3	3
CO3	2	3	3	3	3	2	2	2	3	3	2	3	3	3
CO4	2	3	3	3	3	3	2	2	3	3	3	3	3	3
CO5	2	3	3	3	2	3	2	3	3	3	2	3	3	3

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

TOTAL : 60 PERIODS

21MCT07

Preamble:

Arithmetic And Analytical Ability evaluates the talent and potential toperform a certain task, with no prior knowledge and/or training. This coursedeals with sort of problems on dynamic thinking, numeric capacity and spatial question. This course is further used for prediction of future success both ineducational and vocational careers and aptitude skills help thestudents in the proper choice of courses and careers.

Course Outcomes : Upon completion of the course, students will be able to

- 1. Compute time, work, capacity and identify the pattern by analyzing the given problem/scenario
- 2. Analyze the given problem involving mixture, averages, seating arrangement and apply the suitable method to get the appropriate result.
- 3. Interpret the given chart and determine the solution.
- 4. Identify and apply the appropriate permutation, Combination, probability technique to determine the solution.
- 5. Infer the solution for the given scenario involving syllogisms, clocks, calendar using suitable techniques.

UNIT 1 6 Time and Work, Pipes and Cisterns, Symbol Series UNIT 2 6 Alligation or Mixture, Averages, Seating Arrangements UNIT 3 6 Data Interpretation-Table Charts, Bar Charts, Pie Charts, Line Charts UNIT 4 6 Permutation and Combination, Probability **UNIT 5** 6 Syllogisms, Clocks, Calendar TOTAL : **30 PERIODS**

REFERENCES:

- 1. Dr.R.S.Aggarwal, "Quantitative Aptitude for Competitive Examination", S.Chand Publications, 2017.
- 2. Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S.Chand Publications, 2018.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	-	1	-	-	-	-	-	-	-	1	-	-
CO2	2	3	-	1	-	-	-	-	-	-	-	1	-	-
CO3	2	3	-	1	-	-	-	-	-	-	-	1	-	-
CO4	2	3	-	1	-	-	-	-	-	-	-	1	-	-
CO5	2	3	-	1	-	-	-	-	-	-	-	1	-	-

Mapping of COs with POs and PSOs

21ITT71 ECONOMICS AND MANAGEMENT FOR ENGINEERS LTPC 3003

(Common to BE / B.Tech. BM, CS, EC, EE, IT & MDEProgrammes)

Preamble:

The main aim of this course is to understand the concepts of Economics with respect to the demand and supply analysis. This course makes the students to analyze the theory of production and the analysis of the cost parameter by using the Elasticity. This course will enable the students to manage and plan the situation with the help of the available strategies to support the decision making process.

Course Outcomes: Upon completion of the course, students will be able to:

- Summarize how to solve economics principles to solve economic problems in engineering discipline 1. by satisfying the economic laws.
- Discuss the demand and supply process for a market analysis using Price elasticity, Cross elasticity 2. and Income elasticity.
- Interpret short run and long run costs in the process of production for carrying out a business. 3.
- Apply managerial skills to make decisions and solve problems for achieving organizational 4. objectives.
- 5. Express the principles of effective planning for survival and success of all organizations using standing and single use planning methods.

INTRODUCTION TO ECONOMICS UNIT 1

Introduction toEconomics - Scope of Economics - Positive and Normative Science - Methodology of Economics - Economy Laws - Economy and its basic problems: Economy and its working - Kinds of economy systems - Basic problems of economy.

UNIT 2 DEMAND AND SUPPLY ANALYSIS

The Law of Demand - The Law of Supply - Elasticities of Demand and Supply: Price Elasticity of Demand - Price Elasticity and Consumption Expenditure- Cross Elasticity of Demand - Income Elasticity of Demand – The Elasticity of Price Expectations – The uses of Elasticity– Price Elasticity of Supply.

THEORY OF PRODUCTION AND ANALYSIS OF COST UNIT 3

Meaning of Production – Production concepts – Production Function – Laws of Production – Cost Concepts - Short-Run CostOutput Relations - Long Run Cost output relations - Economics of Scale. 9

UNIT 4 INTRODUCTION TO MANAGEMENT

Management: An Overview - Management Defined - Managerial skills - Managerial roles - Management responsibilities - Management functions. Evolution of Management: Classical approaches to Management - Contemporary Management Perspectives.

UNIT 5 **PLANNING**

Planning and Forecasting: Importance of Planning - Principles of effective Planning - Planning process -Types of Plans. Strategic Planning: Strategic Planning process – Rational decision making.

TOTAL : 45 PERIODS

TEXT BOOKS:

- D.N.Dwivedi, "Principles of Economics", Second Edition, Vikas Publishing House (P) Limited, New 1. Delhi, 2012.
- 2. J.S.Chandan, "Management Concepts and Strategies", Vikas Publishing House (P) Limited, New Delhi, 2003.

REFERENCES:

- Ranbir Singh,"Principles of Engineering Economics and Management", S.K.Kataria& Sons, New 1. Delhi, 2013.
- Manish Varshney and VidhanBanerjee, "Engineeringand Managerial Economics", First Edition, CBS 2. Publishers and Distributors Pvt. Ltd., 2015.

e-RESOURCES:

- http://nptel.ac.in/courses/110101005/, Prof.Trupti Mishra, S.J.M. School of Management, IIT 1. Mumbai, Managerial Economics.
- https://nptel.ac.in/courses/122106031/slides/3_1s.pdf, Dr.M.Thenmozhi, Professor, IIT Madras. 2.

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	3	-	2	I	2	1	-	-	-	2	1	-	1
CO2	1	3	-	2	-	2	1	-	-	-	2	1	-	-
CO3	1	3	-	2	-	2	1	-	-	-	2	1	-	-
CO4	1	3	-	1	-	2	1	-	-	-	2	1	-	-
CO5	1	3	-	1	-	2	1	2	-	-	2	1	-	-

Preamble:

This course on network security aims at exploring the various cryptographic algorithms deployed in offering confidentiality, integrity, authentication and non repudiation. It also focuses on basic concepts of networks, authentication methods, Protocols, standards, Intrusion Detection and Prevention Mechanisms and Firewalls.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Identify the major types of threats and develop strategies to protect organization information assets from common attacks using classical cryptographic techniques.
- 2. Encrypt and decrypt information for a given message using symmetric and asymmetric algorithms.
- 3. Analyze existing authentication and key agreement protocols and choose appropriate protocols for a given message based on the needed functionality
- 4. Classify firewall-based solutions against security threats and employ access control techniques for the existing computer platforms UNIX and Windows using network securityapplications.
- 5. Solve security problems related to e-mail, IP and Web in practical systems using securitytechniques.

UNIT 1 FOUNDATION& NUMBER THEORY

Services, Mechanisms and attacks-the OSI security architecture-Network security model- Classical Encryption techniques-.FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic- Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

UNIT 2 BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY

Data Encryption Standard-Block cipher Design principles- block cipher modes of operation-Advanced Encryption Standard (AES) - Triple DES-Blowfish. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange- Elliptic curve arithmetic-Elliptic curve cryptography.

Case Study: Encrypt and decrypt the message transfer between two users using RSA algorithm.

UNIT 3 HASH FUNCTIONS AND DIGITAL SIGNATURES

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 – SHA512 - Digital signature and authentication protocols – DSS – EI Gamal – Schnorr. Case Study: Authenticate the sensitive file transfer between two users using DSS.

UNIT 4 SECURITY PRACTICE & SYSTEM SECURITY

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs – SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats –Countermeasures – Firewalls design principles – Trusted systems. Case Study: Create your own Virus.

UNIT 5 E-MAIL, IP & WEB SECURITY

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacyauthentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IP-Security: Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3-Exportability-Encoding-Secure Electronic Transaction (SET).Case Study: Detection of Phishing Email.

TOTAL: 45PERIODS

TEXT BOOKS:

- 1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013. (UNIT I,II,III,IV).
- Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002. (UNIT V).

REFERENCES:

- 1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
- 2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.

e-RESOURCES:

- 1. williamstallings.com/Extras/Security-Notes/
- 2. https://www.slideshare.net/gangadhar9989166446/network-security-cryptography-full-notes
- 3. https://nptel.ac.in/courses/106/105/106105031/

LT PC 3003

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	-	-	-	1	-	1	-	-	-	1	-	2
CO2	2	3	-	-	-	1	-	1	-	-	-	1	-	2
CO3	2	3	-	-	-	1	-	1	-	-	-	1	-	1
CO4	2	3	-	-	-	2	1	1	-	-	-	1	-	1
CO5	2	3	-	-	-	2	1	1	-	-	-	1	-	2

21CST72

MACHINE LEARNING

Preamble:

Machine learning is the science of getting computers to act without being explicitly programmed. In the past decade, machine learning has given us self-driving cars, practical speech recognition, effective web search, and a vastly improved understanding of the human genome. This course provides a broad introduction to machine learning, data mining, and statistical pattern recognition.

Course Outcomes: Upon completion of the course, students will be able to:

- Identify and explain the components in design of learning system to perform the given task. 1
- Apply suitable machine learning strategy for any given problem to improve classification efficiency. 2
- 3 Apply dimensionality reduction methods to train a classifier for reducing time and space complexity.
- Apply genetic algorithm to optimize the topology and learning parameters in artificial neural networks. 4
- Apply Sequential covering algorithm and FOIL algorithm to recognize patterns for the given data. 5 9

UNIT 1 **MACHINE LEARNING STRATEGIES**

Learning –Designing a learning system-Issues in machine learning- Examples of Machine learning applications-Learning associations, regression, Classification, Reinforcement Learning, supervised and unsupervised learning-Input representation-Hypothesis space-version spaces.

TREE AND PROBABILISTIC MODELS UNIT 2

Decision Trees – Entropy- Information gain- Constructing Decision Trees –ID3- Issues in Decision tree learning - Classification by Regression (CART)-Bayesian Learning- Baye's theorem-Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm.

UNIT 3 DIMENSIONALITY REDUCTION AND INSTANCE BASED LEARNING

Dimensionality Reduction - Subset selection - Principal Component Analysis - Factor Analysis - Linear Discriminant Analysis – K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions - Case Based Learning.

ARTIFICIAL NEURAL NETWORKS AND GENETIC PROGRAMMING UNIT 4 9 Neural Network Representation - Problems - Perceptrons - Multilayer Networks and Back Propagation Algorithms – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT 5 **ADVANCED LEARNING**

Learning Sets of Rules - Sequential Covering Algorithm - Learning Rule Set - First Order Rules - Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution -Reinforcement Learning – Task – Q-Learning.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 Tom M Mitchell, —Machine Learning, First Edition, McGraw Hill Education, 2013.

REFERENCES:

- Stephen Marsland, --Machine Learning An Algorithmic Perspective, Second Edition, Chapman 1 and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
- EthemAlpaydin, --Introduction to Machine Learning 3e (Adaptive Computation and Machine 2. Learning Series), Third Edition, MIT Press, 2014.

e-RESOURCES:

- https://nptel.ac.in/courses/106/105/106105152/,"Introduction Machine 1 to Learning", Prof.SudeshnaSarkar, Department of computer science and Engineering, IIT Kharagpur.
- https://nptel.ac.in/courses/106/106/106106198/, "Machine Learning for Engineering Science and 2 Applications", Prof.Ganapathy&Prof.BalajiSrinivasan, Department of computer science and Engineering, IIT Madras.

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Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	-	-	-	-	-	-	-	1	2	2
CO2	3	2	2	2	-	-	-	-	-	-	-	1	2	2
CO3	3	2	2	2	-	-	-	-	-	-	-	1	2	2
CO4	3	2	2	2	-	-	-	-	-	-	-	1	2	2
CO5	3	2	2	2	-	-	-	-	-	-	-	1	2	2

21HST71

HUMAN VALUES AND PROFESSIONAL ETHICS (Common to All Programmes)

LTPC 3003

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Preamble:

Universal Human Values is a life skill necessary for all students of Engineering and Technology. The course aims to identify the values and skills, and to realize the need, basic guidelines, content and process of value education. Professional Ethics For Engineers deals with the human values, integrity and work ethics in the common world. This course is mainly concerned about the theories of ethics, which form the basis for the understanding and responsibility of the various groups encountered in Engineering.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Relate the significance of value inputs in a classroom and start applying them in their life and profession.
- 2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.
- Interpret the value of harmonious relationships based on the trust and respect in their life and 3. profession.
- 4. Discuss the ethical issues related to Engineering.

5. Discuss Engineer's work in the context of its impact on society.

INTRODUCTION TO UNIVERSAL HUMAN VALUES UNIT 1

Understanding the need, basic guidelines, content and process for Value Education. Self Exploration-Mechanism for self exploration. Continuous Happiness and Prosperity- Basic Human Aspirations and its requirements for fulfillment of Human Aspirations understanding and living in harmony at various levels.

HARMONY IN ONESELF, FAMILY AND SOCIETY UNIT 2

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationships. Trust and Respect- values of relationship. Difference between intention and competence. Difference between respect and differentiation

HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL UNIT 3 **ETHICS**

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics. Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models.

UNIT 4 ENGINEERING ETHICS

Senses of Engineering Ethics- Variety of moral issues - Types of inquiry - Moral dilemmas - Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of professional roles -Professional responsibility - Moral reasoning - Theories about right action - Self interest - Self respect - Duty ethics - Customs and religion. 9

UNIT 5 ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation – Engineers as responsible experimenters – Role of codes- Codes of Ethics - Sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers (IETE) - A balanced outlook on law - Safe exits - The Bhopal gas tragedy and Challenger case study.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. Gaur R R, Sangal R, Bagaria G P, "A Foundation Course in Human Values and Professional Ethics". 2009
- Govindarajan M, Natarajan S and Senthil Kumar V. S, "Engineering Ethics", PHI Learning Pvt. Ltd, 2. New Delhi, 2017.

REFERENCES:

- 1. Banerjee B P, "Foundations of Ethics and Management", Excel Books. 2005.
- 2. Bajpai B L, "Indian Ethos and Modern Management", New Royal Book Co., Lucknow. Reprinted 2008.
- 3. Subramanian R, "Professional Ethics", Oxford university press, 2017.

e-RESOURCES:

- 1. https://www.uhv.org.in/
- 2. https://nptel.ac.in/courses/109/106/109106117/

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	2	3	3	1	-	-	1	-	-
CO2	-	-	-	-	-	3	1	3	1	2	-	1	-	-
CO3	-	-	-	-	-	1	2	3	-	1	-	1	-	-
CO4	-	-	-	-	-	3	-	3	-	-	-	1	-	-
CO5	-	1	-	-	-	3	1	3	-	-	-	1	-	-

Mapping of COs with POs and PSOs

Preamble:

This laboratory course is intended to expose the students to different cipher techniques and to implement algorithms like DES, RSA, MD5, SHA-1 using Java programming language/Python programming language.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Implement and test symmetric and asymmetric cipher techniques using Java/Python.
- 2. Implement digital signature standard and verify the authentication process using Java/Python.
- 3. Implement and test digital signature standard using GnuPG
- 4. Implement and test honey pot using KF Sensor.
- 5. Implement and test IDS and WEP, WPA using snort and Net stumbler respectively

LIST OF EXPERIMENTS:

- 1. Implement the following Substitution & Transposition Techniques
 - a) Caesar Cipher
 - b) Playfair Cipher
 - c) Hill Cipher
- 2. Implement the following algorithms
 - a) DES
 - b) RSA Algorithm
 - c) Diffiee-Hellman
 - d) MD5
 - e) SHA-1
- 2. Implement the Signature Scheme Digital Signature Standard
- 3. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
- 4. Setup a honey pot and monitor the honeypot on network (KF Sensor)
- 5. Installation of rootkits and study about the variety of options
- 6. Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler)
- 7. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

TOTAL : 45 PERIODS

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	3	1	-	-	-	1	1	-	1	1	-
CO2	1	1	2	3	1	-	-	-	1	1	-	1	1	-
CO3	1	2	2	3	3	-	-	-	1	1	-	1	2	-
CO4	1	1	2	3	3	-	-	-	1	1	-	1	2	-
CO5	2	2	2	3	3	-	-	-	1	1	-	1	2	-

21MCT08INDIAN CONSTITUTION AND TRADITIONAL KNOWLEDGEL T P C2 0 0 0

Preamble:

The course provides basic information on Indian Constitution and Indian Traditional knowledge. This is essential for all citizens and especially for engineers so that they become aware of Indian polity and governance. This also reminds the citizen about their obligation, adherence and up keeping of Constitutional rights.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Outline the evolution of Indian constitution and Federal structure
- 2. List and explain the functions of Centre, States and District Administrations
- 3. Elaborate the roles of Panchayat raj
- 4. Explain the powers and roles of Election Commission
- 5. Illustrate the Indian traditional knowledge and elucidate their recovery

UNIT 1

'Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy - Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

UNIT 2

Governor: Role and Position, CM and Council of ministers, State Secretariat: organisation, Structure and Functions District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation,

UNIT 3

Panchayatraj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT 4

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

UNIT 5

Basics structure of Indian Knowledge System-Modern Science and Indian Knowledge -Philosophical Tradition - Indian Linguistic Tradition (Phonology, morphology, syntax and semantics) – Indian Artistic Tradition

TOTAL: 30 PERIODS

TEXT BOOKS:

- 1. M.Rajaram, Indian Constitution, New Age International, 2009.
- V.Sivaramakrishnan(Ed.) Cultural Heritage of India (Course Material), Bharatiya Vidya Bhavan, Mumbai, 5thEdition, 2014.

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	3	1	2	1	1	-	1	-	-
CO2	-	-	-	-	-	3	1	2	1	1	-	1	-	-
CO3	-	-	-	-	-	3	1	2	1	1	-	1	-	-
CO4	-	-	-	-	-	3	1	2	1	1	-	1	-	-
CO5	-	-	-	-	-	3	1	2	1	1	-	1	-	-

21CSL81

PROJECT WORK

Preamble:

This course develops the ability to solve a specific problems in-depth insight into the concepts, principles, formulation of the projects and network technique right from its identification and literature review till the successful solution of the same. It also trains the students in preparing project reports and to face reviews and viva voce examination.

Course Outcomes : Upon completion of the course, students will be able to

- 1. Apply engineering fundamentals to analyze domain specific Issues to identify problem statement with objective and scope.
- 2. Investigate the identified problem and review state of the art literature survey to synthesis system requirements.
- 3. Identify the risk/impact/technique and interpret the suitable standards related to the problem statement and design appropriate procedures/methods.
- 4. Develop modules using discipline specific tools and implement the modules to achieve valid conclusion.
- 5. Prepare documents related to their findings for detailed presentation, Defend the findings and conclude with oral / written presentation.

Note:

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL : 180 PERIODS

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	2	2	2	3	3	3	3	3	3
CO2	2	3	3	3	2	2	2	2	3	3	3	3	3	3
CO3	2	3	3	3	3	2	2	2	3	3	2	3	3	3
CO4	2	3	3	3	3	3	2	2	3	3	3	3	3	3
CO5	2	3	3	3	2	3	2	3	3	3	2	3	3	3

Mapping of COs with POs and PSOs

PROFESSIONAL ELECTIVES

21CSE11

EXPLORATORY DATA ANALYSIS

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Pre-requisites : Python Programming

Preamble

The main aim of this course to outline an overview of exploratory data analysis. To implement data visualization using Matplotlib. To perform univariate data exploration and analysis. To apply bivariate data exploration and analysis. To use Data exploration and visualization techniques for multivariate and time series data.

EXPLORATORY DATA ANALYSIS UNIT 1

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis - Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT 2 **EDA USING PYTHON**

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data - Hierarchical Indexing - Combining datasets - Concat, Append, Merge and Join -Aggregation and grouping – Pivot Tables – Vectorized String Operations. Case study: Perform EDA on wine Quality Data set.

UNIT 3 UNIVARIATE ANALYSIS

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing - Inequality.

UNIT 4 **BIVARIATE ANALYSIS**

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines.

MULTIVARIATE AND TIME SERIES ANALYSIS UNIT 5

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond -Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Timebased indexing – Visualizing - Grouping - Resampling. Case study: Perform Time Series Analysis and apply the various Visualization techniques.

TEXT BOOKS:

- Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt 1. Publishing, 2020.
- Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First 2. Edition, O Reilly, 2017.
- Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", 3. Wiley Publications, 2nd Edition, 2008.

REFERENCES:

- 1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
- 2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.

e-RESOURCES:

https://analyticsindiamag.com/ 1.

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Total : 45 Periods

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the concepts of exploratory data analysis and data transformation techniques for merging, reshaping and pivoting using software tools of EDA.
- CO2 Implement the data manipulation, indexing and selection using Panda's Matplotlib for wine quality data set.
- CO3 Perform univariate data exploration and analysis.
- CO4 Apply bivariate data exploration and analysis.
- CO5 Apply Data exploration and visualization techniques for multivariate and time series data using Pandas.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	1	-	-	-	-	2	2	3	3
CO2	3	3	3	2	3	1	-	-	-	-	2	2	3	2
CO3	3	3	3	2	3	1	-	-	-	-	2	2	2	2
CO4	3	3	3	2	3	1	-	-	-	-	2	2	2	2
CO5	3	3	3	2	3	1	-	-	-	-	2	2	2	2

Mapping of COs with POs and PSOs

Pre-requisites : Neural Networks and Deep Learning Preamble

Text analysis is a machine learning technique used to automatically extract valuable insights from unstructured text data. Companies use text analysis tools to quickly digest online data and documents, and transform them into actionable insights. Speech analysis is the process of analyzing voice recordings or live customer calls to contact centers with speech recognition software to find useful information and provide quality assurance.

UNIT 1 NATURAL LANGUAGE BASICS

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.

UNIT 2 TEXT CLASSIFICATION

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model –FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models. Case study: Use a transformer for implementing classification.

UNIT 3 QUESTION ANSWERING AND DIALOGUE SYSTEMS

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. Case study: Design a chatbot with a simple dialog system.

UNIT 4 TEXT-TO-SPEECH SYNTHESIS

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems. Case study: Convert text to speech and find accuracy.

UNIT 5 AUTOMATIC SPEECH RECOGNITION

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems. Case study: Design a speech recognition system and find the error rate.

TEXT BOOKS:

- Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to
- 1. Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.
- Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining
- ^{2.} Actionable insights from your data", APress,2018

REFERENCES:

- Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
- 2. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.

e-RESOURCES:

- https://nptel.ac.in/courses/106101007,"Natural Language Processing", Prof. Pushpak Bhattacharyya, IIT Bombay.
- 2. https://nptel.ac.in/courses/106105158," Natural Language Processing", Prof. Pawan Goyal, IIT Kharagpur.

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Total: 45 Periods

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Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain existing and emerging deep learning architectures for text and speech processing
- CO2 Classify the features of text documents using text classification algorithms
- CO3 Develop question-answering systems, chatbots and dialogue systems for a given application.
- CO4 Apply deep learning based text to speech systems to develop a speech synthesizer for a given application.
- CO5 Develop a speech recognition system for a given application using deep learning models.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	-	1	-	-	-	1	1	-	3
CO2	3	3	2	2	1	1	1	-	-	-	1	1	-	3
CO3	3	3	2	2	1	-	1	-	-	-	1	1	-	3
CO4	3	3	2	2	1	1	1	-	-	-	1	1	-	3
CO5	3	3	2	2	1	1	1	-	-	-	1	1	-	3

Mapping of COs with POs and PSOs

21CSE13

LTPC 3003

Preamble:

The main aim of this course is to understand the concepts of Social Networks with respect to the information extracted from the social media. This course makes the students to analyze and mine thesocial network to predict the human behavior by representing the relationships between the users. This course will enable the students to visualize and represent the social network using the available representations.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Discuss the principles behind the social network analysis using the network features.
- 2. Explain social network profiles and perform quantitative and qualitative analysis of commercial social network profiles using log files and log mining.
- 3. Apply the data mining techniques on social networks analysis to extract the semantic relationship.
- 4. Utilize community mining algorithms to predict human behavior for social communities.
- 5. Examine random layout, force directed layout, tree layout and matrix representations for visualization of social networks. 9

UNIT 1 **INTRODUCTION**

Social Network Analysis: Definition and Features - The Development of Social Network Analysis - Basic Graph Theoretical Concepts of Social Network Analysis - Ties, Density, Path, Length, Distance, Betweenness, Centrality, Clique - Electronic Sources for Network Analysis - Electronic Discussion Networks, Blogs and Online Communities, Web-based Networks – Applications of Social Network Analysis.

UNIT 2 SOCIAL NETWORK ANALYSIS

Introduction to Social Networks Profiles - Types of Commercial Social Network Profiles (CSNP) -Quantitative and Qualitative Analysis of CSNP – Analysis of Social Networks Extracted from Log Files – Data Mining Methods Related to SNA and Log Mining – Clustering Techniques – CaseStudy.

SEMANTIC TECHNOLOGY FOR SOCIAL NETWORK ANALYSIS UNIT 3

Introduction to Ontology based Knowledge Representation - Ontology Languages for the Semantic Web -RDF and OWL – Modeling Social Network Data – Network Data Representation, Ontological Representation of Social Individuals and Relationships – Aggregating and Reasoning with Social Network Data – Advanced Representations.

UNIT 4 SOCIAL NETWORK MINING

Detecting and Discovering Communities in Social Network: Evaluating Communities – Methods for Community Detection – Applications of Community Mining Algorithms –Ethical Practices in Social Network Mining – Understanding and Predicting Human Behavior for Social Communities – Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Network Communities – Inferential Methods in Social Network Analysis. 9

VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS UNIT 5

Visualization of Social Networks Node-Edge Diagrams - Random Layout - Force-Directed Layout - Tree Lavout - Matrix Representations - Matrix and Node-Link Diagrams - Hybrid Representations - Visualizing Online Social Networks - Applications - Covert Networks - Community Welfare - Collaboration Networks -Co-Citation Networks – Data Privacy in Social Networks. **TOTAL: 45 PERIODS**

TEXT BOOKS:

1. Peter Mika, "Social Networks and the Semantic Web", Springer, 2007.

2 BorkoFurht, "Handbook of Social Network Technologies and Applications", Springer, 2010.

3. Song Yang, Franziska B. Keller, Lu Zheng, "Social Network Analysis: Methods and Examples", Sage Publication, 2016.

REFERENCES:

1. GuandongXu, Yanchun Zhang, Lin Li, "Web Mining and Social Networking Techniques and Applications", Springer, 2011.

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2. John Scott, Peter J. Carrington, "The SAGE Handbook of Social Network Analysis", Sage

E-RESOURCES:

1. https://nptel.ac.in/courses/106106169/, "Social Networks: The challenge", Prof. Sudharshan Iyengar, IIT –Ropar.

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	1	-	1	1	1	1	-	1	-	1	1	1
CO2	2	3	1	-	1	1	1	1	-	1	-	1	1	2
CO3	2	3	1	-	1	1	1	1	-	1	-	1	1	2
CO4	2	3	1	-	1	1	1	1	-	1	-	1	1	2
CO5	2	3	1	-	1	1	1	1	-	1	-	1	1	2

Preamble

Information Retrieval is part of data science/AI/Data Mining. It deals with retrieving information from data that is stored in systems. An IR system is software that provide access to books, journals and other documents, stores them and manages the document. Web search engines are the most visible IR applications.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the components and frameworks of IR and its role towards AI and web to fetch relevant information from web resources.
- CO2 Apply suitable information retrieval models for a given web application to retrieve required information efficiently.
- CO3 Apply document text mining techniques in information retrieval to categorize and clustering the information.
- CO4 Analyzewebsearcharchitectureforagivenwebapplicationtocheckoptimizedsearchengine.
- CO5 Use Link analysis, Hadoop and Map reduce to evaluate relevant scoring and ranking web search for quality results.

UNIT 1 INTRODUCTION

 $\label{eq:linear} Information Retrieval - Early Developments - The IR Problem - The Users' Task - Information versus Data Retrieval - The IR System - The Software Architecture of the IR System - The Retrieval and Ranking Processes - The Web - The e-Publishing Era - How the web changed Search - Practical Issues on the Web - How People Search - Search Interfaces Today - Visualization in Search Interfaces.$

UNIT 2 MODELING AND RETRIEVAL EVALUATION

Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

UNIT 3 TEXT CLASSIFICATION AND CLUSTERING

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

UNIT 4 WEB RETRIEVAL AND WEB CRAWLING

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

UNIT 5 WEB SEARCH- LINK ANALYSIS AND SPECIALIZED SEARCH

Link Analysis –hubs and authorities – Page Rank and HITS algorithms - Hadoop & Map Reduce – Personalized search-Collaborative filtering and content-based recommendation of documents and products – handling "invisible" Web-Snippet generation, Summarization, Question Answering, Cross-Lingual Retrieval.

TOTAL: 45 PERIODS

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TEXT BOOKS:

- 1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
- 2. Ricci, F, Rokach, L. Shapira, B.Kantor, —Recommender Systems Handbookl, First Edition, 2011

REFERENCES:

- 1. C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press, 2008.
- 2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

e-RESOURCES:

1. https://cse.iitkgp.ac.in/~pabitra/course/ir06/ir06.html.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	1	1	-	-	-	-	-	1	2	-	2
CO2	3	3	2	2	1	-	-	-	-	-	1	2	-	2
CO3	3	3	2	2	2	-	-	-	-	-	1	2	-	2
CO4	3	3	2	2	2	-	-	-	-	-	1	2	-	2
CO5	3	3	2	2	2	-	-	-	-	-	1	2	-	2

Mapping of COs with POs and PSOs

DATA WAREHOUSING AND DATA MINING

21CSE15

Preamble:

The main aim of this course is to give basic knowledge about data warehouse and mining algorithms and also it develops research interest towards advances in data mining.

Course Outcomes: Upon completion of the course, students will be able to:

- Design a data warehouse and data mart that satisfies the information needs of management using given 1. schema for analysis.
- Predict the interesting patterns for a given database, using data cleaning, data transformation, data 2. normalization and data reduction.
- Apply association algorithm to build analytical applications for a given database using Apriori, FP- tree 3. association.
- 4. Analyze the given scenario using classification and K-means clustering to find the optimal classification tree and cluster for an application.
- 5. Apply data mining algorithms for a given application using WEKA tool.

DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL UNIT 1 **PROCESSING (OLAP)**

Basic Concepts - Data Warehousing Components - Building a Data Warehouse - Database Architectures for Parallel Processing - Parallel DBMS Vendors - Multidimensional Data Model - Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems - Typical OLAP Operations, OLAP and OLTP. 9

UNIT 2 DATA MINING – INTRODUCTION

Introduction to Data Mining Systems - Knowledge Discovery Process - Data Mining Techniques - Issues applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity

DATA MINING – FREQUENT PATTERN ANALYSIS UNIT 3

Mining Frequent Patterns, Associations and Correlations - Mining Methods- Pattern Evaluation Method -Pattern Mining in Multilevel, Multi Dimensional Space - Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

UNIT 4 **CLASSIFICATION AND CLUSTERING**

Decision Tree Induction - Bayesian Classification - Rule Based Classification - Classification by Back Propagation - Support Vector Machines - Lazy Learners - Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques - Cluster analysis-Partitioning Methods Hierarchical Methods - Density Based Methods - Grid Based Methods - Evaluation of clustering - Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

WEKA TOOL UNIT 5

Datasets - Introduction, Iris plants database, Breast cancer database, Auto imports database - Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association-rule learners.

TEXT BOOKS:

1. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw - Hill Edition, Thirteenth Reprint 2008.

2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012. **REFERENCES:**

- 1. Sam Anahory, Dennis Murray, "Data Warehousing in the real world", A practical Guide for building
- 2. Paulraj Ponniah, "Data warehousing Fundamentals Comprehensive Guide for IT professionals, Wiley,
- 3. Andrew H. Johnston, "Practical Machine Learning: A Beginner's Guide to Data Mining with WEKA", July 2018.

e-RESOURCES:

- 1. http://nptel.ac.in/courses/106106093/35, "Data mining and Knowledge discovery, Data Mining, Mining for Association rules", Prof. Dr.S.Srinath, IIT-Madras.
- 2. http://nptel.ac.in/courses/106106093/31, "Introduction to Data warehousing and OLAP", Prof. Dr.S.Srinath, IIT-Madras.
 - VCET, B.E-CSE, R2018 Ver. 4, Curriculum and Syllabus

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TOTAL: 45 PERIODS

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	1	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	1	-
CO3	2	3	-	2	-	-	-	-	-	-	-	-	1	-
CO4	2	3	-	2	-	-	-	-	-	-	-	-	1	-
CO5	2	3	-	-	2	-	-	-	-	-	-	-	1	-

VCET, B.E-CSE, R2018 Ver. – 4, Curriculum and Syllabus

22CSE16

Preamble

Business Intelligence systems provide historical, current, and predictive views of business operations, often using data that has been gathered into a data warehouse or a data mart and working from operationaldata.Softwareelementssupportreporting,interactiveslice-and-dice,pivot-tableanalyses, visualization, and statistical data mining.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Summarize the concept of OLTP & OLAP using real time data.
- 2. Describe the essential components in the development of business intelligence system.
- 3. Describe the need and approaches of data integration.
- 4. Familiarize the concepts of multi-dimensional data modeling.
- 5. Design an enterprise dashboard that depicts the key performance indicators that helps in decision making.

UNIT 1 INTRODUCTION TO DIGITAL DATA

Introduction to digital data and its types–structured, semi-structured and unstructured, Introduction To OLTP and OLAP(MOLAP,ROLAP,HOLAP).

UNIT 2 INTRODUCTION TO BUSINESS INTELLIGENCE

Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI,BI Framework, Role of Data Warehousing in BI,BI Infrastructure Components–BI Process, BI Technology, BI Roles & Responsibilities.

UNIT 3 BASICS OF DATA INTEGRATION (EXTRACTION TRANSFORMATION 9

Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, introduction to ETL using SSIS, Introduction to data quality, data profiling concepts and applications.

UNIT 4 INTRODUCTION TO MULTI-DIMENSIONAL DATA MODELING

Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensionalmodeling,conceptsofdimensions,facts,cubes,attribute,hierarchies,starandsnowflake schema, introduction to business metrics and KPIs, creating cubes using SSAS.

UNIT 5 BASICS OF ENTERPRISE REPORTING

Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. R.N Prasad and Seema Acharya," Fundamentals of Business Analytics", Second Edition, Wiley India PVT. Ltd., 2011.

REFERENCES:

- 1. LarissaT.Moss, S.Atre, "BusinessIntelligenceRoadmap:TheCompleteProjectLifecycle of Decision Making ", AddisonWesley,2003.
- 2. CarloVercellis, "BusinessIntelligence:DataMiningandOptimizationforDecisionMaking", WileyPublications, 2009.
- 3. David Loshin Morgan, Second Edition, 2012. Kaufman, "Business Intelligence: The Savvy Managers Guide",

e-RESOURCES:

1. https://nptel.ac.in/courses/110105089

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BUSINESS INTELLIGENCE

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COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	1	1	-	-	-	1	1	-	2
CO2	3	3	2	2	2	1	1	-	-	-	1	1	-	2
CO3	3	3	2	2	2	1	1	-	-	-	1	1	-	2
CO4	3	3	2	2	2	1	1	-	-	-	1	1	-	2
CO5	3	3	2	2	2	1	1	-	-	-	1	1	-	2

21CSE17

Pre-requisites: Exploratory Data Analysis, Neural Networks and Deep Learning **Preamble**

The main aim of this course is to make 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 and to understand the various Object recognition mechanisms.

Course Outcomes: Upon completion of this course, students will be able to:

- Explain image processing techniques in computer vision and video analysis for the T-pyramid of an CO1 image.
- Discuss pre-processing techniques for image smoothing, edge detection, line detection and CO₂ restoration using the homogeneity criterion of equal intensity.
- Perform geometric transformation on objects from three and four pairs of corresponding points CO3 using IoU, R-CNN and YOLO..
- Explain the process involved in face recognition and gesture recognition and apply motion analysis CO4 for an image.
- Elaborate on deep learning-based video analytics using ResNet and GoogleNet architectures for CO5 video surveillance systems.

INTRODUCTION UNIT 1

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- Case Study: T-pyramid of an image

UNIT 2 **IMAGE PRE-PROCESSING**

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-speralct images -Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration – Case Study: Deriving the quad tree representation of an image using the homogeneity criterion of equal intensity

UNIT 3 **OBJECT DETECTION USING MACHINE LEARNING**

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-Case Study: Geometric transforms such as Rotation, Change of scale, Skewing, Affine transform calculated from three pairs of corresponding points and Bilinear transform calculated from four pairs of corresponding points.

FACE RECOGNITION AND GESTURE RECOGNITION UNIT 4

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-Case Study: motion analysis using moving edges, and apply it to your image sequences and Facial Detection and Recognition.

UNIT 5 VIDEO ANALYTICS

Video Processing - use cases of video analytics-Vanishing Gradient and exploding gradient problem-RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3 -Case Study: Event detection in video surveillance system

Total: 45 Periods

TEXT BOOKS:

VCET, B.E-CSE, R2018 Ver. - 4, Curriculum and Syllabus

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- 1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013.
- 2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES:

- 1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, 2011.
- 2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
- 3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.

4. E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press. e-RESOURCES:

- 1. https://onlinecourses.nptel.ac.in/noc21_cs93/preview
- 2. https://appsilon.com/object-detection-yolo-algorithm/

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	-	-	-	-	-	1	2	-	2
CO2	3	3	2	2	2	-	-	-	-	-	1	2	-	2
CO3	3	3	2	2	2	-	-	-	-	-	1	2	-	2
CO4	3	3	2	2	2	-	-	-	-	-	1	2	-	2
CO5	3	3	2	2	2	-	-	-	-	-	1	2	-	2

Mapping of COs with POs and PSOs

21CSE18

Pre-requisites :-Preamble

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.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the concepts of recommender systems.
- CO2 Demonstrate machine-learning and data-mining algorithms in recommender systems data sets.
- CO3 Identify Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics
- CO4 Summarize simple recommender system.
- CO5 Organize about advanced topics of recommender systems.

UNIT 1 INTRODUCTION

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). Case Study : Data similarity measures using Python.

UNIT 2 CONTENT-BASED RECOMMENDATION SYSTEMS

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT 3 COLLABORATIVE FILTERING

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. Case Study : collaborative filter techniques.

UNIT 4 ATTACK-RESISTANT RECOMMENDER SYSTEMS

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms. Case Study : Attack for tampering with recommender systems.

UNIT 5 EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures. Case Study : Accuracy metrics like Receiver Operated Characteristic curves.

TEXT BOOKS:

- 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 Sytems Handbook, 1st ed, Springer (2011),
- Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition,
- 4. Cambridge University Press, 2020.

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Total : 45 Periods

REFERENCES:

- 1. M. Chiang, Networking Life, Cambridge, 2010. (Chapter 4).
- Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer
- 2. (2013), 1st ed

e-RESOURCES:

- 1. https://www.witpress.com/Secure/elibrary/papers/1845641523/1845641523005FU1.pdf
- 2. https://freevideolectures.com/course/4694/nptel-e-business/54

Cos/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	-	1	-	-	-	1	1	-	3
CO2	3	3	2	2	1	-	1	-	-	-	1	1	-	3
CO3	3	3	2	2	1	-	1	-	-	-	1	1	-	2
CO4	3	3	2	2	1	-	1	-	-	-	1	1	-	2
CO5	3	3	2	2	1	-	1	-	-	-	1	1	-	2

Mapping of COs with POs and PSOs

21CSE21

Pre-requisites : Computer Networks

Preamble: Cloud computing involves delivering different types of services over the Internet. From software and analytics to secure and safe data storage and networking resources, everything can be delivered via the cloud. It became a hot issue for its advantages such as "reduce costs", "increase business flexibility" and/or "provide business continuity". Nowadays, all of the legacy systems are being moved to the cloud platform and its demand is increasing day by day. In future, all web or mobile applications will be available on the cloud.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Analyze and identify a specific cloud deployment model and delivery model to adopt for any given cloud application.
- CO2 Discuss the role of data center, virtualization, web, multitenant and service technologies in providing resilient, elastic and cost-efficient computing for a given cloud system.
- CO3 Assess and identify the required cloud computing mechanisms to deploy in cloud architectures when developing a given cloud application.
- CO4 Compare and evaluate the ability of cloud computing architectures to meet a set of requirements for a given business application.
- CO5 Choose suitable security mechanism to provide security for a given cloud application.

UNIT 1 UNDERSTANDING CLOUD COMPUTING

Origins and Influences–Basic Concepts and Terminology – Goals and Benefits–Risks and Challenges– Roles and Boundaries– Cloud Characteristics–Cloud Delivery Models: IaaS, PaaS, SaaS – Cloud Deployment Models: Public, Private, Community, Hybrid Clouds.

UNIT 2 CLOUD ENABLING TECHNOLOGY

Data Center Technology – Virtualization Technology– Web Technology– Multitenant Technology– Service Technology– Case study : VM installation and deployment.

UNIT 3 CLOUD COMPUTING MECHANISM

Cloud Infrastructure Mechanism: Cloud Storage, Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, Billing Management System.

UNIT 4 CLOUD COMPUTING ARCHITECTURE

Fundamental Cloud Architectures: Workload Distribution Architecture– Resource Pooling Architecture– Dynamic Scalability Architecture– Elastic Resource Capacity Architecture– Service Load Balancing Architecture– Cloud Bursting Architecture – Elastic Disk Provisioning Architecture– Redundant Storage Architecture– Advanced Cloud Architectures: Hypervisor Clustering Architecture– Load Balanced Virtual Server Instances Architecture– Dynamic Failure Detection and Recovery Architecture – Case Study : AWS, Microsoft Azure.

UNIT 5 BASIC SECURIOTY IN CLOUD

Basic Terms and Concepts – Threat Agents – Cloud Security Threats – Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images – Case study examples.

TEXT BOOKS:

- 1. Thomas Erl, Zaigham Mahood, Ricardo Puttini, "Cloud Computing, Concept, Technology and Architecture", Prentice Hall, 2013.
- 2. K.Chandrasekaran, "Essentials of Cloud Computing", CRC Press, 2015.

Total : 45 Periods

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REFERENCES:

- 1. Kai Hwang, Geoffrey C Fox, Jack J.Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
- 2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata McGraw-Hill, 2013.

e RESOURCES

1. https://nptel.ac.in/courses/106/105/106105223/,"Google Cloud Computing Foundation Course", Prof. Soumya Kanti Ghosh, IIT Kharagpur.

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	-	1	1	1	1	-	-	-	1	1	3
CO2	3	3	1	-	1	1	1	-	-	-	-	1	1	3
CO3	3	3	1	-	1	1	1	-	-	-	2	1	1	3
CO4	3	3	1	1	1	1	1	_	-	_	2	1	1	3
CO5	3	3	1	1	1	1	1	1	-	-	2	1	1	3

21CSE22

Pre-requisites : Basic Knowledge about DBMS , Database Architecture Preamble

This course introduces the Nosql Databases of database concepts to the students and gives practice to create and maintain a database. It also covers the concepts of logical and physical relationships in a data model and the concept of managing a database system. Students will use a computer aided software engineering tool to design, create, and query a database.

NOSQL DATABASES

Course Outcomes: Upon completion of this course, students will be able to:

- Explain the detailed architecture, Database properties and storage requirements CO1
- Differentiate and identify right database models for real time applications CO2
- CO3 Outline Key value architecture and characteristics
- Design Schema and implement CRUD operations, distributed data operations, implement various CO4 column store internals
- CO5 Develop Application with Graph Data model

INTRODUCTION TO NOSQL CONCEPTS UNIT 1

Data base revolutions: First generation, second generation, third generation, Managing Transactions and Data Integrity, ACID and BASE for reliable database transactions, Speeding performance by strategic use of RAM, SSD, and disk, Achieving horizontal scalability with Data base sharding, Brewers CAP theorem.

NOSQL DATA ARCHITECTURE PATTERNS UNIT 2

NoSQL Data model: Aggregate Models- Document Data Model- Key-Value Data Model-Columnar Data Model, Graph Based Data Model Graph Data Model, NoSQL system ways to handle big data problems, Moving Queries to data, not data to the query, hash rings to distribute the data on clusters, replication to scale reads. Database distributed queries to Data nodes.

UNIT 3 KEY VALUE DATA STORES

From array to key value databases, Essential features of key value Databases, Properties of keys, Characteristics of Values, Key-Value Database Data Modeling Terms, Key-Value Architecture and implementation Terms, Designing Structured Values, Limitations of Key-Value Databases, Design Patterns for Key-Value Databases, Case Study: Key-Value Databases for Mobile Application Configuration

DOCUMENT ORIENTED DATABASE UNIT 4

Document, Collection, Naming, CRUD operation, querying, indexing, Replication, Sharding,

Consistency Implementation: Distributed consistency, Eventual Consistency, Capped Collection, Case studies: document oriented database: Mongo DB and/or Cassandra.

COLUMNAR DATA MODEL: Data warehousing schemas: Comparison of columnar and row-oriented Column-store Architectures: C-Store and Vector-Wise, Column-store storage. internals and. Inserts/updates/deletes, Indexing, Adaptive Indexing and Database Cracking.

DATA MODELING WITH GRAPH UNIT 5

Comparison of Relational and Graph Modeling, Property Graph Model Graph Analytics: Link analysis algorithm- Web as a graph, Page Rank- Markov chain, page rank computation, Topic specific page rank (Page Ranking Computation techniques: iterative processing, Random walk distribution Querying Graphs: Introduction to Cypher, case study: Building a Graph Database Application- community detection

Total : 45 Periods

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Page 127
TEXT BOOKS:

- Guy Harrison, Next Generation Database: NoSQL and big data, Apress. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence,
- 2. Wiley Publications,1st Edition ,2019.

REFERENCES:

- Christopher D.manning, Prabhakar Raghavan, Hinrich Schutze, An introduction to
- ^{1.} Information Retrieval, Cambridge University Press
- 2. Daniel Abadi, Peter Boncz and Stavros Harizopoulas, The Design and Implementation of
- ^{2.} Modern Column-Oriented Database Systems, Now Publishers.

e-RESOURCES:

- 1. https://www.ibm.com/cloud/learn/nosql-databases
- 2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
- 3. https://www.geeksforgeeks.org/introduction-to-nosql/
- 4. https://www.javatpoint.com/nosql-databa

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	3	-	2	3	2	1
CO2	3	2	2	2	3	-	-	-	2	-	-	2	2	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	1	1
CO4	3	3	3	3	-	-	-	-	-	-	-	3	2	2
CO5	3	2	2	2	-	2	-	-	-	-	2	2	3	2

Mapping of COs with POs and PSOs

knowledge of SOA methodologies, modeling, design, SOA technologies, orchestration and architectural frameworks.

Course Outcomes: Upon completion of this course, students will be able to:

Pre-requisites: Software Engineering and Object-Oriented Analysis and Design.

Create a valid and well-formed XML document for web based data entities using XML schema and CO1 DTD.

"service" and "architecture" and establishes a strong understanding of the concepts needed to have an effective working

- CO₂ Develop an XML application with a database using SAX and XSL Technologies.
- Compare the characteristics, benefits, service orientation principles of SOA with the components of CO3 Distributed system for a given application framework.
- CO4 Construct web service architecture using WSDL, SOAP and UDDI for business applications.
- Discuss the web service specification like WS-BPEL, WS-Coordination, WS-Policy, and WS-Security CO5 to build secure vs interaction SOA based applications.

UNIT 1 **INTRODUCTION TO XML**

Preamble

XML document structure - Well formed and valid documents - Name spaces - DTD - XML Schema - X-Files-Case study: XML Vocabulary.

UNIT 2 BUILDING XML- BASED APPLICATIONS

Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML-Case study: Raw AJAX.

SERVICE ORIENTED ARCHITECTURES UNIT 3

Characteristics of SOA, Comparing SOA with Client-Server, Distributed Internet architectures - Benefits of SOA -Anatomy of SOA - Principles of Service orientation.

UNIT 4 WEB SERVICES

Service descriptions - WSDL - Messaging with SOAP - Service discovery - Message Exchange Patterns-Orchestration – Choreography – Service layers - WS Transactions – Web Services Enhancements.

UNIT 5 **BUILDING SOA-BASED APPLICATIONS**

Service Oriented Analysis and Design – Service Modeling – WS-BPEL – WS-Coordination – WS-Policy-WS-Security – SOA support in J2EE.

TEXT BOOKS:

- 1. Guy Harrison, Next Generation Database: NoSQL and big data, Apress. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence,
- 2. Wiley Publications, 1st Edition, 2019.

REFERENCES:

- Christopher D.manning, Prabhakar Raghavan, Hinrich Schutze, An introduction to 1.
- Information Retrieval, Cambridge University Press

21CSE23 SERVICE ORIENTED ARCHITECTURE L Т 3 Λ

This course enables the student to understand the XML fundamental concepts, its usage in data exchanges, XML related technologies, protocols and find out way to communicate with databases. This course makes the students to define

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Total : 45 Periods

- 2. Daniel Abadi, Peter Boncz and Stavros Harizopoulas, The Design and Implementation of
- Modern Column-Oriented Database Systems, Now Publishers.

e-RESOURCES:

- 1. https://www.ibm.com/cloud/learn/nosql-databases
- 2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
- 3. https://www.geeksforgeeks.org/introduction-to-nosql/
- 4. https://www.javatpoint.com/nosql-databa

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	3	-	2	3	2	1
CO2	3	2	2	2	3	-	-	-	2	-	-	2	2	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	1	1
CO4	3	3	3	3	-	-	-	-	-	-	-	3	2	2
CO5	3	2	2	2	-	2	-	-	-	-	2	2	3	2

Pre-requisites : Basics of website/app design and development Preamble

The course UI/UX Design introduces a sound knowledge in UI & UX to understand the need for UI and UX, the various Research Methods used in Design, explore the various Tools used in UI & UX and Creating a wireframe and prototype.

UI/UX DESIGN

Course Outcomes: Upon completion of this course, students will be able to:

- Build user interfaces for user applications using divergent and convergent thinking. CO1
- Design user interface with necessary elements and patterns for user applications using UI style guides. CO2
- Evaluate UX design skills and design Process and its Methodology in product development. CO3
- Implement Sketching principles in responsive design for user interface. CO4
- Design user research methods of Personas, Solution Ideation, Scenarios using UI and UX. CO5

UNIT 1 FOUNDATIONS OF DESIGN

UI vs. Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

FOUNDATIONS OF UI DESIGN UNIT 2

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles - Branding - Style Guides.

UNIT 3 FOUNDATIONS OF UX DESIGN

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.

WIREFRAMING, PROTOTYPING AND TESTING UNIT 4

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.

RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE UNIT 5

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas -Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.

TEXT BOOKS:

- Joel Marsh, "UX for Beginners", O'Reilly, 2022. 1.
- Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021. 2.

REFERENCES:

- Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition, O'Reilly 2020 1.
- Steve Schoger, Adam Wathan "Refactoring UI", 2018 2.

e-RESOURCES:

- https://www.nngroup.com/articles/ 1.
- https://www.interaction-design.org/literature 2.

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Total : 45 Periods

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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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	2	1	-	1	-	-	-	2	1	3	1
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CO4	3	2	3	2	1	-	1	-	-	-	2	1	3	1
CO5	3	2	3	2	1	-	1	-	-	-	2	1	3	1

Pre-requisites : Knowledge on Software Engineering concepts and Programming languages like Java, Python, Pearl, etc.

Preamble

DevOps is the combination of cultural philosophies, practices, and tools that increase an organization's ability to deliver applications and services at high velocity: evolving and improving products at a faster pace than organizations using traditional software development and infrastructure management processes.

Course Outcomes: Upon completion of this course, students will be able to

- 1. Understand different actions performed through Version control tools like Git.
- 2. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
- 3. Ability to Perform Automated Continuous Deployment
- 4. Ability to do configuration management using Ansible
- ^{5.} Understand to leverage Cloud-based DevOps tools using Azure DevOps

UNIT 1 INTRODUCTION TO DEVOPS

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT 2 COMPILE AND BUILD USING MAVEN & GRADLE

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 Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

UNIT 3 CONTINUOUS INTEGRATION USING JENKINS

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 4 CONFIGURATION MANAGEMENT USING ANSIBLE

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT 5 BUILDING DEVOPS PIPELINES USING AZURE

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

TEXT BOOKS:

- 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: Cicd 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 by Mitesh Soni
- 2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015

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Total : 45 Periods

e-RESOURCES:

- 1. https://www.jenkins.io/user-handbook.pdf
- 2. https://maven.apache.org/guides/getting-started/

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	-	-	-	-	-	2	1	2	2
CO2	3	3	3	2	2	-	-	-	-	-	2	1	2	2
CO3	3	3	3	2	2	-	-	-	-	-	2	1	2	2
CO4	3	3	3	2	2	_	-	-	-	-	2	1	2	2
CO5	3	3	3	2	2	-	-	-	-	-	2	1	2	2

Mapping of COs with POs and PSOs

Pre-requisites : Software Engineering **Preamble**

This course enables the learner to understand the basics of software testing. Which addresses how to do the testing and planning .It teaches to build test cases and execute them. To focus on wide aspects of testing and understanding multiple facets of testing and also to get an insight about test automation and the tools used for test automation.

Course Outcomes: Upon completion of this course, 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 Testing

UNIT 1 FOUNDATIONS OF SOFTWARE TESTING

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 2 TEST PLANNING

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 3 TEST DESIGN AND EXECUTION

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 4 ADVANCED TESTING CONCEPTS

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 5 TEST AUTOMATION AND TOOLS

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 : 45 Periods

TEXT BOOKS:

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

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REFERENCES:

- 1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
- 2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
- 3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Fourth Edition, 2014, Taylor & Francis Group.
- 4. Carl Cocchiaro, 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 WebDriver Practical Guide, 2014, Packt Publishing.
- 7. Varun Menon, TestNg Beginner's Guide, 2013, Packt Publishing

e-RESOURCES:

- 1. https://onlinecourses.nptel.ac.in/noc22_cs61/preview
- 2. https://onlinecourses.nptel.ac.in/noc23_cs38/preview

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	2	1	-	-	-	-	-	2	1	1	2
CO2	3	3	1	2	1	-	-	-	-	-	2	1	1	2
CO3	3	3	1	2	1	-	-	-	-	-	2	1	1	2
CO4	3	3	1	2	1	-	-	-	-	-	2	1	1	2
CO5	3	3	1	2	1	-	-	-	-	-	2	1	1	2

Pre-requisites : Basic knowledge on HTML and Object Oriented Programming. **Preamble**

JavaScript is a loosely-typed client side scripting language that executes in the user's web browser. A web page without JavaScript is unimaginable today. There are many open source application development frameworks based on JavaScript.

Course Outcomes: At the end of this course, the students will be able to:

- CO1 Understanding the basics concepts of HTML, CSS and Java Script in HTML.
- CO2 JavaScript core: Identify expressions and operators. Summarize flow control. Demonstrate objects and arrays usage. Define functions and methods.
- CO3 Learn key jQuery concepts like callbacks and event handlers and understand the Document Object Model
- (DOM) and how JavaScript manipulates objects in the DOM.
- CO4 Understanding the concept of Node.JS and accessing database using MongoDB.
- CO5 Gaining knowledge on Angular JS, Responsive web design, and Python with Django.

UNIT 1 FRONT-END WEB DEVELOPMENT

Introduction to HTML - Introduction to CSS- Basics of JavaScript- Features of JavaScript-Advantages and Disadvantages of JavaScript- How does JavaScript works?-Structure of a JavaScript program- Writing JavaScript in Notepad++/Visual Studio Code/ Eclipse IDE.- Adding JavaScript in HTML- Including External Javascript In Html.

UNIT 2 JAVASCRIPT CORE

JavaScript Data Types, Keywords, Comments and Variables - JavaScript Expressions and Operators - JavaScript Statements (Conditional and Looping), Functions and Objects- User Input and Output in JavaScript.

UNIT 3 GETTING STARTED WITH JQUERY UI

jQuery – Basics - Using jQuery UI on a Web Page- jQuery setup- jQuery – Selectors - Select Elements by Name, id, attribute - jQuery Methods - jQuery DOM Manipulation- jQuery callbacks and Events-Ajax methods of jQuery.

UNIT 4 NODE.JS

Node.js Basics - Node.js Modules (Local, Export Modules)- Node Package Manager (NPM) - Create Web Server in Node.js - Node.js File System - Data Access in Node.js -Access MongoDB in Node.js

UNIT 5 ANGULAR JS

Angular JS Basics - Angular Expressions and Data Binding- Angular MVC-Angular JS Modules and Forms - AngularJS Bootstrap Application. Responsive Web Design- Twitter Bootstrap - Making our application responsive. Python Backend Web Development with Django - User Registration and Login Authentication in Django –Steps in End to End Web Development – Steps in Host and manage the project live in any public hosting platform.

TEXT BOOKS:

- 1. JavaScript the Definitive Guide 7/ED Paperback 15 June 2020.
- 2. Eloquent JavaScript 3E: A Modern Introduction to Programming Paperback 4 December 2018.
- 3. JavaScript from Beginner to Professional: Learn JavaScript quickly by building fun, interactive, and
- dynamic web apps, games, and pages Paperback Import, 22 January 2021.

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Total : 45 Periods

REFERENCES:

- 1. https://www.lcg.ufrj.br/nodejs/books/react-beginners-handbook.pdf
- 2. https://pepa.holla.cz/wp-content/uploads/2015/10/Beginning-AngularJS.pdf

e-RESOURCES:

- 1. https://onlinecourses.swayam2.ac.in/aic20_sp11/preview, "Principles of Web Programming", by Prof Kannan Moudgalya, IIT Mumbai.
- 2. http://nptel.ac.in/courses/106105084/25
- 3. http://nptel.ac.in/courses/106105084/26
- https://archive.nptel.ac.in/courses/106/106/106106156, " Introduction to modern application development", by Prof. Aamod Sane, Prof. Abhijat Vichare, Prof. Madhavan Mukund, IIT Chennai.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	2	3	-	-	-	-	-	-	1	3	3
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CO3	2	3	3	2	3	-	-	-	-	-	-	1	3	3
CO4	2	3	3	2	3	-	-	-	-	-	-	1	3	3
CO5	2	3	3	2	3	-	-	-	-	-	-	1	3	3

Mapping of COs with POs and PSOs

PYTHON WEB DEVELOPMENT

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Pre-requisites : PYTHON Preamble

Python Web Development is designed to enrich the knowledge of different Web based Python Frameworks and covered Python fundamentals including OOPS concepts. The course has been designed for both the Frontend and Back-end development processes. SQL is also covered to connect our application with the Database.

Course Outcomes: Upon completion of this course, students will be able to:

- Develop a Python program using modules and packages to solve a given problem. CO1
- Develop a Web page using HTML, CSS, JavaScript Concepts. CO₂
- Build a Django application using Web application tools CO3
- Develop CRUD Operations in Database CO4
- CO5 Design and develop Django Web application with hands-on.

UNIT 1 **INTRODUCTION TO PYTHON**

Python interpreter - Revisiting Python List & Dictionary - Classes and Objects - Decorators - Regular Expression.

UNIT 2 WEB TECHNOLOGIES

Understanding web servers and web clients - HTML Tags - CSS Classes - Using JavaScript & JQuery -Front-end framework: Bootstrap and Materialize CSS - Responsive Grid Design.

UNIT 3 **DJANGO FRAMEWORK**

Introduction To Django - Django App Architecture - Django Models - Django Admin - Django Urls - Django Views - Django Orm & Querysets - Django Forms - Django Users & Auth - Django Templates & Static Files -Django Tests & Exceptions - Django Security & Web Application Tools.

UNIT 4 DATABASES

CRUD Operations in Sqlite3 - CRUD Operations in MySQL/MariaDB - CRUD Operations in PostgreSQL -CRUD Operations in MongoDB - CRUD Operations in Neo4j.

UNIT 5 DJANGO REST API FRAMEWORK

Introduction to Rest API - Working with JSON files - Serialization - Routers - Class based views - API Permissions API request methods - Understating response objects and headers Using CURL - Using Postman - Creating API endpoints in Django web application.

TEXT BOOKS:

- Fabrizio Romano, Gaston C. Hillar, Arun Ravindran, "Learn Web Development with Python", Packt 1.
- Publishing 1st edition 2018
- 2. Aidas Bendoraitis, Jake Kronika, "Django 3 Web Development", Packt Publishing - 4th edition - 2020)

REFERENCES:

- Gaston C. Hillar, "Django RESTful Web Services", Packt Publishing 1st edition 2018 1.
- 2. Eric Matthes, "Python Crash course", Third Edition, No Starch Press, 2023.

e-RESOURCES:

- https://www.educative.io/blog/web-development-in-python 1.
- https://realpython.com/learning-paths/become-python-web-developer/ 2.

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Total : 45 Periods

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO4	3	3	2	2	1	-	1	-	-	-	1	2	3	1
CO5	3	3	2	2	1	-	1	-	-	-	1	2	3	1

Pre-requisites : Computer Networks Preamble:

A distributed system is a system whose components are located on different networked computers, which communicate and coordinate their actions by passing messages to one another. The components interact withone another in order to achieve a common goal. An application of distributed systems includes multiplayer online games, web search, mobile and ubiquitous computing, finance and trading systems.

Course Outcomes: Upon completion of this course, students will be able to

- CO1 Discuss resource sharing principles, trends and challenges in a distributed system using World Wide Webas a case study.
- CO2 Illustrate process communication using remote method invocation for a given distributed environment.
- CO3 Describe the file systems for a distributed environment using distributed file service implementations.
- CO4 Apply suitable concurrency control method to ensure multiple transactions to maintain ACID property and serializability in the schedules.
- CO5 Explain process and resource management policies for a given distributed environment using schedulingalgorithms.

UNIT 1 INTRODUCTION

Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web- System models-Physical model-Architectural model-Fundamental model.

UNIT 2 COMMUNICATION IN DISTRIBUTED SYSTEM

Inter process Communication - the API for internet protocols – External data representation and marshalling- Remote Invocation – Request-reply protocols - Remote procedure call - Remote method invocation. Case study: Java RMI – Group communication - Publish-subscribe systems - Message queues - Shared memory approaches.

UNIT 3 DISTRIBUTED FILE SYSTEM AND NAME SERVICES

Distributed File Systems –Introduction – File service architecture – Andrew File system. **Case study:** Google File system. Naming - Introduction-Name services and domain name system-Directory Services-Peer to peer Systems-Napster-Peer to peer middleware- Routing overlays.

UNIT 4 DISTRIBUTED TRANSACTIONS AND CONCURRENCY CONTROL

Introduction - Clocks, events and process states - Synchronizing physical clocks- Logical time and logical clocks- Coordination and Agreement – Introduction - Distributed mutual exclusion algorithms – Election algorithms – Distributed Transactions– Flat and nested distributed transactions-Atomic Commit protocols – Concurrency control in Distributed systems- Distributed deadlocks-Transaction Recovery

UNIT 5 PROCESS & RESOURCE MANAGEMENT

Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation. **Resource Management:** Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

Total : 45 Periods

TEXT BOOKS:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.

REFERENCES:

Pradeep, "Distributed K Sinha Operating Systems: Concepts and Design", Prentice Hall of

1. India,2012

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e-RESOURCES:

- 1. https://nptel.ac.in/courses/106106107/, "Inter process Communication", Prof. Ananthanarayana VS, Department of Information Technology, NITK ,Surathkal.
- 2. https://onlinecourses.nptel.ac.in/, "Time and global states", Dr. Rajiv Misra, Department of ComputerScience and Engineering, IIT, Patna.

Mapping of COs with POs and PSOs

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	-	-	-	-	-	-	1	-	1	-	2
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CO3	3	3	2	1	-	-	-	-	-	1	-	1	-	2
CO4	3	3	2	1	-	-	-	-	-	1	-	1	-	2
CO5	3	3	2	1	-	-	-	-	-	1	-	1	-	2

EDGE COMPUTING AND FOG COMPUTING

Pre-requisites : Preamble

It acquire knowledge on Edge Computing Architectures and Models and helps to understand Edge Computing technologies in which we can develop applications in Edge Computing and to acquire knowledge on the concepts of Fog Computing to understand optimization techniques data management in Fog Computing and to study the application development in Fog Computing

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Describe the key architectures in edge computing to ensure all the components are active in the environment.
- CO2 Examine the various edge computing models to brings enterprise applications closer to data sources.
- CO3 Understand principles of Fog Computing and difference between Fog and cloud computing to access data faster and efficient ways.
- CO4 Analyze the various optimization metrics in Fog computing to increase the performance of computation.
- CO5 Designing and modeling the industrial applications for easy communication to maintain networks to store and manage data for improving scalability.

UNIT 1 EDGE COMPUTING ARCHITECTURES

An overview of edge computing Open challenges - Edge computing in a doudisation mode Standard reference architecture - Edge computing as a VNF - CloudPath-Cloud4Home-Femto Clouds-Scalable and Secure On loading of Edge ections Using AirBox

UNIT 2 EDGE COMPUTING MODELS

Big data analytical models-Data security and privacy models- Networking models and protocols for edge computing - Computing and storage models for edge computing - Resource allocation models for edge computing

UNIT 3 FOG COMPUTING FUNDAMENTALS

Concepts-Principles and related paradigms-Fog Computing in the loT environment-Fog Computing in the realm of Cloud Computing-Fog Computing in a developing world context

UNIT 4 OPTIMIZATION PROBLEMS IN FOG COMPUTING

Case for optimization in Fog Computing Formal modelling framework for Fog Computing Optimization opportunities along the Fog archit and rvice life cycle-Towards a taxonomy of optimization problems in Fog Computing-Optimization techniques

UNIT 5 APPLICATIONS OF FOG AND EDGE COMPUTING

Snart olies enabled by edge computing-Smart healthcare systems enabled by edge computing Smart hospitals enabled by edge computing Human Object Detection-Object Tracking-Lightweight Human Detection-Data-Driven Intelligent Transportation Systems

TEXT BOOKS:

- 1. Javid Taher Shuguang Deng. "Edge Computing: Models, lecnologies and applications" First Edson, The Institution of Engineering and Technology, 2020 2. Je Can Quen Zhang, Weisong Shi "Edge Computing: A Primer, First Edison, Springer national Publishing 2018.
- 2. Mahmood, Zargham (Ed)" Fog Computing-Concepts, Frameworks and Technologies. First Editon Springer, 2018.

REFERENCES:

- 1. At Singh Edge Computing: Simply in Depth", First Edition, Amazon Digital Services LLC, KDP Print 2019
- 2. Wu, Jie, Chang, Wei (Eds.), "Fog/Edge Computing for Security, Privacy, and Applications", First Edition, Springer International Publishing, 2020

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Total: 45 Periods

e RESOURCES

1. https://www.e-education.psu.edu/geog583/node/55

COs/POs	PO 1	PO 2	PO 3	РО 4	РО 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	2	-	-	-	-	-	-	1	2	2
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CO3	3	2	2	1	2	-	-	-	-	-	-	1	2	2
CO4	3	2	2	1	2	-	-	-	-	-	-	1	2	2
CO5	3	2	2	1	2	-	-	-	-	-	-	1	2	2

Mapping of COs with POs and PSOs

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Pre-requisites : Computer Networks, Cloud Computing, Network Security

Preamble: The course covers the fundamental Cloud Computing terminology, definition & concepts. It helps students to understand the security design and architectural considerations for Cloud. It also makes the students to get familiar with the Identity, Access control in Cloud. The best practices for Cloud security using various design patterns are discussed. This also introducers learners to monitor and audit cloud applications for security.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the fundamental security concepts for any given cloud application.
- CO2 Discuss the strategies for a secure architecture and design of a given cloud application
- CO3 Describe access control and identity management to apply for a given secure cloud application.
- CO4 Explain the different design patterns to provide security for an given cloud application
- CO5 Describe the different monitoring, auditing and management provisions of security to deploy for any given cloud application.

UNIT 1 FUNDAMENTALS OF CLOUD SECURITY CONCEPTS

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT 2 SECURITY DESIGN AND ARCHITECTURE FOR CLOUD

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 3 ACCESS CONTROL AND IDENTITY MANAGEMENT

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 4 CLOUD SECURITY DESIGN PATTERNS

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud. Case study Example

UNIT 5 MONITORING, AUDITING AND MANAGEMENT

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. Case study Example

Total : 45 Periods

TEXT BOOKS:

- 1. Raj Kumar Buyya , James Broberg, Andrzej Goscinski, "Cloud Computing:Principles and Paradigms", Wiley 2013
- 2. Dave Shackleford, "Virtualization Security:Protecting Virtualized Environment (SYBEX)", Wiley 2012.

REFERENCES:

- 1. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy", ORIELLY 2009.
- 2. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, "Mastering Cloud Computing: Foundations and Applications Programming", Morgan Kaufmann, 2013.

e RESOURCES

- 1. http://www.cloudbus.org/cloudsim/
- 2. https://www.youtube.com/watch?v=44IBhZwa4ZM
- 3. https://www.youtube.com/watch?v=xceZmVGNS_Q

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO4	3	3	2	2	-	2	1	1	-	-	-	1	2	3
CO5	3	3	2	2	-	2	1	1	-	-	-	1	2	3

DEVOPS AND SITE RELIABILITY ENGINEERING L 21CSE34

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Pre-requisites : Pre-requisites : Knowledge on Software Engineering concepts and Programming languages like Java, Python, Pearl.

Preamble

DevOps and SRE is the combination of cultural philosophies, practices, and tools that increase an organization's ability to deliver applications and services at high velocities is is done through automation and continuous integration and delivery and to improve the reliability of high-scale systems

Course Outcomes: Upon completion of this course, students will be able to

- Understand different actions performed through Version control tools like Git to make CO1 comparisons in different code versions.
- Perform Continuous Integration, Testing and Deployment using Jenkins by building and automating test cases using Maven & Gradle for Making Development and Operations CO₂ Repeatable, Accessible, and Easier to Manage at Scale.
- Ability to Perform Automated Continuous Deployment for changing the production environment CO3 automatically to the changes in the code.
- CO4 Understanding Basics Concept of SRE to ensure their software applications remain reliable
- Implementing SRE Process for a given real time application to perform operations to scale with CO5 load

INTRODUCTION TO DEVOPS UNIT 1

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT 2 **COMPILE AND BUILD USING MAVEN & GRADLE**

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 Artificats, Dependency management, Installation of Gradle, Understand build using Gradle.

CONTINUOUS INTEGRATION USING JENKINS UNIT 3

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 4 **BASICS OF SITE RELIABILITY ENGINEERING**

Introduction, principle of SRE-SRE roles and responsibilities, SRE implementation

UNIT 5 SRE PROCESSESS AND BEST PRACTICES

Improving Enterprise Workflows-Monitoring System Performance-SRE &DEVOPS :Similarities And Difference Building SRE Sucess Culture At Linkedin.

TEXT BOOKS:

- Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From 1. Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016
- Stephen Fleming, DevOps and Site Reliability Engineering (SRE) Handbook: Non-Programmer's 2. Guide Paperback – Import, 23 November 2018

3.

- **REFERENCES:**
 - Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications 1. Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni

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Total : 45 Periods

2. Site Reliability Engineering by Betsy Beyer, Chris Jones, Niall Richard Murphy, Jennifer Petoff Released April 2016.

e-RESOURCES:

- 1. https://www.jenkins.io/user-handbook.pdf.
- 2. https://www.linkedin.com/learning/site-reliability-engineering-service-level-agreements-and-objectives.

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO5	3	3	2	1	1	-	-	-	-	-	-	1	2	2

Mapping of COs with POs and PSOs

CLOUD SERVICES MANAGEMENT

С L Т р 0 3 3 0

Pre-requisites : Computer Networks, Cloud Computing, Service Oriented Architecture Preamble

This course helps the students to exhibit cloud-design skills to build and automate business solutions using cloud technologies. This makes them to possess strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services. The students will ge an idea to solve the real world problems using Cloud services and technologies.

Course Outcomes: Upon completion of this course, students will be able to

- Explain the underlying cloud terminologies to use for a given application CO1
- Describe the various cloud strategies and management strategies to meet the business needs. CO2
- CO3 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 CO4 business environment
- CO5 Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

CLOUD SERVICE MANAGEMENT FUNDAMENTALS UNIT 1

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 2 **CLOUD SERVICES STRATEGY**

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.

CLOUD SERVICE MANAGEMENT UNIT 3

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.

CLOUD SERVICE ECONOMICS UNIT 4

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 5 **CLOUD SERVICE GOVERNANCE & VALUE**

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.

TEXT BOOKS:

- 1. Enamul Haque, "Cloud Service Management and Governance: Smart Service Management in Cloud Era", Enel Publications, 2020
- Thomas Erl, Ricardo Puttini, Zaigham Mohammad, "Cloud Computing: Concepts, Technology & 2. Architecture", Prentice Hall Press, 2013.
- Thomas Erl, Robert Cope, Amin Naserpour, "Cloud Computing Design Patterns", Pearson, 2013. 3.

REFERENCES:

- Praveen Ayyappa, "Economics of Cloud Computing", LAP Lambert Academic Publishing, 2020 1.
- Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, "Mastering Cloud Computing: 2. Foundations and Applications Programming", Morgan Kaufmann, 2013.

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Total : 45 Periods

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e-RESOURCES:

- 1. https://www.youtube.com/watch?v=1V5FyasVMaM
- 2. https://www.youtube.com/watch?v=_7TJf_8LEN8

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	-	2	1	-	-	-	1	1	2	3
CO2	3	3	2	2	-	2	1	-	-	-	1	1	2	3
CO3	3	3	2	2	1	2	1	-	-	-	1	1	2	3
CO4	3	3	2	2	1	2	1	-	-	-	1	1	2	3
CO5	3	3	2	2	1	2	1	-	-	-	1	1	2	3

Mapping of COs with POs and PSOs

TEXT BOOKS:

21CSE36 INFORMATION STORAGE MANAGEMENT

Pre-requisites : Database Management Systems

Preamble: Information Storage and Management (ISM) is the Knowledge gap in understanding varied components of information storage infrastructure in classic and virtual environments. It provides a comprehensive learning on storage technology, which will enable to make more informed decisions in an increasingly complex IT environment. It builds a strong understanding of underlying storage technologies and prepares you to learn advanced concepts, technologies and products. Storage networking technologies such as FC-SAN, IP-SAN, NAS, object-based and unified storage; business continuity solutions such as backup and replication.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Select from various storage technologies to suit for required application.
- CO2 Explain the concept of RAID and different RAID levels and their implementations and benefits.
- CO3 Describe the benefits of the different network storage options for different application environments.
- CO4 Discuss the different role in providing disaster recovery and business continuity capabilities.
- CO5 Use the storage security framework and practice storage monitoring and management activities.

UNIT 1 STORAGE TECHNOLOGY

Introduction to Information storage management-Challenges in data storage and data management-Solutions available for data storage-Core elements of data center infrastructure-Role of each element in supporting business activities.

UNIT 2 STORAGE SYSTEMS ARCHITECTURE

Evolution of storage architecture-Key characteristics of data center-Physical and logical components of a connectivity environment -Major physical components of a disk drive and their function-logical constructs of a physical disk, access characteristics-and performance Implication- RAID implementation, RAID techniques-RAID levels,-impact of RAID on disk performance

UNIT 3 INTRODUCTION TO NETWORKED STORAGE

Evolution of networked storage-Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN-Benefits of the different networked storage options-understand the appropriateness of the different networked storage options for different application environments

UNIT 4 INFORMATION AVAILABILITY, MONITORING & MANAGING DATACENTERS

Business continuity (BC)- BC planning lifecycle-failure analysis and solution - Disaster recovery (DR), architecture of backup/recovery and the different backup/ recovery topologies-replication technologies and their role in ensuring information availability and business continuity-Remote replication technologies and their role in providing disaster recovery and business continuity capabilities.-Identify key areas to monitor in a data center-Industry standards for data center monitoring and management-Key metrics to monitor for different components in a storage infrastructure- Key management tasks in a data center

UNIT 5 SECURING STORAGE AND STORAGE VIRTUALIZATION

Information security-Risk traid, Storage security domains-Monitoring storage management-Storage infrastructure management activities-Storage infrastructure management challenges-Virtualization technologies-block-level and file-level virtualization technologies and processes

Total : 45 Periods

- 1. EMC Corporation, "Information Storage and Management: Storing, Managing, and Protecting DigitalInformation", Wiley, India, 2011
- 2. Marc Farley, -Building Storage Networks^I, Tata McGraw Hill, Osborne, 2001.

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REFERENCES:

- 1. Robert Spalding, -Storage Networks: The Complete Reference—, Tata McGraw Hill, Osborne, 2003.
- 2. Meeta Gupta ,Storage Area Network Fundamentals, Pearson Education Limited,2002

e RESOURCES

- 1. https://www.youtube.com/watch?v=A6rfvcF3zi4," Overview of Information Storage and Management"
- 2. https://www.youtube.com/watch?v=mZvmtZA2YH4," Information storage management"

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	-	-	-	-	-	-	1	1	-	2
CO2	3	3	2	-	-	-	-	-	-	-	1	1	-	2
CO3	3	3	2	-	-	-	-	-	-	-	1	1	-	2
CO4	3	3	2	2	-	2	2	-	-	-	1	1	1	2
CO5	3	3	2	2	-	2	2	2	-	-	1	1	1	2

Mapping of COs with POs and PSOs

VCET, B.E-CSE, R2018 Ver. - 4, Curriculum and Syllabus

21CSE37

VIRTUALIZATION

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Pre-requisites : Computer Networks, Cloud Computing Preamble:

Learn the basics and types of Virtualization and easy understand the Hypervisors and its types it help to Explore the Virtualization Solutions which can be Experiment the virtualization platforms.

Course Outcomes: Upon completion of this course, students will be able to

- CO1 Discuss the virtualization concepts and Hypervisor to provide greater IT mobility
- CO2 Apply the Virtualization for real-world applications to mask server resources from server users.
- CO3 Install & Configure the different VM platforms to achieve major advances in speed, agility, and security
- CO4 Experiment with the VM with various software helps to achieve location independence by abstracting the physical location of the data.
- CO5 Create virtualization for real-world applications to increase the performance.

UNIT 1 INTRODUCTION TO VIRTUALIZATION

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors

UNIT 2 SERVER AND DESKTOP VIRTUALIZATION

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 3 NETWORK VIRTUALIZATION

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization- VLAN-WAN Architecture-WAN Virtualization

UNIT 4 STORAGE VIRTUALIZATION

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNIT 5 VIRTUALIZATION TOOLS

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study

TEXT BOOKS:

- 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

REFERENCES:

- 1. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005
- 2. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

e-RESOURCES:

1. https://www.mygreatlearning.com/blog/virtualization-in-cloud-computing/

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Total : 45 Periods

Mapping of COs with POs and PSOs

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	-	3
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CO4	3	3	3	2	1	-	-	-	-	-	2	1	1	3
CO5	3	3	3	2	1	-	-	-	-	-	2	1	1	3

21CSE41 AUGMENTED REALITY AND VIRTUAL REALITY

Pre-requisites : Computer Graphics & Multimedia

Preamble: This course is designed to give historical and modern overviews and perspectives on augmented reality and virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of augmented reality and virtual reality systems.

Course Outcomes: Upon completion of this course, students will be able to

- Explain the types and choose appropriate tool for designing augmented reality based applications CO1
- Analyze the hardware requirement of AR and explain the use of computer vision concepts for CO2 designing AR.
- Select an appropriate VR tool for a virtual reality based application. CO3
- CO4 Categorize and explain different models in VR modeling and choose appropriate modeling technique for a given problem.
- Design and Explain a solution for a given scenario using AR-VR components and micro learning CO5 tools.

UNIT 1 IINTRODUCTION TO AUGMENTED REALITY(AR)

History of AR - Augmented reality characteristics – Difference between Augmented Reality and Virtual Reality - AR technological components - Technologies used in AR - Feature Extraction - Hardware components – AR devices – Importance of AR - Real world uses of AR – AR types – Software tools available for AR.

UNIT 2 TECHNOLOGIES NEEDED FOR AUGMENTED REALITY

Hardware technology - virtual scenes - 3D objects - AR components - Display - HMD - Eyeglasses -Contact Lenses - significance of AR - AR powered devices - AR application development drawbacks -Compatibility - Performance - AR libraries - Motion tracking - Environmental understanding -Anchors.

Case Study: Study the design of an AR application with C# and Unity

UNIT 3 INTRODUCTION TO VIRTUAL REALITY(VR)

Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

UNIT 4 VR MODELING

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling - Transformation Matrices - Object Position - Transformation Invariants - Object Hierarchies - Viewing the 3D World - Physical Modeling - Collision Detection - Surface Deformation - Force Computation - Force Smoothing and Mapping - Behavior Modeling - Model Management. Case Study: GHOST (General Haptics Open Software Toolkit) software development toolkit.

UNIT 5 AUGMENTED REALITY AND VIRTUAL REALITY FOR MICRO 9 **LEARNING**

Micro learning techniques – Utilizing VR for learning – VR for Practical online assessment – VR info graphics - Virtual case considerations - Utilizing AR for learning - Accessible learning - sensible data elevated learner engagement - VR technology - Components of VR - VR Hardware - VR applications -Civil Engineering – Real Estate – Biology and Medicine – Virtual Mall – VR in Education – Virtual Laboratory – Factory Planning – Automobile Industry.

Case Study: Study of Microsoft Hololens.

Total: 45 Periods

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TEXT BOOKS:

- 1. Kaliraj, P., Devi, T. "Innovating with Augmented Reality: Applications in Education and Industry" (P. Kaliraj, Ed.) (1st ed.). CRC Press (2021). Taylor & Francis Group
- 2. Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2023.
- 3. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004

REFERENCES:

- 1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018
- 2. Schmalstieg / Hollerer,- "Augmented Reality: Principles & Practice" Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494

e-RESOURCES:

- 1. https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf
- 2. http://lavalle.pl/vr/book.html
- 3. https://www.coursera.org/learn/introduction-virtual-reality
- 4. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0133115621849497605635_sh ared/overview

Mapping of COs with POs and PSOs

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	1	-	-	-	-	-	1	3	2
CO2	3	3	2	2	2	1	-	-	-	-	-	1	3	2
CO3	3	3	2	2	2	1	-	-	-	-	-	1	3	2
CO4	3	3	2	2	2	1	-	-	-	-	-	1	3	2
CO5	3	3	2	2	2	1	-	-	-	-	-	1	3	2

Pre-requisites : Python Programming, C Programming, Operating Systems

Preamble: With the growing reliance on digital technologies and the ever-increasing threats to our online systems and data, understanding and mitigating cyber risks have become paramount. This course will explore the essential principles, concepts, and practices that form the foundation of cybersecurity.

CYBER SECURITY

Course Outcomes: Upon completion of this course, students will be able to

- CO1 Discuss the fundamental concepts, principles, and terminology related to cyber security.
- CO2 Describe the cyber attacks and tools for mitigating them.
- CO3 Interpret potential security risks during the reconnaissance phase.
- CO4 Identify security breaches for enhancing the overall security against cyber attacks.
- CO5 Illustrate the steps to prevent cyber attacks.

UNIT 1 INTRODUCTION

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 2 ATTACKS AND COUNTERMEASURES

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 – Countermeasures.

UNIT 3 RECONNAISSANCE

Harvester – Whois – Netcraft – 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 Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

UNIT 4 INTRUSION DETECTION

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT 5 INTRUSION PREVENTION

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 : 45 Periods

TEXT BOOKS:

- 1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021 (Unit 1)
- 2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011 (Unit 1)
- 3. <u>https://owasp.org/www-project-top-ten/</u>

REFERENCES:

- 1. David Kim, Michael G. 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. Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007 (Unit 3)
- 4. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015 (Units 4 and 5)

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e-RESOURCES:

- 1. <u>https://onlinecourses.nptel.ac.in/noc23_cs127/preview</u>, "Cyber Security and Privacy", Prof. Saji K Mathew, IIT Madras.
- <u>https://onlinecourses.swayam2.ac.in/nou19_cs08/preview</u>, "Introduction to Cyber Security", Dr. Jeetendra Pande, Uttarakhand Open University, Haldwani.

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	2	-	1	-	-	1	-	-	-	1	3	2
CO2	1	2	2	-	1	-	-	1	-	-	-	1	3	2
CO3	1	2	2	-	1	-	-	1	-	-	-	1	3	2
CO4	1	2	2	2	1	-	-	1	-	-	-	1	3	2
CO5	1	2	2	2	1	-	-	1	-	-	-	1	3	2

Mapping of COs with POs and PSOs

Pre-requisites : Web Programming, Professional Communication

Preamble: This course typically provides an introduction and sets the context for the design process. It aims to create user interfaces that are not only visually appealing but also intuitive, efficient, and enjoyable to use. The designs will be rooted in user needs and preferences, providing a seamless and engaging experience.

USER INTERFACE DESIGN

Course Outcomes: Upon completion of this course, students will be able to

- CO1 Discuss the necessity of user interaction by understanding usability engineering and user modeling.
- CO2 Explain the methodologies for designing interactive systems.
- CO3 Identify the core and complex design issues for interaction.
- CO4 Describe the evaluation methodologies of design.
- CO5 Illustrate design issues for web and mobile platforms

UNIT 1 INTRODUCTION

Context of Interaction – Ergonomics - Designing Interactive systems – Understanding Userscognition and cognitive frame works, User Centred approaches - Usability, Universal Usability - Understanding and conceptualizing interaction - Guidelines, Principles and Theories.

UNIT 2 INTERACTION DESIGN

Universal design principles, guidelines, heuristics, HCI Patterns, Design Frame Works, Design Methods, Prototyping, Understanding Interaction Styles, Direct Manipulation and Immersive Environments, Fluid Navigation, Expressive Human and Command Languages, Communication and Collaboration.

UNIT 3 DESIGN AND EVALUATION

Advancing the User Experience, Timely User Experience, Information Search, Data Visualization Evaluation Techniques- Assessing User Experience- Usability Testing – Heuristic Evaluation and Walkthroughs, Analytics Predictive Models.

UNIT 4 MODELS AND THEORIES

Cognitive Models, Socio-Organizational Issues and Stake Holder Requirements, Communication And Collaboration Models task Analysis, Dialog Notations and Design, Models of the System, Modeling Rich Interaction, Ubiquitous Computing.

UNIT 5 DESIGNING INTERACTIONS FOR WEB AND MOBILE PLATFORMS

Hypertext, Multimedia and WWW, Designing for the web Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Use Transitions-Lookup patterns-Feedback Patterns, Mobile Apps, Mobile Navigation, Content and Control Idioms, Multi-Touch Gestures, Inter-App Integration, Mobile Web.

TEXT BOOKS:

- 1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, NiklasElmqvist, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", Sixth Edition, Pearson Education, 2016.
- 2. Jenny Preece, Helen Sharp, Yvonne Rogers, "Interaction Design: Beyond Human Computer Interaction", Wiley Student Edition, 4th Edition, Wiley, 2015.
- 3. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", Third Edition, Pearson Education, 2004.



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Total: 45 Periods

REFERENCES:

- 1. Alan Cooper, Robert Reimann, David Cronin, Christopher Noessel, "About Face: The Essentials of Interaction Design", 4th Edition, Wiley, 2014.
- 2. Donald A. Norman, "Design of Everyday Things", MIT Press, 2013.
- 3. Cameron Banga, Josh Weinhold, "Essential Mobile Interaction Design: Perfecting Interface Design in Mobile Apps", Addison-Wesley Professional, 1 edition, 2014.
- 4. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O "Reilly, 2009.
- 5. Steven Hoober, Eric Berkman, "Designing Mobile Interfaces Patterns for Interaction Design", O'Reilly, 2011.

e-RESOURCES:

- 1. <u>https://onlinecourses.nptel.ac.in/noc21_ar05/preview</u>, User Interface Design, by Prof. Saptarshi Kolay, IIT Roorkee.
- 2. <u>https://www.udemy.com/course/ui-ux-web-design-using-adobe-xd/</u>, by Daniel Walter Scott

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO4	2	2	2	-	2	-	-	-	-	-	-	1	2	3
CO5	2	2	2	-	2	-	-	-	-	-	-	1	2	3

Mapping of COs with POs and PSOs

Pre-requisites : Mathematics

Preamble: This course gives fundamental knowledge on the concepts and techniques of robot manipulator, its kinematics. It also familiarizes the students on various Programming and Machine Vision application in robots. It also builds confidence among students to evaluate, choose and incorporate robots in engineering systems.

Course Outcomes: Upon completion of this course, students will be able to

- CO1 Interpret various features of robots and the technology involved in robotics.
- CO2 Apply basic engineering knowledge and laws for designing robots.
- CO3 Choose the drive and gripper of a robot suitable for an environment.
- CO4 Explain the image processing and image analysis techniques for machine vision system.
- CO5 Develop a simple program for the working of a robot.

UNIT 1 FUNDAMENTALS OF ROBOT

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications

UNIT 2 ROBOT KINEMATICS

Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices.

UNIT 3 ROBOT DRIVE SYSTEMS AND END EFFECTORS

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design considerations of a gripper.

UNIT 4 SENSORS IN ROBOTICS

Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, other algorithms, applications – Inspection, identification, visual serving and navigation.

UNIT 5 PROGRAMMING AND APPLICATIONS OF ROBOT

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TEXT BOOKS:

- 1. Mikell.P.Groover, "Industrial Robotics Technology, Programming and applications" McGraw Hill 2_{ND} edition 2017.
- 2. Ganesh.S.Hedge,"A textbook of Industrial Robotics", Lakshmi Publications, 2006

REFERENCES:

- 1. Fu K.S. Gonalz R.C. and ice C.S.G."Robotics Control, Sensing, Vision and Intelligence", McGraw Hill book co. 2007.
- 2. YoramKoren, "Robotics for Engineers", McGraw Hill Book, Co., 2002.

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Total : 45 Periods

e-RESOURCES:

- 1. <u>https://nptel.ac.in/courses/107106090</u>, "Introduction to robotics" by Dr. Krishna Vasudevan, Dr. T Asokan, Dr. Balaraman Ravindran, IIT Madras.
- 2. <u>https://onlinecourses.nptel.ac.in/noc19_me74/preview</u>, "Robotics" by Prof.Dilip Kumar Pratihar, IIT Kharagpur.

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO4	3	2	1	1	-	-	-	-	-	-	-	1	-	3
CO5	3	2	1	1	-	-	-	-	-	-	-	1	-	3

Mapping of COs with POs and PSOs

21CSE45 **BLOCKCHAIN TECHNOLOGIES AND FINTECH**

Pre-requisites : Data Structures using Python

Preamble: Blockchain is a self-sustaining, peer to peer distributed database ledger technology for managing and recording transactions with no central regulatory and ownership involvement. It is like an online bank ledger, open to both parties in a transaction. Blockchain gained increasing importance because of its relevance in facilitating a single shared version of the truth for any digital asset

Course Outcomes: Upon completion of this course, students will be able to

- Identify and explain the key benefits of block chain for a business or a network environment CO1
- CO2 Explain the components of block chain to develop a block chain system
- CO3 Design a bitcoin wallet and Develop Ethereum Virtual Machine for the given business model.
- CO4 Describe the history, importance and evolution of Fintech.
- CO5 Analyze evolving financial landscapes in the payment industry to improve payment processes, financial services, and customer experiences.

UNIT 1 GETTING STARTED WITH BLOCK CHAIN

What is Blockchain - Centralized Vs. Decentralized Systems - Layers of Blockchain - Why is Blockchain Important – Blockchain uses and Use Cases.

UNIT 2 WORKING OF BLOCK CHAIN

Blockchain foundation - Cryptography - Game Theory - Merkle Trees - Properties of Blockchain solutions - Blockchain Transactions - Distributed Consensus Mechanisms.

UNIT 3 WORKING OF BITCOIN AND ETHERIUM

Bitcoin Blockchain - The Bitcoin Network - Bitcoin Scripts - Bitcoin Wallets - Ethereum Blockchain -Transaction and Message Structure - Smart Contracts – Ethereum Virtual Machine

UNIT 4 INTRODUCTION TO 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 5 PAYMENT INDUSTRY

FinTech in Payment Industry-Multichannel digital wallets, applications supporting wallets, onboarding and KYC application, FinTech in Lending Industry- Formal lending, Informal lending, P2P lending, POS lending, Online lending, Payday lending, Microfinance, Crowd funding.

TEXT BOOKS:

- Bikramaditya Singhal, Gautam Dhameja and Priyansu Sekhar Panda, "Beginning Blockchain A 1. Beginner's Guide to Building Blockchain Solutions", Apress Publication, 2018.
- Susanne Chishti, Janos Barberis, "The FINTECH Book: The Financial Technology Handbook for 2. Investors, Entrepreneurs and Visionaries", Wiley Publications, 2016
- Swee Won Lo Yu Wang David Kuo Chuen Lee, "Blockchain and Smart Contracts: Design 3. Thinking and Programming for FinTech", Singapore University of Social Sciences - World Scientific Future Economy Series.

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Total : 45 Periods

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REFERENCES:

- 1. Manav Gupta, "Blockchain for the Enterprise: the definitive guide to adoption of blockchain in the enterprise", ISBN- 10:1999387104, 2018.
- 2. Arner D., Barbers J., Buckley R, "The evolution of FinTech: a new post crisis paradigm", University of New South Wales Research Series, 2015
- 3. Paul Moon Sub Choi, Seth H. Huang, "FinTech with Artificial Intelligence, Big Data, and Blockchain, Springer, 2021.

e-RESOURCES:

- 1. <u>https://onlinecourses.nptel.ac.in/noc22_cs44/preview</u>, "Blockchain and its Applications" by Prof. Sandip Chakraborty, Prof. Shamik Sural, IIT Kharagpur.
- 2. <u>https://www.coursera.org/specializations/financialtechnology</u>, "Financial Technology (FinTech) Innovations Specialization", Robert Dittmar, Andrew Wu, ROSS school of Business.

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	3	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	3	2	2	1	-	-	-	-	-	-	1	3	2
CO4	3	3	2	2	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

Mapping of COs with POs and PSOs

VCET, B.E-CSE, R2018 Ver. - 4, Curriculum and Syllabus

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.

Choose gaming engines suitable for an environment.

CO4 Select a suitable platform and framework to design a game.

UNIT 2 GAME DESIGN PRINCIPLES

CO5 Develop a simple game using Pygame. UNIT 1 3D GRAPHICS FOR GAME DESIGN

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.

Preamble: This course provides basic skills for conceptualizing, designing, implementing and testing the game. It majorly emphasizes on theoretical and practical approach to game design by utilizing standardized tools. The students will have a wider scope to develop their creative side and there is an

UNIT 3 GAME ENGINE DESIGN

Rendering Concept - Software Rendering - Hardware Rendering - Spatial Sorting Algorithms -Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Path finding.

UNIT 4 OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS

Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT 5 GAME DEVELOPMENT USING PYGAME

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 Game.

TEXT BOOKS:

- Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic 1. Approach", Addison Wesley, 2013
- Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to 2. Professional", Apress, 2007
- Paul Craven, "Python Arcade games", Apress Publishers, 2016 3.

REFERENCES:

- David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", 1.
- Second Edition, CRC Press, 2006
- Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011 2.

e-RESOURCES:

- https://onlinecourses.nptel.ac.in/noc19_ge32/preview, Game Theory, by K.S. Mallikarjuna Rao, 1. **IIT Bombay.**
- https://www.coursera.org/specializations/game-design-and-development, Game Design and 2. Development with Unity 2020 Specialization, Prof. Brian Winn, Michigan State University.

emphasis on using their imagination to build and enrich the gaming experience Course Outcomes: Upon completion of this course, students will be able to Explain the basic concepts of 2D and 3D Graphics for a game.

Summarize the script for preproduction, production and post – production of a game.

CO1

CO2

CO3

Pre-requisites : Java Programming

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Total : 45 Periods

Mapping of COs with POs and PSOs

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	2	2	-	-	1	1	-	I	-	2	2
CO2	2	2	3	2	2	-	-	1	1	-	-	-	2	2
CO3	2	2	3	2	2	-	-	1	1	-	-	-	2	2
CO4	2	2	3	2	2	-	-	1	1	-	-	-	2	2
CO5	2	2	3	2	2	-	-	1	1	-	-	-	2	2

VCET, B.E-CSE, R2018 Ver. - 4, Curriculum and Syllabus

21CSE47

Pre-requisites :

Preamble: The course is aimed at giving exposure to and enhancing the knowledge and skills of fresh graduate engineers and engineers involved in the operation use of 3D Scanners and 3D printing / additive manufacturing with the aid of CAD packages. It gives exposure and on hand experience in the field of CAD packages, 3D Scanner and 3D Printing.

Course Outcomes: Upon completion of this course, students will be able to

- Outline and examine the basic concepts of 3D printing technology. CO1
- CO2 Apply the skills to work with 3D printing technologies.
- Categorize the concepts and working principles of 3D printing using inkjet technique. CO3
- CO4 Explain the working principles of 3D printing using laser technique.
- CO5 Illustrate various methods for designing and modeling of industrial applications.

UNIT 1 INTRODUCTION

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats.

UNIT 2 PRINCIPLE

Processes - Extrusion, Wire, Granular, Lamination, Photo polymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations.

UNIT 3 INKJET TECHNOLOGY

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, Mulitjet; Powder based fabrication -Colour Jet.

UNIT 4 LASER TECHNOLOGY

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.

Case Study: Study 3D printer(s) including print heads, build envelope, materials used and related support removal system(s).

UNIT 5 INDUSTRIAL APPLICATIONS

Product Models, manufacturing - Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends.

TEXT BOOKS:

- Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent 1. Publishing Platform, 2013
- Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & 2. Sons, 2013
- Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second 3. edition, World Scientific Publishers, 2010

REFERENCES:

- Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007 1.
- Joan Horvath, Mastering 3D Printing, APress, 2014 2.

e-RESOURCES:

- https://archive.nptel.ac.in/courses/112/103/112103306/,"Fundamentals of Additive Manufacturing 1. Technologies", Prof. Sajan Kapil, IIT Guwahati.
- https://www.coursera.org/learn/introduction-to-3d-modeling, "Introduction to 3D Modeling", Prof. Glenn Wilcox, University of Michigan. 2.

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Total : 45 Periods

Mapping of COs with POs and PSOs

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	-	3	1	-	-	-	-	-	1	3	2
CO2	2	2	3	-	3	1	-	-	-	-	-	1	3	2
CO3	2	2	3	-	3	1	-	-	-	-	-	1	3	2
CO4	2	2	3	-	3	1	-	-	-	-	-	1	3	2
CO5	2	2	3	-	3	1	-	-	-	-	-	1	3	2

Pre-requisites : Probability and Random Processes, Linear Algebra

Preamble: In the last decade due to availability of cheap computation, several neural network approaches had been explored in order to advance the performance of many state-of-the-art visual recognition problems such as image searching, understanding, medical applications, autonomous vehicles such as drones and self-driving cars etc. All these problems relies of efficient, accurate and robust solutions for basic vision tasks such like image classification, localization and detection. In this course students will be given an exposure to the details of neural networks as well as deep learning architectures.

DEEP LEARNING

Course Outcomes: Upon completion of this course, students will be able to

- CO1 Explain the basics concepts of deep learning and various deep learning algorithms
- CO2 Illustrate the skills to optimize neural networks, prevent overfitting, and improve the performance and generalization of trained models
- CO3 Apply the knowledge about different variants of the convolution function, structured outputs, data types, and efficient algorithms for real world applications
- CO4 Apply LSTM, deep recurrent networks, recursive neural networks, and deep generative models to applications viz. natural language processing, speech recognition, machine translation, and recommendation systems.
- CO5 Demonstrate how CNNs and RNNs can be applied to various real-world scenarios

UNIT 1 FOUNDATIONS OF NEURAL NETWORK AND DEEP LEARNING

Basics of Artificial Neural Networks (ANN): Introduction to Deep Learning- Neural Network Basics-Artificial Neural Network and its layers- Computational Models of Neurons, Structure of Neural Networks, Functional Units of ANN for Pattern Recognition Tasks. Feed forward Neural Networks: Pattern Classification using Perceptron, Multilayer Feed-Forward Neural Networks (MLFFNNs), Back propagation in Feed-Forward Networks.

UNIT 2 DEEP NEURAL NETWORKS (DNNS)

Deep Neural Networks (DNNs): Difficulty of training DNNs, Greedy layer wise training, Optimization for training DNNs, Newer Optimization Methods for Neural Networks (AdaGrad, RMSProp, Adam), Second order methods for training, Regularization methods (dropout, drop connect, batch normalization).

UNIT 3 CONVOLUTIONAL NEURAL NETWORKS (CNNS)

Convolutional Neural Networks (CNNs): Introduction to CNN- Understanding Convolution and Pooling- Different Classic CNN Architectures-Variants of the Basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features - LeNet, AlexNet.

UNIT 4 RECURRENT NEURAL NETWORKS

Recurrent Neural Networks (RNNs): Sequence modeling using RNNs, Back propagation through time, Long Short Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture Deep Recurrent Networks Recursive Neural Networks. **Deep Generative Models:** Boltzmann Machines -Restrictive Boltzmann Machines (RBMs), Stacking RBMs, Application of RBM in Recommender Systems.

UNIT 5 APPLICATIONS OF DEEP LEARNING

Applications: Application of CNN in Computer Vision: Image Classification, Object Detection - Automatic Image Captioning – Image Generation with Generative Adversarial Networks – Video to Text with LSTM models – Computer - Speech Recognition - Application of RNN in NLP and Time Series Forecasting.

Total : 45 Periods

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TEXT BOOKS:

- 1. Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, Available online: http://www.deeplearningbook.org, 2017.
- 2. Nikhil Baruma, Fundamentals of Deep Learning, O'Reilly publication, 2019.
- 3. Charu C. Aggarwal. Neural Networks and Deep Learning: A Textbook. Springer. 2019.

REFERENCES:

- 1. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127.
- 2. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018

e-RESOURCES:

- 1. https://www.tensorflow.org/
- 2. <u>https://archive.nptel.ac.in/courses/106/106106184/</u>, "Deep Learning", Mitesh M Khapra, IIT Madras Ropar

Mapping of COs with POs and PSOs

COsPOs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	2	3	3	-	1	-	-	-	1	3	3
CO2	2	3	3	2	3	3	-	1	-	-	-	1	3	3
CO3	2	3	3	2	3	3	-	1	-	-	-	1	3	3
CO4	2	3	3	2	3	3	-	1	-	-	-	1	3	3
CO5	2	3	3	2	3	3	-	1	-	-	-	1	3	3

KNOWLEDGE ENGINEERING

Pre-requisites : Artificial Intelligence, Machine Learning **Preamble**

Knowledge engineering is the technology behind the creation of expert systems to assist with issues related to their programmed field of knowledge. Expert systems involve a large, expandable knowledge base integrated with a rules engine that specifies how to apply information to each particular situation.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Understand the basics of Knowledge Engineering
- CO2 Apply methodologies and modelling for Agent Design and Development
- CO3 Implementing Ontologies for design and development
- CO4 Apply reasoning with ontologies and rules in learning and development
- CO5 Understand learning and rule learning using Machine learning.

UNIT 1 REASONING UNDER UNCERTAINTY

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 2 METHODOLOGY AND MODELING

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 3 ONTOLOGIES – DESIGN AND DEVELOPMENT

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.

UNIT 4 REASONIING WITH ONTOLOGIES AND RULES

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 5 LEARNING AND RULE LEARNING

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.

TEXT BOOKS:

- Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive
- 1. Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 Chapter 1 / Unit 2 Chapter 3,4 / Unit 3 Chapter 5, 6 / Unit 4 7, Unit 5 Chapter 8, 9)

REFERENCES:

- 1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004
- 2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018
- 3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000
- 4. King, Knowledge Management and Organizational Learning, Springer, 2009

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Total : 45 Periods

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1. https://archive.nptel.ac.in/courses/106/106/106106140/

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	1	-	-	-	-	2	1	-	2
CO2	3	3	2	2	1	1	-	-	-	-	2	1	-	2
CO3	3	3	2	2	1	1	-	-	-	-	2	1	-	2
CO4	3	3	2	2	1	1	-	-	-	-	2	1	-	2
CO5	3	3	2	2	1	1	-	-	-	-	2	1	-	2

PROMPT ENGINEERING

21CSE52

Pre-requisites : AI, NLP Preamble

Primary aim of the course is to introduce learners with essentials of prompt engineering. Prompt engineering is a concept in artificial intelligence, particularly natural language processing. In prompt engineering, the description of the task that the AI is supposed to accomplish is embedded in the input, the essentials cover techniques and applications and challenges of prompt engineering core algorithms for solving basic tasks with ChatGPT.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Understand the with basic principles of prompt engineering
- CO2 Implement a techniques for prompt engineering
- CO3 Design a tag set to be used for evaluating and testing prompts.
- CO4 Use tools to creating a perfect prompt with chatGPT
- CO5 Compare and contrast the use of different applications and challenges of prompt engineering.

UNIT 1 INTRODUCTION

Introduction to Prompt Engineering- What is Prompt Engineering? - Importance of Prompt Engineering - Types of Prompts. Basic Principles of Prompt Engineering : Understanding Language Models - Data Pre-Processing - Generating Prompt.

UNIT 2 TECHNIQUES FOR PROMPT ENGINEERING

Pattern Matching - Template-Based Prompt Generation - Text Augmentation. Advanced Prompt Engineering: Transfer Learning for Prompt Engineering - Fine-Tuning Models for Specific Tasks - Adversarial Prompt Engineering

UNIT 3 EVALUATING AND TESTING PROMPTS

Metrics for Evaluating Prompts - Human Evaluation of Prompts - Testing Prompts on Different Models and Tasks. ChatGPT Prompt Engineering: Challenges & Best Practices – Standard Prompts - Role Prompting - Chain of Thoughts Prompting.

UNIT 4 CREATING A PERFECT PROMPT WITH ChatGPT

Structure - How to use word document - Using Industries - Using Tone, Voice, & Style - Mentioning Types of Customers - Using Context Background - Follow-up Prompts Structure.

UNIT 5 APPLICATIONS AND CHALLENGES OF PROMPT ENGINEERING

Knowledge Probing - Information Extraction - "Reasoning" in NLP - Meta-Applications. Challenges : Prompt Design - Selection of Tuning Strategy - 5 Selection of Pre-trained Models - 6 Theoretical and Empirical Analysis of Prompting.

TEXT BOOKS:

1. Nathan Hunter - The Art of Prompt Engineering with chatGPT: A Hands-On Guide Independently published, Pearson Publication, 2023.

REFERENCES:

- 1. Ryan Turner ChatGPT & Social Media Marketing: The Ultimate Guide to Succeeding on Social Media. Discover how Artificial Intelligence can make you the world's best Social Media Manager, Independently published, 2023.
- 2. Pengfei Liu, Weizhe Yuan, Pre-train, Prompt, and Predict: A Systematic Survey of Prompting Methods in Natural Language Processing, arXiv:2107.13586v1, 2021
- 3. Bruce Brown ,ChatGPT Prompt Engineering: PROMPTS (ver. 3a) , 2022

e-RESOURCES:

- 1. https://www.udemy.com/course/chatgpt-prompt-engineering-for-beginners/
- 2. <u>https://www.theknowledgeacademy.com/in/courses/artificial-intelligence-tools-training/chatgpt-prompt-engineering-training/</u>

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Total: 45 Periods

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	2	3	3	-	1	-	1	-	2	-	2
CO2	3	2	3	2	3	3	-	1	-	1	-	2	-	2
CO3	3	2	3	2	3	3	-	1	-	1	-	2	-	2
CO4	3	2	3	2	3	3	-	1	-	1	-	2	-	2
CO5	3	2	3	2	3	3	-	1	-	1	-	2	-	2

COMPUTER VISION

L T P C 3 0 0 3

Pre-requisites : Nil **Preamble**

The course covers some fundamental aspects and ideas of computer vision and some well-known application areas. It is a specialized course useful for graduate students or for high-level undergraduate, particularly who want to work in computer vision, image analysis, visual pattern recognition etc.

Course Outcomes: At the end of this course, the students will be able to:

- CO1 Understand basic knowledge, theories and methods in image processing and computer vision.
- CO2 Implementing basic and some advanced image processing techniques in OpenCV.
- CO3 Apply 2D feature-based image alignment by segmentation and motion estimations.
- CO4 Implementing Representation and Reconstruction by Apply 3D image reconstruction techniques
- CO5 Design and develop innovative image processing and computer vision applications.

UNIT 1 INTRODUCTION TO IMAGE FORMATION AND PROCESSING

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Global transformations.

UNIT 2 FEATURE DETECTION, MATCHING AND SEGMENTATION

Points and patches - Edges - Lines - Hough transforms- Segmentation - Active contours - Split and merge - Mean shift and mode finding - K-means and mixtures of Gaussians- Normalized cuts - Graph cuts and energy-based methods.

UNIT 3 FEATURE-BASED ALIGNMENT & MOTION ESTIMATION

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT 4 3D RECONSTRUCTION

Shape from X - Active range finding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT 5 IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

Total : 45 Periods

TEXT BOOKS:

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

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.

e-RESOURCES:

- 1. http://nptel.ac.in/
- 2. https://visiondummy.com

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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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	-	-	-	2	1	2	2	-	2
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CO4	3	3	3	2	3	-	-	-	2	1	2	2	-	2
CO5	3	3	3	2	3	-	-	-	2	1	2	2	-	2

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3	0	0	3

Pre-requisites : Nil Preamble

Primary aim of the course is to introduce learners with essentials of natural language processing. The essentials cover linguistic aspects, core algorithms for solving basic tasks, statistical and shallow machine learning models for several natural language processing tasks.

Course Outcomes: At the end of this course, the students will be able to:

- CO1 Tag a given text with basic Language features
- CO2 Implement a rule based system to tackle morphology/syntax of a language
- CO3 Design a tag set to be used for statistical processing for real-time applications.
- CO4 Compare and contrast the use of different statistical approaches for different types of NLP applications.
- CO5 Design innovative NLP applications by using tools to process natural language

UNIT 1 INTRODUCTION

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT 2 WORD LEVEL ANALYSIS

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT 3 SYNTACTIC ANALYSIS

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, DynamicProgramming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT 4 SEMANTICS AND PRAGMATICS

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT 5 DISCOURSE ANALYSIS AND LEXICAL RESOURCES

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

TEXT BOOKS:

- 1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014
- 2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First
- ^{2.} Edition, O'Reilly Media, 2009.

REFERENCES:

- 1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
- 2. Richard M Reese, —Natural Language Processing with Javal, O'Reilly Media, 2015.

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Total: 45 Periods

- 3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition,
- Chapman and Hall/CRC Press, 2010.
- 4. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

- 1. http://nptel.ac.in/
- 2. https://visiondummy.com

Mapping of COs with POs and PSOs

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CO3	3	3	2	2	2	1	-	1	-	-	-	1	1	3
CO4	3	3	2	2	2	1	-	1	-	-	-	1	1	3
CO5	3	3	2	2	2	1	-	1	-	-	-	1	1	3

COGNITIVE SCIENCE AND ANALYTICS

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3	0	0	3

Pre-requisites : Nil

Preamble

Information as representation of knowledge is the object of study of an emergent scientific field - Cognitive Science. Increasing applications in Human-centered design, the structural, functional and computational mechanisms of the brain are engaged. Understanding and predicting human behavior will help humans in exerting more control over situations. This will be useful in tackling everyday problems and attaining optimal solutions.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Understand the underlying theory behind cognition from materialism to mental Science.
- CO₂ Apply suitable Logical Representation and Reasoning to the cognition elements computationally
- Implementing mathematical functions through WebPPL by using probabilistic programming CO3 language.
- Develop applications using cognitive inference model and generative models for interactions CO4
- Develop applications using cognitive learning model to learn new things faster. CO5

UNIT 1 PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE

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 2 **COMPUTATIONAL INTELLIGENCE**

Machines and Cognition - Artificial Intelligence - Architectures of Cognition - Knowledge Based Systems -Logical Representation and Reasoning - Logical Decision Making -Learning - Language - Vision- Case Study on reasoning algorithms

PROBABILISTIC PROGRAMMING LANGUAGE UNIT 3

WebPPL Language - Syntax - Using Javascript Libraries - Manipulating probability types and distributions -Finding Inference – Exploring random computation – Co-routines: Functions that receive continuations – Enumeration- Case Study on Mathematical functions using WebPPL.

UNIT 4 INFERENCE MODELS OF COGNITION

Generative Models - Conditioning - Causal and statistical dependence - Conditional dependence - Data Analysis - Algorithms for Inference-Case Study on Conditional inference learning model and Generative Model.

LEARNING MODELS OF COGNITION UNIT 5

Learning as Conditional Inference - Learning with a Language of Thought - Hierarchical Models- Learning (Deep) Continuous Functions – Mixture Models- Case Study on hierarchical model and Mixture model.

Total : 45 Periods

TEXT BOOKS:

- Vijay V Raghavan, Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory 1. and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
- 2. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020.

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REFERENCES:

- 1. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
- 2. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences", The MIT Press, 1999.

e-RESOURCES:

- 1. https://onlinecourses.nptel.ac.in/noc20_hs29/preview, "Introduction to Cognitive Psychology", By Prof. Naveen Kashyap, IIT Guwahati.
- 2. https://onlinecourses.nptel.ac.in/noc22_ee122/preview, "Cognition and its computation", Prof. Sharba Bandyopadhyay and Prof. Rajlakshmi Guha , IIT- Kharagpur.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	-	2	1	2	-	-	-	1	1	2
CO2	3	2	2	2	-	2	1	2	-	-	-	1	1	2
CO3	3	2	2	2	-	2	1	2	-	_	-	1	1	2
CO4	3	2	2	2	-	2	1	2	-	-	-	1	1	2
CO5	3	2	2	2	-	2	1	2	-	-	-	1	1	2

Mapping of COs with POs and PSOs

UNIT 2 MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS Issues in designing a MAC Protocol - Classification of MAC Protocols - Contention based protocols -Contention based protocols with Reservation Mechanisms – Contention based protocols with Scheduling Mechanisms – Multi channel MAC – IEEE 802.11.

ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS UNIT 3 **NETWORKS**

Issues in designing a routing and Transport Layer protocol for Ad hoc networks – proactive routing, reactive routing (on - demand), hybrid routing - Classification of Transport Layer solutions - TCP over Ad hoc networks.

UNIT 4 WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS

Single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures - data relaying and aggregation strategies - MAC layer protocols: self - organizing, Hybrid TDMA/FDMA and CSMA based MAC - IEEE 802.15.4 - Case study: Wireless Sensor Network in Sustainable Agriculture.

UNIT 5 WSN ROUTING, LOCALIZATION & QOS

Issues in WSN routing - OLSR - Localization - Indoor and Sensor Network Localization - absolute and relative localization, triangulation – QOS in WSN – Energy Efficient Design – Synchronization – Transport Layer Issues - Case study: WBAN revisited.

TEXT BOOKS:

- 1. C. Siva Ram Murthy, and B. S. Manoj, "Ad hoc Wireless Networks: Architectures and Protocols", Prentice Hall Professional Technical Reference, First Edition, 2008
- Kazem Sohraby, Daniel Minoli, & TaiebZnati, "Wireless Sensor Networks-Technology, Protocols, 2. and Applications", John Wiley, 2007

Т L 21CSE61 **AD HOC AND WIRELESS SENSOR NETWORKS** 3

Pre-requisites : Computer Networks

Preamble: This course enables the student to understand the fundamental concepts of adhoc wireless sensor networking system that facilitate the erection of infrastructure less networks in unknown time and place, MAC protocol, routing and transport layer protocol design issues. This course enables the students to evaluate the QoS related performance measurements of ad hoc and sensor networks.

Course Outcomes: Upon completion of this course, students will be able to

Outline the fundamentals of wireless communication technology that facilitate the insight of infrastructure less networks formation, application and design issues of the given Ad hoc and CO1 Sensor networks

Describe the MAC Protocol designing issues and contention-based algorithms with reservation and scheduling to achieve node mobility, time synchronization, bandwidth efficiency and QoS

- CO2 support for the given Ad hoc wireless network
- Explain the issues behind the routing protocol blueprint and classification in transport layer to CO3 suit with Ad hoc Wireless Network
- Delineate the MAC layer protocols to emphasize the energy efficient operation, efficient neighbor CO4 discovery and channel assignment operations for the Wireless sensor networks
- Discuss the architecture, data handling and localization techniques to optimize the location discovery of CO5 sensor nodes for the given wireless sensor networks

UNIT 1 TUNING TO SENSOR NETWORKS FUNDAMENTALS

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the wireless channel – Mobile Ad hoc Networks (MANETs) and Wireless Sensor networks (WSNs): concepts and architectures – Applications of Ad Hoc and Sensor networks – Design Challenges in Ad hoc and Sensor Networks

Total : 45 Periods

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REFERENCES:

- 1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
- 2. Feng Zhao and LeonidesGuibas, "Wireless Sensor Networks", Elsevier Publication 2002.
- 3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005.
- 4. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

e-RESOURCES:

- 1. http://nptel/courses/video/106105160/, "Medium Access Control in Wireless Networks", Prof Sudip Misra, IIT Kharagpur.
- 2. https://nptel.ac.in/courses/106105160/, "Introduction: Wireless Ad Hoc Networks", Prof Sudip Misra, IIT Kharagpur.

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	-	1	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	1	-	-	-	-	-	1	-	-	-	1
CO3	3	2	-	1	-	-	1	-	-	2	-	-	-	2
CO4	3	2	2	1	-	-	-	-	-	-	-	2	-	1
CO5	3	2	2	1	-	-	-	1	-	-	-	2	-	2

Mapping of COs with POs and PSOs

MOBILE COMMUNICATION

Pre-requisites : Analog and Digital Data Communication / Digital Electronics /Computer Networks Preamble:

To understand the basic concepts of mobile computing.

- To learn the basics of mobile telecommunication system .
- To be familiar with the network layer protocols and Ad-Hoc networks.
- To know the basis of transport and application layer protocols.
- To gain knowledge about different mobile platforms and application development.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the basics of mobile telecommunication systems.
- CO2 Illustrate the generations of telecommunication systems in wireless networks
- CO3 Determine the functionality of MAC, network layer and Identify appropriate routing protocol for a given Ad hoc network
- CO4 Explain the functionalities and architecture of mobile Transport and Application layers
- CO5 Develop a mobile application using android/blackberry/ios/Windows SDK

UNIT 1 INTRODUCTION TO MOBILE COMMUNICATION

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies (1G,2G,3G,4G,5G)- Multiplexing – Spread spectrum - MAC Protocols – SDMA- TDMA- FDMA-OFDMA - CDMA – Massive MIMO

UNIT 2 MOBILE TELECOMMUNICATION SYSTEM

Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security- Bluetooth – Li-Fi.

UNIT 3 MOBILE NETWORK LAYER

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security

UNIT 4 MOBILE TRANSPORT AND APPLICATION LAYER

Mobile TCP-WAP - Architecture - WDP - WTLS - WTP - WSP - WAE - WTA Architecture - WML

UNIT 5 MOBILE PLATFORMS AND APPLICATIONS

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

TEXT BOOKS:

- 1. Jochen Schiller, —Mobile Communications, PHI, Second Edition, Reprint edition 2008.
- 2. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing, PHI Learning Pvt.Ltd, New Delhi 2019

REFERENCES:

- 1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2010
- 2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, —Principles of Mobile Computingl, Springer, 2006.
- 3. William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital Systems^{II}, Second Edition,TataMcGraw Hill Edition ,2006.

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Total: 45 Periods

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- 1. Android Developers : http://developer.android.com/index.html
- 2. Windows Phone DevCenter : http://developer.windowsphone.com
- 3. https://nptel.ac.in/courses/106106147
- 4. https://alison.com/course/introduction-to-mobile-and-cloud-computing-revised

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	1	1	2	-	2
CO2	3	3	-	-	-	-	-	-	-	1	1	2	-	2
CO3	3	3	2	-	-	-	-	-	-	1	1	2	-	2
CO4	3	3	2	2	2	-	-	-	-	1	1	2	-	2
CO5	3	3	2	2	2	-	-	-	-	1	1	2	3	3

Mapping of COs with POs and PSOs

Pre-requisites : Cryptography And Network Security **Preamble**

This course enables the learner to learn ethical hacking and security challenges in computer networking. Which addresses the data security issues and types of attacks includes malwares, viruses, sniffer and denial of service. It teaches wireless hacking and hacking in operating system environments. Learners also learn how to protect the network system using firewalls and filters and also about the legal, professional and ethical issues.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Classify computer based vulnerabilities and distinguish the type of security threat for given situation
- CO2 Apply appropriate foot printing and port scanning tools for a given scenario
- CO3 Use enumeration and vulnerability analysis techniques for a given scenario in different operating systems
- CO4 Describe various hacking options available in web applications in wired and wireless networks
- CO5 Illustrate Risk Analysis Tools, Honeypots for network protection

UNIT 1 INTRODUCTION

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 2 FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS

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 3 ENUMERATION AND VULNERABILITY ANALYSIS

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 4 SYSTEM HACKING

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – WardrivingWireless Hacking - Tools of the Trade

UNIT 5 NETWORK PROTECTION SYSTEMS

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.

TEXT BOOKS:

- 1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
- 2. 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.

ETHICAL HACKING

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Total : 45 Periods

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REFERENCES:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	-	-	1	-	1	2	-	1	1	2
CO2	3	2	1	1	3	-	1	-	2	1	1	1	1	2
CO3	3	2	2	1	3	-	1	-	1	2	1	1	1	2
CO4	3	1	1	2	3	-	1	-	1	2	1	1	1	2
CO5	3	3	1	1	3	-	1	-	2	1	1	1	1	1

SOFTWARE DEFINED NETWORKS

Preamble:

The course introduces software defined networks, an emerging paradigm in computer networking that allows a logically centralized software program to control the behavior of an entire network and to deal with the ever increasing network management burden created by our interconnected world. The goal of SDN is to improve

network control by enabling enterprises and service providers to respond quickly to changing business requirements.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Explain the challenges and opportunities associated with adopting SDN compared to traditional approaches of networking.
- Explain the operation of SDN to centralize network intelligence for controlling an enterprise 2. network.
- 3. Identify the pros and cons of applying SDN in WAN and data centers.
- 4. Describe techniques to enable applications for controlling the underlying network using SDN.
- 5. Describe the use of SDN for a given networking application.

EVOLUTION AND GENESIS OF SDN UNIT 1

Basic Packet-Switching Terminology- The Modern Data Center- Traditional Switch Architecture-Autonomous and Dynamic Forwarding Tables-Evolution of Switches and Control Planes-Cost-SDN Implications for Research and Innovation-Data Center Innovation-Data Center Needs-The Evolution of Networking Technology- Forerunners of SDN - Birth of Software Defined Networking 9

WORKING OF SDN UNIT 2

Sustaining SDN Interoperability- Network Virtualization-Virtual LANs - OpenFlow VLAN Support -Fundamental Characteristics of SDN- SDN Operation-SDN Devices- SDN Controller- Alternate SDN Methods.

UNIT 3 SDN IN DATA CENTER AND OTHER ENVIRONMENTS

Data Center definition and demands- Tunneling Technologies for the Data Center- Path Technologies in the Data Center-Ethernet Fabrics in the Data Center - SDN Use Cases in the Data Center - Open SDN versus Overlays in

the Data Center- Real-World Data Center- SDN in Other Environments: Wide Area Networks- Service Provider and Carrier Networks- Campus Networks.

UNIT 4 PLAYERS IN SDN ECOSYSTEM

Players in the SDN Ecosystem: Academic Research Institutions - Industry Research Labs - Network Equipment Manufacturers-Software Vendors-White-Box Switches-Merchant Silicon Vendors-Original Device Manufacturers-Enterprises-Standards Bodies and Industry Alliances.

SDN APPLICATIONS UNIT 5

SDN Applications: Reactive versus Proactive Applications-Analyzing Simple SDN Applications-A Simple Reactive Java Application-Background on Controllers-Using the Floodlight Controller- Using the Cisco XNC Controller- Switch Considerations- Creating Network Virtualization Tunnels-Offloading Flows in the Data Center-Access Control for the Campus-Traffic Engineering for Service Providers.

TOTAL : 45PERIODS

TEXT BOOKS:

- Paul Goransson and Chuck Black, -Software Defined Networks: A Comprehensive Approach, First 1. Edition, Morgan Kaufmann, 2014.
- 2. Thomas D. Nadeau, Ken Gray, -SDN: Software Defined Networks, O'Reilly Media, 2013, First Edition.

REFERENCES:

- 1. SiamakAzodolmolky, —Software Defined Networking with Open Flow, Packet Publishing, 2013.
- Vivek Tiwari, —SDN and Open Flow for Beginners, Amazon Digital Services, Inc., 2013. 2.
- 3. Fei Hu, Editor, —Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

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- 1. Website: Open Networking Foundation :http://opennetworking.org.
- 2. Website: Project Floodlight:http://www.projectfloodlight.org/floodli ght/
- 3. Website: OpenDaylight: https://www.opendaylight.org/
- 4. Website: Mininet An Instant Virtual Network on your laptop:http://mininet.org/

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

Mapping of COs with POs and PSOs

Pre-requisites : Python

Preamble: The course cyber forensics aims to reveal electronic discovery technique used to determine the technical and criminal evidence also involves electronic data storage extraction for legal purposes. **Course Outcomes:** Upon completion of this course, students will be able to

CO1 Indentify traditional problems associated with Computer Crime, Identity Theft & Identity Fraud using incident response methodology, – Forensic duplication and investigation

CYBER FORENSICS

Analyze the hardware and software computer forensics tools using acquisition, validation, CO2 extraction and reconstruction-based functionalities for preserving the computer generated

records from cyber attacks. Assess the characteristics of network forensics using knoppix tool and packet sniffers for

- CO3 analyzing data stealing malware during the cyber attack and compare the features of E-mail,
- mobile device forensics using e-mail server and sim card reader investigation for mitigating the effects of phishing and identity theft.
- CO4 Discover the available computer on the network using scanning and enumerating technology and escalating the privileges for cracking the system.
- CO5 Elaborate the vulnerabilities that affect the web server, wireless network and mobile platforms.

UNIT 1 COMPUTER CRIME

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques – Incident and incident response methodology – Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. – Forensics Technology and Systems – Understanding Computer Investigation – Data Acquisition.

UNIT 2 EVIDENCE COLLECTION AND FORENSICS TOOLS

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT 3 ANALYSIS AND VALIDATION

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

UNIT 4 ETHICAL HACKING

 $\label{eq:constraint} Introduction \ to \ Ethical \ Hacking - Foot \ printing \ and \ Reconnaissance - Scanning \ Networks - Enumeration - System \ Hacking - Malware \ Threats - Sniffing.$

UNIT 5 ETHICAL HACKING IN WEB

Social Engineering – Denial of Service – Session Hijacking – Hacking Web servers – Hacking Web Applications – SQL Injection – Hacking Wireless Networks – Hacking Mobile Platforms

Total : 45 Periods

- **TEXT BOOKS:**
 - 1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, —Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.

REFERENCES:

- 1. MarjieT.Britz, —Computer Forensics and Cyber Crime: An Introduction, 3rdEdition, Prentice Hall, 2013.
- 2. AnkitFadia Ethical Hacking Second Edition, Macmillan India Ltd, 2006.
- 3. Kenneth C.Brancik —Insider Computer Fraud Auerbach Publications Taylor & amp; Francis Group-2008.

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- 1. https://www.netacad.com/courses/security/introduction-cybersecurity.
- http://www.cse.scu.edu/~tschwarz/COEN252_09/ln.html.

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	1	1	1	-	-	-	1	-	3
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CO3	3	3	2	2	1	1	1	1	-	-	-	1	-	3
CO4	3	3	2	2	1	1	1	1	-	-	1	1	-	3
CO5	3	3	2	2	2	1	1	1	-	-	1	1	-	3

Mapping of COs with POs and PSOs

Pre-requisites : Computer Networks, Python Programming

Preamble: The purpose of this course is to impart knowledge on IoT Architecture and various protocols, study their implementations and data analytics.

Course Outcomes: Upon completion of this course, students will be able to

- CO1 Explain the concept of IoT
- CO2 Analyze various protocols for IoT
- CO3 Design a PoC of an IoT system using Rasperry Pi/Arduino
- CO4 Apply data analytics and use cloud offerings related to IoT
- CO5 Analyze applications of IoT in real time scenario

UNIT 1 FUNDAMENTALS OF IoT

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT 2 IoT PROTOCOLS

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT 3 DESIGN AND DEVELOPMENT

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.

UNIT 4 DATA ANALYTICS AND SUPPORTING SERVICES

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

UNIT 5 CASE STUDIES/INDUSTRIAL APPLICATIONS

Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

Total : 45 Periods

Page 191

TEXT BOOKS:

David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, -IoT

1. Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCES:

4.

- 2. Arshdeep Bahga, Vijay Madisetti, —Internet of Things A hands-on approach, Universities Press, 2015
- Olivier Hersent, David Boswarthick, Omar Elloumi, —The Internet of Things Key applications and Protocols, Wiley, 2012 (for Unit 2) Jan Ho⁻⁻ Iler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David

Jan Ho⁻ Iler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014

INTERNET OF THINGS

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- 5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011
- 6. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011

1. https://archive.nptel.ac.in/courses/106/105/106105166/

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	3	-	-	2	2	2	-	-	3	3
CO4	3	3	2	3	3	-	-	2	-	-	-	-	3	3
CO5	3	3	3	3	3	-	2	2	2	-	-	-	3	3

Mapping of COs with POs and PSOs

INFORMATION SECURITY

Pre-requisites :

Preamble: Information security, sometimes shortened to InfoSec, is the practice of preventing unauthorized access, use, disclosure, disruption, modification, inspection, recording or destruction of information. The information or data may take any form, e.g. electronic or physical. Information security's primary focus is the balanced protection of the confidentiality, integrity and availability of data.

Course Outcomes: Upon completion of this course, students will be able to

- Explain security principles and components in information management using security SDLC for a CO1 business Environment.
- Understand security threats and attacks and apply a security policy to overcome the threats in a given CO2Environment.
- Identify and analyze risk factors, vulnerabilities to provide a security solution for managing the CO3 risks.
- Analyze security models and frameworks and use best practices and standards to develop a security CO4 policy for an organization.
- Apply security technologies for informational protection in an organization. CO5

UNIT 1 SECURITY REQUIREMENTS AND SECURE SDLC

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 2 SECURITY INVESTIGATION

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 3 SECURITY ANALYSIS

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem.

UNIT 4 LOGICAL DESIGN

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.

UNIT 5 PHYSICAL DESIGN

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel.

TEXT BOOKS:

- Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Sixth Edition, 1. Cengage Learning, 2017.
- Nina Godbole, Information Systems Security: Security Management, Metrics, Frameworks and
- 2. Best Practices, John Wiley & Sons, 2008.

REFERENCES:

- Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol 1-3 1. CRCPress LLC, 2004.
- 2. Stuart McClure, Joel Scrambray, George Kurtz, -Hacking Exposed, Tata McGrawHill, 2003
- Matt Bishop, Computer Security Art and Science, Pearson/PHI, 2002. 3.

Total : 45 Periods

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- https://nptel.ac.in/courses/106106129, "Introduction to Information Security", Prof. V. Kamakoti, Department of Computer Science and Engineering, IIT-Madras. https://nptel.ac.in/courses/106106141, "Information Security-II", Prof. V. Kamakoti, 1.
- 2.
- Department of Computer Science and Engineering, IIT-Madras.

COsPOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	2	-	2	-	1	1	1	1	2	-	2
CO2	3	3	1	2	-	2	-	1	1	1	1	2	-	2
CO3	3	3	2	2	-	1	1	1	1	1	2	2	-	2
CO4	3	2	2	1	-	1	1	1	2	1	2	2	1	3
CO5	3	2	2	2	-	1	1	1	2	1	2	2	1	3

Mapping of COs with POs and PSOs

21CSO01

CYBER SECURITY

Preamble

Cyber security is the body of technologies, processes, and practices designed to protect networks, computers, and data from attack, damage, and unauthorized access. Cyber security teaches professionals to spot vulnerabilities, fend off attacks, and immediately respond to emergencies.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Identify the cyber criminals using Indian and global legal perspectives.
- 2. Interpret the cyber offences using the tools for active, passive attack in social engineering.
- 3. Analyze the security challenges in electronic gadgets using traditional, modern techniques and identify the threat.
- 4. Select the appropriate tools and methods used to identify the vulnerability faced by an organization.
- 5. Analyze the security standards in an organization to identify the cost and type of threats.

UNIT 1 **CYBERCRIME AND INFORMATION SECURITY**

Cybercrime and information security - Cybercriminals - Classifications of Cybercrimes - Cybercrime: The Legal Perspectives - Indian Perspective - Cybercrime and the Indian ITA 2000 - Global perspective.

UNIT 2 **CYBER OFFENSES**

Categories of Cybercrime - Attacks - Social Engineering - Cyberstalking - Cybercafe and cybercrimes- Botnet - Attack Vector.

UNIT 3 CYBERCRIME: MOBILE AND WIRELESS DEVICES

Credit card Frauds in mobile and wireless computing era - Security challenges - Authentication Service Security – Attacks on Mobile/cell phones.

TOOLS AND METHOD USED IN CYBERCRIME UNIT 4

Proxy Servers and Anonymizers - Phishing - Password Cracking - Keyloggers and Spywares - virus and worms - Trojan Horses and Backdoors - DoS and DDoS Attacks.

CYBERSECURITY ON ORGANIZATIONAL IMPLICATIONS UNIT 5

Cost of Cybercrimes and IPR issues - Web Threats for Organizations - Security and Privacy implications from cloud computing – Protecting people's privacy in the organization – Organizational guidelines for internet usage, safe computing guidelines and computer usage policy.

TEXT BOOK:

Nina Godbole, SunitBelapure, "Cyber Security" Wiley India, 1st edition copyright 2011 reprint 1. 2013.

REFERENCES:

- Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs , Jeffrey Schmidt, Joseph Weiss "Cyber 1. Security Policy Guidebook", John Wiley & Sons, 2012.
- Marjie T. Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson publication, 2. 2nd edition.
- Dan Shoemaker, "Cyber security The Essential Body Of Knowledge", First Edition, Cengage 3. Learning, 2011.

e-RESOURCES:

- http://larose.staff.ub.ac.id/files/2011/12/Cyber-Criminology-Exploring-Internet-Crimes-and-Criminal-1.
- Behavior.pdf.
- 2. https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf.

VCET, B.E-CSE, R2018 Ver. - 4, Curriculum and Syllabus

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TOTAL : 45 PERIODS

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	-	-	-	2	3	-	-	-	-	1	-	-
CO2	3	2	-	-	-	2	3	-	-	-	-	1	-	-
CO3	3	2	-	-	-	2	3	-	-	-	-	1	-	-
CO4	3	2	-	-	-	2	3	-	-	-	-	1	-	-
CO5	3	2	-	-	-	2	3	-	-	-	-	1	-	-

Mapping of COs with POs and PSOs

21CSO02

WEB DESIGNING

Preamble:

Web design refers to the writing, mark-up and coding involved in Web development, which includes Web content, Web client and scripting. This course deals with most common web programming technologies such as HTML, CSS and Java Script.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Construct a web page with essential elements using HTML5.
- 2. plain the form and canvas elements for a given web page using HTML5.
- 3. Design the web page and specify how to apply styles using CSS3.
- 4. Develop a script for a given scenario using components of JavaScript.
- 5. Exhibit the ability to design dynamic web pages with validation using JavaScript objects and event handling mechanisms.

WEBSITES BASICS, HTML 5 UNIT 1

Web Essentials: Evolution of the Internet and World Wide Web- Web Basics- Client-Side Scripting versus Server-Side Scripting- World Wide Web Consortium (W3C)-HTML5: Introduction- Editing HTML5- First HTML5 Example- Headings- Linking- Images- Special Characters and Horizontal Rules- Lists- Tables.

HTML5 - FORM ELEMENTS AND CANVAS UNIT 2

Form- Internal Linking- meta Elements- New HTML5 Form input Types- Input and data list Elements and auto complete Attribute- Page-Structure Elements- Canvas: Introduction- Coordinate System-Rectangles- Using Paths to Draw Lines- Drawing Arcs and Circles- Shadows- Linear Gradients- Radial Gradients- Images- Transformations- Text.

UNIT 3 **CASCADING STYLE SHEETS (CSS3)**

Types of CSS- Inline Styles- Embedded Style Sheets- Conflicting Styles- Linking External Style Sheets- Positioning Elements- Backgrounds- Element Dimensions- Box Model and Text Flow- Media Types and Media Queries- Drop-Down Menus- Text Shadows- Rounded Corners- Color- Box Shadows- Linear Gradients- Radial Gradients- Image Borders- Transitions and Transformations. 9

UNIT 4 **INTRODUCTION TO SCRIPTING LANGUAGE**

JavaScript: Introduction to Java script- Modifying Your First Script - Memory Concepts- Arithmetic-Decision Making-Obtaining User Input with prompt Dialogs-Control Statements- Functions- Objects. DOCUMENT OBJECT MODEL AND EVENT HANDLING **UNIT 5**

Document Object Model: Introduction- Modeling a Document: DOM Nodes and Trees- Traversing and Modifying a DOM Tree- DOM Collections- Dynamic Styles- Using a Timer and Dynamic Styles to Create Animated Effects- Event Handling: Introduction- Reviewing the load Event- Event mouse move and the event Object- Rollovers with mouse over and mouse out- Form Processing with focus and blur- More Form Processing with submit and reset- Event Bubbling- Case Study: Creation of a website using express studio.

TEXT BOOKS:

- 1. Paul Deitel, Harvey DeitelandAbbeyDeitel, "Internet and World Wide Web How to Program", 5th Edition, Pearson Publications, 2012.
- Danny Goodman, Michael Morrison, Paul Novitski, and Tia GustaffRayl, "JavaScript Bible", 7th 2. Edition, Wiley Publications, 2010.

REFERENCES:

- David Flanagan, "JavaScript The Definitive Guide", 6th Edition, O'Reilly Media Publications, 1. 2011.
- 2. cholas C. Zakas, "Professional JavaScript for Web Developer", 3rd Edition, Wrox Publications, 2012.
- Ian Lloyds, "Build your own website the Right Way Using HTML & CSS", Site point publications, 3. 2008.

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TOTAL : 45PERIODS

- 1. http://nptel.ac.in/courses/106105084/1, Internet Technologies, Prof. I. Sengupta, Department of Computer Science and Engineering, IIT Kharagpur.
- 2. p://www.w3schools.com/html/
- 3. www.liveweaver.com.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	3	2	-	2	-	-	-	I	-	-	1	-	-
CO2	-	3	2	-	2	-	-	-	I	-	-	1	-	-
CO3	-	3	2	-	2	-	-	-	-	-	-	1	-	-
CO4	-	3	2	-	2	-	-	-	-	-	-	1	-	-
CO5	-	3	2	-	2	-	-	-	-	-	-	1	-	_

Mapping of COs with POs and PSOs

21CSO03

KNOWLEDGE MANAGEMENT

Preamble

Knowledge Management addresses contemporary issues in managing knowledge, intellectual capital and other intangible assets by discussing the fundamental concepts of knowledge and its creation, acquisition, representation, dissemination, use and re-use, the role and use of knowledge in organizations and institutions, KM systems and its application in knowledge generation and transfer, and in the representation, organization, and exchange of knowledge, knowledge codification and system development, its testing, KM tools and portals, and finally ethical, managerial and legal issues in knowledge management.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Explain the evolution of knowledge management, challenges, ethical and legal issues and corporate social responsibilities of KM in organizations.
- 2. Determine the quality of organizational knowledge, knowledge sharing using knowledge market approach.
- 3. Use KM tools and portals to develop a quality knowledge bank/ repository.
- 4. Analyze KM applications to identify the key components for a successful management.
- 5. Use current trends and develop enterprise knowledge management applications for a business plan.

UNIT 1 KNOWLEDGE MANAGEMENT

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 2 CREATING THE CULTURE OF LEARNING AND KNOWLEDGE 9 SHARING

Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.

UNIT 3 KNOWLEDGE MANAGEMENT-THE TOOLS

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 4 KNOWLEDGEMANAGEMENT-APPLICATION

Components of a Knowledge Strategy - Case Studies (From Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries).

UNIT 5 FUTURE TRENDS AND CASE STUDIES

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 : 45 PERIODS

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TEXT BOOKS:

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

REFERENCES:

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

e-RESOURCES:

- 1. http://nptel.ac.in/courses/110105076/
- 2. http://study.com/academy/lesson/knowledge-management-theory-strategies.html.
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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO2	-	-	-	-	1	-	3	1	1	-	2	1	-	-
CO3	-	-	-	-	3	-	3	1	1	-	2	1	-	-
CO4	-	-	-	-	1	-	3	1	1	-	2	1	-	-
CO5	-	-	-	-	1	-	3	1	1	-	2	1	-	-

21CSO04

GREEN COMPUTING

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TOTAL : 45 PERIODS

Preamble

To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment, skill in energy saving practices in their use of hardware, examine technology tools that can reduce paper waste and carbon footprint by user, and to understand how to minimize equipment disposal reauirements.

Course Outcomes: Upon completion of the course, students will be able to:

- To realize the concept of green IT and relate it to sustainable development. 1.
- 2. Identify green assets and model them for various enterprises to save energy.
- Discuss how the choice of hardware and software can facilitate a more sustainable operation for 3 green grid framework.
- Apply various methods and tools to measure energy consumption that meet the green compliance 4. and standards.
- Realize the impact and awareness among stakeholders and promote green agenda and green 5. initiatives in their working environments leading to green movement. 9

UNIT 1 FUNDAMENTALS

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power - Green IT Strategies: Drivers, Dimensions, and Goals - Environmentally Responsible Business: Policies, Practices, and Metrics.

UNIT 2 **GREEN ASSETS AND MODELING**

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration - Green Enterprise Architecture - Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

UNIT 3 GRID FRAMEWORK

Virtualizing of IT systems - Role of electric utilities, Telecommuting, teleconferencing and teleporting -Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

GREEN COMPLIANCE UNIT 4

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

CASE STUDIES UNIT 5

The Environmentally Responsible Business Strategies (ERBS) - Case Study Scenarios for Trial Runs -Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

TEXT BOOKS:

1. BhuvanUnhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011.

2. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.

REFERENCES:

- Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM 1. rebook, 2011.
- John Lamb, "The Greening of IT", Pearson Education, 2009. 2.
- Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", 3. Lulu.com. 2008.

e-RESOURCES:

- 1. https://www.igi-global.com/journal/international-journal-green-computing/1175.
- https://www.researchgate.net/publication/325360535_Green_Computing_Current_Research_Trends. 2.

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO2	-	2	-	-	-	1	3	-	-	2	-	1	-	-
CO3	-	2	-	-	-	1	3	-	-	2	-	1	-	-
CO4	-	2	-	-	-	1	1	-	-	2	-	1	-	-
CO5	-	2	-	-	-	1	3	-	-	2	-	1	-	-

18CSO05

PRINCIPLES OF ARTIFICIAL INTELLIGENCE

Preamble:

4.

Artificial Intelligence refers to the simulation of human intelligence in machines that are programmed to think like humans. The course aims to provide the application of uninformed and informed search methods for AI problems, infer the rules using first order logic for the knowledge representation. It also gives exposure to students about Types of Learning, expert systems and applications of AI in Natural Language Processing and Robotics.

Course Outcomes: Upon completion of the course, students will be able to:

- Discuss about the development of AI characteristics and structure of agents. 1.
- 2. Apply appropriate search strategy to find an optimal solution for a given AI problem. Apply resolution procedure to derive conclusion from the given set of statements in knowledge
- representation. 3.

Discuss about supervised, unsupervised ,reinforcement learning methods and architecture of expert systems.

5. Discuss the ability of AI to solve problems in the areas of Natural Language Processing and Robotics.

UNIT 1 **OVERVIEW OF AI**

Introduction- What is AI- Goals of AI - History of AI- Intelligent Agents: Agents and Environments -Characteristics-Structure of Agents - Applications of AI.

PROBLEM SOLVING METHODS UNIT 2

Problem solving agents - Example problems - Searching for solution - Uninformed search strategies: Breadth-first search, Depth-first search- Informed search strategies: A* search - Constraint Satisfaction Problem.

UNIT 3 **KNOWLEDGE REPRESENTATION**

Knowledge Representation -Using Predicate logic:Representing simple facts-Representing instance and ISA relationships-Computable functions and predicates- Forward chaining - Backward chaining - Resolution.

UNIT 4 LEARNING AND EXPERT SYSTEMS

Learning: Supervised learning- Unsupervised learning- Reinforcement learning. Expert Systems: components of expert system-Representing using domain knowledge – Expert system shells. Case study: MYCIN. 9

AI APPLICATIONS UNIT 5

Natural Language Processing: Information Retrieval- Information Extraction-Robotics : Hardware -Perception – Moving- Robotic software architectures- Application domains.

TEXT BOOKS:

- Stuart Russel and Peter Norvig "Artificial Intelligence A Modern Approach", 3rd Edition, Pearson 1. Education 2010.
- Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", 3rd Edition, McGraw Hill-2. 2008.

REFERENCES:

- 1. Deepak Khemani, "A First Course in Artificial Intelligence", Tata Mc Graw Hill Education 2013
- Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009. 2.
- 3. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008

e-RESOURCES:

- http://nptel.ac.in/courses/106106126/1,"Introduction, State space search, Heuristic search, problem 1. decomposition, Planning, Constraint satisfaction", Prof. Deepak Khemani, Department of Computer Science and Engineering, IIT, Madras.
- http://nptel.ac.in/courses/106105077, "Introduction, knowledge representation, problem solving, 2. learning methods", Prof. Sudeshna Sarkar, Department of Computer Science and Engineering, IIT-Kharagpur.

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TOTAL : 45 PERIODS

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	1	-	1	1	-	-	-	-	1	-	-
CO2	2	3	2	1	-	1	1	-	-	-	-	1	-	-
CO3	2	3	2	1	-	1	1	-	-	-	-	1	-	-
CO4	2	3	2	1	-	1	1	-	-	-	-	1	-	-
CO5	2	3	2	1	-	1	1	-	-	-	-	1	-	-

Prerequisite:

Knowledge of basic statistics (t-test, chi-square-test, regression) and know the difference between descriptive and inferential statistics.

R Programming

Preamble:

The goal of R programming is to emphasize on the understanding of how R works, with the aim of a beginner, rather than expert, use. R is a system for statistical analyses and graphics. R is both software and a language considered as a dialect of the S language created by the AT&T Bell Laboratories. R is freely distributed under the terms of the GNU General Public License; its development and distribution are carried out by several statisticians known as the R Development Core Team.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Understand the basics of R programming and able to develop R script using GUI.
- 2. Understand the depth of exploratory data analysis and able to represent the data in charts and graphs.

Module 1 – Overview of R language

- Defining the R project
- Generating R codes, Scripts
- Text editors for R
- Graphical User Interfaces (GUIs) for R, Packages.

Module 2 – R Objects and Exploratory Data Analysis

- R Objects and data structures: Variable classes, Vectors and matrices, Data frames and lists.
- Manipulating objects in R: Mathematical operations, Decision making, loops, functions and Strings.
- Exploratory Data Analysis: Reading, creating and storing R -CSV file, Excel File.
- Graphical Representation: R-PIE chart Bar chart line graphs.

REFERENCES:

- 1. Jared P. Lander, "R for everyone", Pearson Education, 2nd Edition, 2015
- 2. Norman Matloff, "The Art of R Programming", No Starch Press, 2011.

e-Resources:

- 1. https://www.udemy.com/course/r-basics/
- 2. https://www.coursera.org/learn/r-programming/

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TOTAL: 30 PERIODS

Prerequisite:

Knowledge on Algorithms, Computer Programming, C programming, Visual Studio Code IDLE and a little conceptual insight about cloud computing and server side programming.

GO LANG

Preamble:

Go is an open source programming language that makes it easy to build simple, reliable, and efficient software. Go was originally built for programs related to networking and infrastructure. Go is expressive, concise, clean, and efficient. Its concurrency mechanisms make it easy to write programs that get the most out of multi-core and networked machines, while its novel type system enables flexible and modular program construction. Go compiles quickly to machine code yet has the convenience of garbage collection and the power of run-time reflection. It's a fast, statically typed, compiled language that feels like a dynamically typed, interpreted language. It was intended to replace popular high-performance server-side languages like Java and C++. Today, Go is used for a variety of applications like cloud and server side applications, DevOps, command line tools and much more.

Course Outcomes: Upon completion of the course, students will be able to:

1 Develop algorithm and write Go programs for a given problem statement using appropriate Go . language construct.

Module 1 – Fundamentals of Go Lang

- Environmental Setup and Installation
- Variables, Identifiers, Operators, Expressions
- Data Types
- Conditional Statements

Module 2 – Go Routines, Go Structures and Error Handling

- Functions, Go Methods struct type receiver, non struct type receiver, pointer receiver. •
- Go Routines- creation, anonymous Go Routines, multiple Go Routines, and Channels •
- Structures –defining a struct, accessing fields of struct, pointers to struct, nested struct •
- Interfaces
- Defer and Error Handling.

REFERENCES:

- 1. Nathan Youngman and Roger Peppé "Get Programming with Go"- Manning Publication, 2018
- 2. Alan A. A. Donovan and Brian Kernighan "The Go Programming Language", Addison Wesley publication, 2018

e-Resources:

- 1. https://tour.golang.org.
- 2. https://golang.org/doc/effective_go.html.
- 3. http://www.golangbootcamp.com/book/

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TOTAL : 30 PERIODS

Prerequisite:

Knowledge of Object Oriented Programming Concepts, Java Script.

Preamble:

Type Script is an open-source pure object-oriented programming language developed and maintained by Microsoft under the Apache 2 license. TypeScript extends JavaScript by adding data types, classes, and other object-oriented features with type-checking. It is a typed superset of JavaScript that compiles to plain Java Script. This course aims to impart knowledge about the implementation of TypeScript among the student community.

Course Outcomes: Upon completion of the course, students will be able to:

Know about typescript and benefits of typescript over other scripting languages. 1.

Type Script

2. Create generics with typescript.

Module 1 – Introduction to TypeScript

Getting to Know TypeScript - Typescript's Type System - Components - Setup the Environment -Basic Data Types -Type Inference -Type Casting -Difference between let and var -Const Declaration-Arrow Functions. 20

Module 2 – Implementation of TypeScript

Classes-Type casting- Type Assertion -Static Properties-Interface Implementation by class-Array Destructuring -Object Destructuring -Mixed Destructuring-Generic Classes-Modules.

TOTAL : 30 PERIODS

REFERENCES:

- 1. Dan Vanderkam, "Effective TypeScript" O'Reilly Media; 1st edition, 2019.
- 2. Remo H. Jansen, "Learning TypeScript" Packt Publishing; 1st edition 2015.

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LTPC 0 0 21

A Raspberry Pi is a credit-card sized computer that can be used when a typ robotics or with embedded systems. It's a great learning tool, and since it with input/output, storage, and WiFi capabilities, it can be used to inter This course aims to impart knowledge about the implementation and use community.	pical PC is overkill, such as in 's a fully functional computer face and control other things. of Raspberry Pi to the student
Course Outcomes: Upon completion of the course, students will be able t	0:
1. Build projects with Raspberry Pi	
Module 1 – Architecture and Booting up of RPi	10
Introduction and comparison of Raspberry Pi models	
• Understanding SoC architecture and SoCs used in Raspberry Pi	
Pin Description of Raspberry Pi	
Raspbian O.S Tools like Leafpad Editor	
Installing Raspbian on Pi	
• First boot and Basic Configuration of Pi	
Module 2 – Working with RPi, IoT design and Applications using RP	i 20
Working with RPi using Python	
Imbibing RPi with C	
LAMP Web-server	
GPIO Control over Web Browser	
Creating Custom Web Page for LAMP	
Communicating data using on-board module	

- Node RED, MQTT Protocol
- Using Node-RED Visual Editor on RPi

TOTAL : 30 PERIODS

REFERENCES:

1. Simon Monk, "Raspberry Pi Cookbook: Software and hardware problems and solutions", OReilly Publications, 2013.

2. 'The official raspberry Pi Projects Book' – from the makers of the official Raspberry Pi magazine.

e-Resources:

- 1. https://www.raspberrypi.org/
- 2. https://opensource.com/resources/raspberry-pi
- 3. https://tutorials-raspberrypi.com/

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18CSV04

Prerequisite:

Preamble:

Raspberry Pi

C programming, Python Programming and Object Oriented Programming

18CSV05 Practical Machine Learning with TensorFlow

Prerequisite:

Programming in Python, Data Mining or Machine Learning or Data Science

Preamble:

Machine learning often requires heavy computation and for that Tensor flow was developed as an open source library. Tensor flow not only does the heavy computation but can also build data flows. Apart from machine learning, it is also used in wide variety of other domains by the experts. This course contains different topics to make you understand everything about next-generation machine learning by Tensor flow. It includes all the basics of Tensor flow with detail description of tensors, operators and variables. Installation of Tensor flow on Windows, Mac and Linux is clearly shown. Additionally, it gives insights into the basics of machine learning and its types. This course also covers various algorithms like linear regression, logistic regression, NN regression, K-Means algorithm and others. Herein, advanced machine learning is also well elaborated with the topics of neural networks, convolution neural networks, recurrent neural networks and so on.

Course Outcomes: Upon completion of the course, students will be able to:

1 Able to work with ML algorithms with tensorflow

Module 1 – Fundamentals of Tensors

- Getting started with Tensor flow
- Overview of Machine Learning
- Data Input and Preprocessing with Tensor flow
- Machine Learning Model Building

Module 2 – Neural Networks & Model Training

- Prediction with Tensorflow
- Monitoring and evaluating models using Tensorboard
- Advance Tensorflow (Building custom models CNNs, Scaling up for large datasets)
- Distributed training with hardware accelerators

REFERENCES:

 Nishant Shukla, Kenneth Fricklas, "Machine Learning with TensorFlow", Manning Publications, January 2018

e-Resources:

1. <u>https://nptel.ac.in/courses/106/106/106106213/#</u> "Practical Machine Learning with TensorFlow" by Prof. Balaraman Ravindran and Mr. Ashish Tendulkar

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TOTAL : 30 PERIODS

Prerequisite:

Knowledge on Computer Programming, Microsoft Excel, Tables, Data modeling and have little knowledge of DAX (Data Analysis expressions) language.

Preamble:

Microsoft Power BI is a business intelligence and analytics platform consisting of applications and services designed to provide coherent visual and interactive insights into data. This course covers the installation and configuration of the primary tools and services that BI professionals utilize to design and develop Power BI content, including Power BI Desktop, the On-Premises Data Gateway and the Power BI Publisher for Excel.

Course Outcomes: Upon completion of the course, students will be able to:

1. Design a Power BI dashboard for a given business model and publish the reports in dashboard.

Module 1 – Fundamentals of Power BI

- Power BI architecture and Data Access.
- Power BI Desktop installation. •
- Integrating Power BI and Data Source. .
- Creating Visuals for Excel Tables. •

Module 2 – Implementation, Publishing and sharing of Power BI desktop 20 Visualization

- Hands-on with Creating Visualizations in Power BI .
- DAX concept
- Embedding business definitions to DAX Measures •
- **Creating Power BI Dashboard** •
- Setting up scheduled refreshes and security •
- Publishing Power BI report .

REFERENCES:

- 1. Brett Powell "Microsoft Power BI Cookbook: Creating Business Intelligence Solutions of Analytical Data Models, Reports, and Dashboard", Packt Publishing, 2017.
- 2. Philip Seamark "Beginning DAX with Power BI: The SQL Pro's Guide to Better Business Intelligence", Apress Publishing, 2018

e-Resources:

- 1. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0130944302595522562323_shared/ overview
- 2. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0130944169681960962022_shared/ overview
- 3. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0130944354379038722546_shared/ overview

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TOTAL: 30 PERIODS

the needs of any firm while keeping the risks under control.

UNIT 1 INTRODUCTION TO FINANCIAL MANGEMENT

Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts.

FINANCIAL MANAGEMENT

UNIT 2 SOURCES OF FINANCE

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 3 INVESTMENT DECISIONS

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 4 FINANCING AND DIVIDEND DECISION

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 5 WORKING CAPITAL DECISION

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.

TEXT BOOKS:

- M.Y. Khan and P.K.Jain Financial management, Text, Tata McGraw Hill. 1.
- 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, Theory and Practice, McGraw Hill, 10th Edition.
- 3. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011

e-RESOURCES:

- https://onlinecourses.nptel.ac.in/noc20_mg31/preview 1.
- 2. https://emeritus.org/in/learn/what-is-financial-management/

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Acquire the knowledge of the decision areas in finance.
- CO2 Learn the various sources of Finance
- CO3 Describe about capital budgeting and cost of capital.
- CO4 Discuss on how to construct a robust capital structure and dividend policy
- Develop an understanding of tools on Working Capital Management. CO5

Preamble

Pre-requisites : -

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Total : 45 Periods

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	2	-	1	-	-	-	-	3	1	-	-
CO2	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	3	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	2	1	-	1	-	-	3	1	-	-

21ITM12

Pre-requisites : -Preamble

The main aim of this course is to introduce the quantitative techniques that apply to investment valuation and management.

UNIT 1 THE INVESTMENT ENVIRONMENT

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 2 FIXED INCOME SECURITIES

Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

UNIT 3 APPROACHES TO EQUITY ANALYSIS

Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

UNIT 4 PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES

Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India.

UNIT 5 INVESTOR PROTECTION

Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness and activism.

Total : 45 Periods

TEXT BOOKS:

- 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.

REFERENCES:

- 1. Rustagi, R. P. Investment Management Theory and Practice. Sultan Chand & Sons, 2021.
- 2. ZviBodie, Alex Kane, Alan J Marcus, PitabusMohanty, Investments, McGraw Hill Education (India), 11 Edition(SIE), 2019

e-RESOURCES:

- 1. https://onlinecourses.nptel.ac.in/noc23_mg62/preview
- 2. https://www.coursera.org/learn/investing-fundamentals

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Describe the investment environment in which investment decisions are taken.
- CO2 Explain how to Value bonds and equities
- CO3 Explain the various approaches to value securities
- CO4 Describe how to create efficient portfolios through diversification
- CO5 Discuss the mechanism of investor protection in India.

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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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	-	3	-	1	-	-	-	-	3	1	-	-
CO2	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	2	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	-	1	-	1	-	-	3	1	-	-

21ITM13 BANKING, FINANCIAL SERVICES AND INSURANCE L I P

Pre-requisites :-Preamble

The main aim of this course is to train the students in various aspects related to banking and its allied areas. Make to understand the objective of preparation of financial statements to the users of financial statements. It includes accounting of Banking, Insurance companies.

UNIT 1 INTRODUCTION TO INDIAN BANKING SYSTEM

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 2 MANAGING BANK FUNDS / PRODUCTS

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 3 DEVELOPMENTIN BANKING TECHNOLOGY

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 4 FINANCIAL SERVICES

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 5 INSURANCE

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 : 45 Periods

TEXT BOOKS:

- 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
- ^{2.} Management", PHI Learning Pvt. Ltd., New Delhi 2010.

REFERENCES:

1. Peter S. Rose and Sylvia C. and Hudgins, "Bank Management and Financial Services", Tata McGraw Hill, New Delhi, 2017

e-RESOURCES:

- 1. https://onlinecourses.swayam2.ac.in/cec20_mg08/preview
- 2. https://www.coursera.org/courses?query=banking

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the Banking system in India
- CO2 Grasp how banks raise their sources and how they deploy it
- CO3 Discuss the development in banking technology
- CO4 Utilize the financial services in India
- CO5 Know the insurance Industry in India

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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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	2	-	1	-	-	-	-	3	1	-	-
CO2	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	3	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	-	1	-	1	-	-	3	1	-	-

21ITM14 INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS $\begin{array}{ccc} L & T & P & C \\ 4 & 0 & 0 & 3 \end{array}$

Pre-requisites : -Preamble

Blockchain is a self-sustaining, peer to peer distributed database ledger technology for managing and recording transactions with no central regulatory and ownership involvement. It is like an online bank ledger, open to both parties in a transaction. Blockchain gained increasing importance because of its relevance in facilitating a single shared version of the truth for any digital asset.

UNIT 1 INTRODUCTION TO BLOCKCHAIN

Blockchain: 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 2 INTRODUCTION TO CRYPTOCURRENCY

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 3 ETHEREUM

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 4 WEB3 AND HYPERLEDGE

Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.

UNIT 5 EMERGING TRENDS

Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools.

Total : 45 Periods

TEXT BOOKS:

- Imran. Bashir. Mastering block chain: Distributed Ledger Technology, Decentralization, and
- 1. Smart Contracts Explained. Packt Publishing, 2nd Edition, 2018
- 2. Peter Borovykh, Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018.
- 3. ArshdeepBahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", VPT, 2017.

REFERENCES:

- 1. Andreas M. Antonopoulos ," Mastering Bitcoin Programming the Open Blockchain", O"Reilly Publication,2017
- 2. William Mougayar, "The Business Blockchain: Promise, Practice, and Application of the Next
- ^{2.} Internet Technology", Wiley Edition, 2016

e-RESOURCES:

- 1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
- 2. https://onlinecourses.nptel.ac.in/noc20_cs01/preview

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Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Identify and explain the key benefits of block chain for a business or a network environment.
- CO2 Articulate the core components of Bitcoin Network with the necessary scriplets and Design a Bitcoin Wallet.
- CO3 Describe Ethereum Eco system, Ethereum Virtual Machine and Encoding schemes and Develop a private network for a given business model.
- CO4 Explain the WEB3 and Hyperledge
- CO5 Investigate the given business model and critique the strengths and flaws of block chain implementation.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	2	-	1	-	-	-	-	3	1	-	-
CO2	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	3	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	2	1	-	1	-	-	3	1	-	-

Mapping of COs with POs and PSOs

L 21**ITM15** FINTECH PERSONAL FINANCE AND PAYMENTS 4

Pre-requisites : -Preamble

The main aim of this course is to introduce the fundamental building blocks of financial technologies and explore the disruptive force of changing payment methods, analyze the changing regulatory landscape, and gain a deeper understanding of Crypto currency, Bitcoin, InsurTech, crowdfunding, peer-to-peer lending.

UNIT 1 CURRENCY EXCHANGE AND PAYMENT

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 2 DIGITAL FINANCE AND ALTERNATIVE FINANCE

A Brief History of Financial Innovation, Digitization of Financial Services, Crowd funding, Charity and Equity,. Introduction to the concept of Initial Coin Offering.

UNIT 3 INSURETECH

InsurTech Introduction, Business model disruption AI/ML in InsurTech • IoT and InsurTech ,Risk Modeling ,Fraud Detection Processing claims and Underwriting Innovations in Insurance Services.

UNIT 4 PEER TO PEER LENDING

P2P and Marketplace Lending, New Models and New Products in market place lending P2P Infrastructure and technologies, Concept of Crowdfunding, Crowdfunding Architecture and Technology, P2P and Crowdfunding unicorns and business models, SME/MSME Lending: Unique opportunities and Challenges, Solutions and Innovations.

UNIT 5 REGULATORY ISSUES

FinTech Regulations: Global Regulations and Domestic Regulations, Evolution of RegTech, RegTech Ecosystem: Financial Institutions, RegTech Ecosystem: Startups RegTech, Startups: Challenges, RegTech Ecosystem: Regulators, Use of AI in regulation and Fraud detection.

Total : 45 Periods

TEXT BOOKS:

- Swanson Seth, Fintech for Beginners: Understanding and Utilizing the power of technology, 1 Createspace Independent Publishing Platform, 2016.
- Models AuTanda, Fintech Bigtech And Banks Digitalization and Its Impact On Banking Business, 2. Springer, 2019

REFERENCES:

- Henning Diedrich, Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized 1. Autonomous Organizations, Wildfire Publishing, 2016
- Jacob William, FinTech: TheBeginner's Guide to Financial Technology, Createspace Independent 2. Publishing Platform, 2016
- IIBF, Digital Banking, Taxmann Publication, 2016 3.
- Jacob William, Financial Technology, Create space Independent Pub, 2016 4.
- LukeSutton,FinancialTechnology:Bitcoin&Blockchain,CreatespaceIndependentPub,2016 5.

e-RESOURCES:

- https://onlinecourses.nptel.ac.in/noc22_mg20/preview 1.
- 2. https://www.coursera.org/specializations/wharton-fintech



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Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the currency exchange and payment
- CO2 Identify the digital finance and alternative finance
- CO3 Describe the InsurTech
- CO4 Identify the Peer to Peer lending
- CO5 Discuss the FinTech -regulatory issues

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	2	-	1	-	-	-	-	3	1	-	-
CO2	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	3	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	-	1	-	1	-	-	3	1	-	-

21ITM16

Pre-requisites : -Preamble

The main aim of this course is to set the stage for understanding the FinTech landscape and ecosystem and grappling with the potential direction of future change. Business and regulatory implications of technology for the financial industry and How new technology impacts economies, markets, companies and individuals

UNIT 1 INTRODUCTION

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 2 PAYMENT INDUSTRY

FinTech in Payment Industry-Multichannel digital wallets, applications supporting wallets, onboarding and KYC application, FinTech in Lending Industry- Formal lending, Informal lending, P2P lending, POS lending, Online lending, Payday lending, Microfinance, Crowdfunding.

UNIT 3 INSURANCE INDUSTRY

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 4 FINTECH AROUND THE GLOBE

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 5 FUTURE OF FINTECH

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.

TEXT BOOKS:

- 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

REFERENCES:

- 1. Richard Hayen, FinTech: The Impact and Influence of Financial Technology on Banking and the Finance Industry, 2016
- 2. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018
- 3. Sanjay Phadke, Fintech Future : The Digital DNA of Finance Paperback .Sage Publications, 2020
- 4. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services Paperback, 2018

e-RESOURCES:

- 1. https://www.edx.org/course/introduction-to-fintech
- 2. https://nptel.ac.in/courses/110105121

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Total : 45 Periods

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Learn about history, importance and evolution of Fintech
- CO2 Acquire the knowledge of Fintech in payment industry
- CO3 Acquire the knowledge of Fintech in insurance industry
- CO4 Learn the Fintech developments around the world
- CO5 Know about the future of Fintech

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO2	2	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	3	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	2	1	-	1	-	-	3	1	-	-

21MEM21

FOUNDATIONS OF ENTREPRENEURSHIP

LTPC 3 0 0 3

Course Outcomes: Upon completion of the course, students will be able to:

- Learn the basics of Entrepreneurship 1.
- 2. Understand the business ownership patterns and environment
- 3. Understand the Job opportunities in Industries relating to Technopreneurship
- Learn about applications of technopreneurship and successful technopreneurs 4.
- Acquaint with the recent and emerging trends in entrepreneurship 5.

INTRODUCTION TO ENTREPRENEURSHIP UNIT 1

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. 9

BUSINESS OWNERSHIP & ENVRIONMENT UNIT 2

Types of Business Ownership - BusinessEnvironmental Factors - Political-Economic-Sociological-Technological-Environmental-Legal aspects - Human Resources Mobilisation-Basics of Managing Finance-Essentials of Marketing Management - Production and Operations Planning - Systems Management and Administration

UNIT 3 FUNDAMENTALS OF TECHNOPRENEURSHIP

Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society - Economy- Job Opportunities in Technopreneurship - Recent trends

APPLICATIONS OF TECHNOPRENEURSHIP UNIT 4

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 5 **EMERGING TRENDS IN ENTREPRENEURSHIP**

Effective Business Management Strategies For Franchising - Sub-Contracting- Leasing- Technopreneurs -Agripreneurs - Netpreneurs-Portfolio entrepreneurship - NGO Entrepreneurship _ Recent EntrepreneurialDevelopments - Local - National - Global perspectives

TEXT BOOKS:

- S.S.Khanka, "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 2021. 1.
- 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
- Edward Elgar. 2007. Entrepreneurship, Cooperation and the Firm: The Emergence and Survival of 2. High- Technology Ventures in Europe. Edi: Jan Ulijn, Dominique Drillon, and Frank Lasch. Wiley Pub.
- Lang, J. 2002, The High Tech Entrepreneur's Handbook, Ft.com 3.
- 4. David Sheff 2002, China Dawn: The Story of a Technology and Business Revolution,
- 5. HarperBusiness, https://fanny.staff.uns.ac.id/files/2013/12/Technopreneur-BASED-EDUCATION-REVOLUTION.pdf
- JumpStart: A Technoprenuership Fable, Dennis Posadas, (Singapore: Pearson Prentice Hall, 2009 6.

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TOTAL: 45 PERIODS

21MEM22 TEAM BUILDING AND LEADERSHIP MANAGEMENT FOR LTPC 3 0 0 3 **BUSINESS**

Course Outcomes: Upon completion of the course, students will be able to:

- Learn the basics of managing teams for business. 1.
- 2. Understand developing effective teams for business management.
- 3. Understand the fundamentals of leadership for running a business.
- Learn about the importance of leadership for business development 4.
- 5. Acquaint with emerging trends in leadership effectiveness for entrepreneurs.

INTRODUCTION TO MANAGING TEAMS UNIT 1

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.

MANAGING AND DEVELOPING EFFECTIVE TEAMS UNIT 2

Team-based Organisations- Leadershp 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 3 **INTRODUCTION TO LEADERSHIP**

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 4 LEADERSHIP IN ORGANISATIONS

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 5 LEADERSHIP EFFECTIVENESS

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: 45 PERIODS

REFERENCES:

- Hughes, R.L., Ginnett, R.C., & Curphy, G.J., Leadership: Enhancing the lessons of experience, 1. 9th Ed, McGraw Hill Education, Chennai, India. (2019).
- Katzenback, J.R., Smith, D.K., The Wisdom of Teams: Creating the High Performance 2. Organisations, Harvard Business Review Press, (2015).
- 3. Haldar, 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).

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21MEM23 CREATIVITY & INNOVATION IN ENTREPRENEURSHIP

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Learn the basics of creativity for developing Entrepreneurship
- 2. Understand the importance of creative intelligence for business growth
- 3. Understand the advances through Innovation in Industries
- 4. Learn about applications of innovation in building successful ventures
- 5. Acquaint with developing innovative business models to run the business efficiently and effectively

UNIT 1 CREATIVITY

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 2 CREATIVE INTELLIGENCE

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 3 INNOVATION

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 4 INNOVATION AND ENTREPRENEURSHIP

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 5 INNOVATIVE BUSINESS MODELS

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: 45 PERIODS

REFERENCES:

- 1. Creativity and Innovation in Entrepreneurship, Kankha, Sultan Chand
- 2. Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata Mc Graw 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. Dale Timpe, Creativity, Jaico Publishing House, 2003.
- 7. Brian Clegg, Paul Birch, Creativity, Kogan Page, 2009.
- 8. Strategic Innovation: Building and Sustaining Innovative Organizations- Course Era, Raj Echambadi.

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INTRODUCTION TO MARKETING MANAGEMENT

5. Comprehend the contemporary marketing scenarios and offer solutions to marketing issues

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. 9

MARKETING ENVIRONMENT UNIT 2

Understand the marketing environment

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 3 PRODUCT AND PRICING MANAGEMENT

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 4 PROMOTION AND DISTRIBTUION MANAGEMENT

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

CONTEMPORARY ISSUES IN MARKETING MANAGEMENT UNIT 5

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

REFERENCES:

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4.

UNIT 1

- Marketing Management, Sherlekar S.A, Himalaya Publishing House, 2016. 1.
- 2. Marketing Management, Philip Kortler and Kevin Lane Keller, PHI 15th Ed, 2015
- Marketing Management- An Indian perspective, Vijay Prakash Anand, Biztantra, Second edition, 3. 2016.
- 4. Marketing Management Global Perspective, Indian Context, V.S.Ramaswamy &S.Namakumari, Macmillan Publishers India,5th edition, 2015
- 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.

PRINCIPLES OF MARKETING MANAGEMENT FOR BUSINESS

Course Outcomes: Upon completion of the course, students will be able to:

Knowledge of promotion and distribution in marketing management.

the awareness of marketing management process

Acquaint about product and pricing strategies



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TOTAL: 45 PERIODS

21MEM25 HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS

Course Outcomes: Upon completion of the course, students will be able to:

- 1. To understand the Evolution of HRM and Challenges faced by HR Managers
- 2. To learn about the HR Planning Methods and practices
- 3. To acquaint about the Recruitment and Selection Techniques followed in Industries
- 4. To known about the methods of Training and Employee Development.
- 5. To comprehend the techniques of controlling human resources in organisations

UNIT 1 INTRODUCTION TO HRM

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 2 HUMAN RESOURCE PLANNING

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 3 RECRUITMENT AND SELECTION

Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.

UNIT 4 TRAINING AND EMPLOYEE DEVELOPMENT

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 5 CONTROLLING HUMAN RESOURCES

Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends

TOTAL: 45 PERIODS

REFERENCES:

- 1. Gary Dessler and Biju Varkkey, 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.
- 7. K. Aswathappa, Sadhna Dash, Human Resource Management Text and Cases, 9th Edition, McGraw Hill, 2021.
- 8. Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford. 2012

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21MEM26

FINANCING NEW BUSINESS VENTURES

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Course Outcomes: Upon completion of the course, students will be able to:

- Learn the basics of starting a new business venture 1.
- Understand the basics of venture financing. 2.
- Understand the sources of debt financing. 3.
- 4. Understand the sources of equity financing.
- Acquaint with the methods of fund raising for new business ventures. 5.

ESSENTIALS OF NEW BUSINES VENTURE UNIT 1

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.

INTRODUCTION TO VENTURE FINANCING UNIT 2

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 Dent and Equity - Challenges and Opportunities.

UNIT 3 SOURCES OF DEBT FINANCING

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. 9

UNIT 4 SOURCES OF EQUITY FINANCING

Own Capital, Unsecured Loan - Government Subsidies, Margin Money- Equity Funding - Private Equity Fund- Schemes of Commercial banks - Angel Funding - Crowdfunding- Venture Capital.

UNIT 5 **METHODS OF FUND RAISING FOR NEW VENTURES**

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

REFERENCES:

- Principles of Corporate Finance by Brealey and Myers et al., 12TH ed, McGraw Hill Education (India) 1. Private Limited, 2018
- 2. Prasanna Chandra, Projects : Planning , Analysis, Selection , Financing, Implementation and Review, McGraw Hilld Education India Pvt Ltd ,New Delhi , 2019.
- Introduction to Project Finance. Andrew Fight, Butterworth-Heinemann, 2006. 3.

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TOTAL: 45 PERIODS

21ECM31	PRINCIPLES OF PUBLIC ADMINISTRATION	L 3	Т 0	Р 0	C 3
UNIT 1				9)
Meaning, Nature and Scop Public Administration	e of Public Administration - Importance of Public Administration	1 - Ev	volut	ion (of
UNIT 2 New Public Administration	n - New Public Management - Public and Private Administration			9)
UNIT 3 Relationships with Politica Approach	al Science, History and Sociology - Classical Approach - Scientif	ic M	anag	9 eme) nt
UNIT 4				9)
Bureaucratic Approach: M Riggs	lax Weber - Human Relations Approach : Elton Mayo - Ecologi	cal A	Appro	oach	ι:
UNIT 5					9
Leadership: Leadership - Barriers - Decision Making	Styles - Approaches - Communication: Communication Typ g: Decision Making - Types, Techniques and Processes.	es -	Pro	cess	-
	TOTAL	: 45]	PER	IOD	S
REFERENCES:					
1. Avasthi and Mah	neswari: Public Administration in India, Agra:LakshmiNarain Ag	arwa	1,201	13	

- 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.

21EC	M32 CONSTITUTION OF INDIA	L 3	I	Т 0	Р 0	С 3
UNIT	1					9
Consti	itutional Development Since 1909 to 1947 - Making of the Constitution -	- Constituent	A	ssen	nbly	,
UNIT Funda	2 mental Rights - Fundamental Duties - Directive Principles of State Polic	у				9
UNIT	3					9
Presid	ent – Parliament - Supreme Court					
UNIT	4					9
Gover	nor - State Legislature - High Court					
UNIT	5					9
Secula	arism - Social Justice - Minority Safeguards					
DFFF	DENCES.	TOTAL :	45	PE	RIC	DDS
1	Basy DD: Introduction to Indian Constitution: Prentice Hall: New Del'	hi				
2	Kenner A. C. Ledier Communitient and Delitical Sectors 2.01 - 1.0		т.	P	- 11- '	
2.	Kapur. A.C. Indian Government and Political System; S.Chand and Con	npany Ltd., I	Nev	V D	eini.	•
3.	Kapur. A.C: Indian Government and Political System; S.Chand and Con	npany Ltd., I	Nev	v Do	elhi.	

4. Agarwal R.C: Indian Political System; S.Chand& Co., New Delhi

21EC	M33 PUBLIC PERSONNEL ADMINISTRATION	L 3	Т 0	Р 0	C 3
UNIT	1				9
Mean Burea	ng - Scope and Importance of Personnel Administration - Types of Perucratic - Democratic and Representative systems.	sonr	nel S	Syste	ms:
UNIT Gener Admi	2 alist Vs. Specialist - Civil Servants' Relationship with Political Executiv nistration.	e -	Inte	grity	9 in
UNIT Recru Promo	3 itment: Direct Recruitment and Recruitment from Within - Training: Kind otion	ls o	f Tr	ainin	9 Ig -
UNIT	4				9
All In	dia Services - Service Conditions - State Public Service Commission				
UNIT	5				9
Emplo	over Employee Relations - Wage and Salary Administration - Allowances and Be	enefit	S		
	ΤΟΤΑ	L:4	5 PE	ERIC	DS
REF	CRENCES:				
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.
- 7. Davar R.S. Personnel Management & Industrial Relations

Mod	ern: Process and techniques of decision-making
UNI	Г 5
Adm	inistrative thinkers: Kautilya, Woodrow Willson, C.I. Barnard . Peter Drucker
	ΤΟΤΑ
REF 1.	ERENCES: Crozior M : The Bureaucratic phenomenon (Chand)
2.	Blau. P.M and Scott. W : Formal Organizations (RKP)
3.	Presthus. R : The Organizational Society (MAC)

Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a

Motivation Theories, content, process and contemporary; Theories of Leadership: Traditional and

Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory

- 4. Alvi, Shum Sun Nisa : Eminent Administrative Thinkers.
- 5. Keith Davis : Organization Theory (MAC)

discipline and Identity of Public Administration

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UNIT 1

UNIT 2

UNIT 3

UNIT 4

ADMINISTRATIVE THEORIES

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9 Organization goals and Behavior, Groups in organization and group dynamics, Organizational Design.

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AL: 45 PERIODS

21ECM35INDIAN ADMINISTRATIVE SYSTEMLT30	Р 0	C 3
UNIT 1 Evolution and Constitutional Context of Indian Administration, Constitutional Authorities Commission, Union Public Services Commission, Election Commission, Comptroller and General of India, Attorney General of India	Fina Aud	9 Ince litor
UNIT 2 Role & Functions of the District Collector, Relationship between the District Collector and Superintendent of Police, Role of Block Development Officer in development programmes, Loca Government	9 1	9
UNIT 3 Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Cons Amendment Act 1992	stitutic	9 onal
UNIT 4	(9
Coalition politics in India, Integrity and Vigilance in Indian Administration		
UNIT 5		9
Corruption – Ombudsman, Lok Pal &LokAyuktha		
TOTAL : 45 P REFERENCES: 1. S.R. Maheswari : Indian Administration 2. Khera. S.S : Administration in India	ERIO	DS

Ramesh K. Arora : Indian Public Administration 3.

- 4. T.N. Chaturvedi : State administration in India
- 5. Basu, D.D : Introduction to the Constitution of India

21ECM36	PUBLIC POLICY ADMINISTRATION	L 3	Т 0	Р 0	C 3
UNIT 1					9
Meaning and Definition or relationship with social sc	of Public Policy - Nature, Scope and Importance of public ences especially with political science and Public Adm	ic policy – inistration	Publ	ic po	olicy
UNIT 2 Approaches in Policy Ana – Dror's Optimal Model	alysis - Institutional Approach – Incremental Approach a	and System	's Ap	proa	9 Ich
UNIT 3 Major stages involved in Evaluation.	Policy making Process – Policy Formulation – Policy	Implement	ation	– Pc	9 olicy
UNIT 4					9
Institutional Framework of Political Parties	of Policy making – Role of Bureaucracy – Role of Inte	erest Group	s and	l Rol	e of
UNIT 5					9

Introduction to the following Public Policies – New Economic Policy – Population Policy – Agriculture policy - Information Technology Policy.

TOTAL : 45 PERIODS

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.

21CSM41

Course Outcomes: Upon completion of this course, students will be able to

- CO1 Facilitate objective solutions in business decision making.
- CO2 Understand and solve business problems
- CO3 Apply statistical techniques to data sets, and correctly interpret the results.
- CO4 Develop skill-set that is in demand in both the research and business environments
- CO5 Enable the students to apply the statistical techniques in a work setting.

UNIT 1 INTRODUCTION

Basic definitions and rules for probability, Baye's theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

STATISTICS FOR MANAGEMENT

UNIT 2 SAMPLING DISTRIBUTION AND ESTIMATION

Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.

UNIT 3 TESTING OF HYPOTHESIS - PARAMETIRC TESTS

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 4 TESTING OF HYPOTHESIS - PARAMETIRC TESTS

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 5 CORRELATION AND REGRESSION

Correlation – Rank Correlation – Regression – Estimation of Regression line – Method of Least Squares – Standard Error of estimate.

Total : 45 Periods

TEXT BOOKS:

- 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.

REFERENCES:

- 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. David R. Anderson, Dennis J. Sweeney, Thomas A.Williams, Jeffrey D.Camm, James J.Cochran,
- 5. Statistics for business and economics, 13th edition, Thomson (South Western) Asia, Singapore, 2016.
- 6. N. D. Vohra, Business Statistics, Tata McGraw Hill, 2017

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21CSM	I42 DATAMINING FOR BUSINESS INTELLIGENCE	L 3	Т 0	Р 0	C 3
Course	• Outcomes: Upon completion of this course, 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				
CO5	Develop and implement machine learning and Artificial algorithms				
UNIT 1	1 INTRODUCTION				9
Data m	ining, Text mining, Web mining, Data ware house				
UNIT 2	2 DATA MINING PROCESS				9
Data m	ining process – KDD, CRISP-DM, SEMMA Prediction performance measures				
UNIT 3	3 PREDICTION TECHNIQUES				9
Data vi	sualization, Time series – ARIMA, Winter Holts,				
UNIT 4	4 CLASSIFICATION AND CLUSTERING TECHNIOUES				9
Classifi	cation, Association, Clustering.				
UNIT :	5 MACHINE LEARNING AND AI				9
Genetic	algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm opt	imiza	tion		

TEXT BOOKS:

- 1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
- 2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.

REFERENCES:

- 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.

Total : 45 Periods

Course Outcomes: Upon completion of this course, students will be able to

- CO1 Conversant about HR metrics and ready to apply at work settings.
- CO2 Resolve HR issues using people analytics in Recruitment
- CO3 Analyze HR analytics in Training and Development
- CO4 Analyze HR Analytics in Employee Engagement And Career Progression
- CO5 Analyze HR Analytics in Workforce Diversity And Development

UNIT 1 INTRODUCTION TO HR ANALYTICS

People Analytics - stages of maturity - Human Capital in the Value Chain : impact on business – HR metrics and KPIs.

HUMAN RESOURCE ANALYTICS

UNIT 2 HR ANLYTICS I - RECRUITMENT

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 3 HR ANALYTICS II - TRAINING AND DEVELOPMENT

Training & Development Metrics : Percentage of employees trained- Internally and externally trained - Training hours and cost per employee - ROI.

UNIT 4 HR ANALYTICS III - EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION

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 5 HR ANALYTICS IV- WORKFORCE DIVERSITY AND DEVELOPMENT 9

Workforce Diversity and Development Metrics : Employees per manager – Workforce age profiling - Workforce service profiling - Churnover index - Workforce diversity index - Gender mix

Total : 45 Periods

TEXT BOOKS:

- 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.

REFERENCES:

- 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.

Sesil, J. C., Applying advanced analytics to HR management decisions: Methods fo selection,

- 5. 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

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21CSM44 DIGITAL MARKETING AND SOCIAL NETWORK ANALYTICS $\begin{array}{cc} L & T \\ 2 & 0 \end{array}$

Course Outcomes: Upon completion of this course, students will be able to

- CO1 Analyze the Marketing Budget and performance.
- CO2 Create a community building in social media.
- CO3 Use the techniques in Social Media Policies And Measurements
- CO4 Analyze the web analytics in data collection.
- CO5 Apply the search analytics in various data visualization.

UNIT 1 MARKETING ANALYTICS

Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis

UNIT 2 COMMUNITY BUILDING AND MANAGEMENT

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 3 SOCIAL MEDIA POLICIES AND MEASUREMENTS

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT 4 WEB ANALYTICS

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 5 SEARCH ANALYTICS

Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization

TEXT BOOKS:

- 1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013
- 2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014

REFERENCES:

- 3. Bittu Kumar, Social Networking, V & S Publishers, 2013
- 4. Avinash Kaushik, Web Analytics An Hour a Day, Wiley Publishing, 2007
- 5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004
- 6. Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

Total : 45 Periods

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Course Outcomes: Upon completion of this course, students will be able to

Enable quantitative solutions in business decision making under conditions of certainty, risk and CO1 uncertainty.

SUPPLY CHAIN ANALYTICS

- CO2 Apply Warehousing Decisions in data collections
- Apply the various strategies in Inventory Management. CO3
- Explain various Transportation Network Models CO4
- CO5 Explain various MCDM Models

UNIT 1 INTRODUCTION

Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains - Basics, transforming supply chains.

WAREHOUSING DECISIONS UNIT 2

P-Median Methods - Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods.

UNIT 3 INVENTORY MANAGEMENT

Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.

TRANSPORTATION NETWORK MODELS UNIT 4

Minimal Spanning Tree, Shortest Path Algorithms, Maximal Flow Problems, Transportation Problems, Set covering and Set Partitioning Problems, Travelling Salesman Problem, Scheduling Algorithms.

MCDM MODELS UNIT 5

Analytic Hierarchy Process(AHP), Data Envelopment Analysis (DEA), Fuzzy Logic an Techniques, the analytical network process (ANP), TOPSIS.

TEXT BOOKS:

- Nada R. Sanders, Big data driven supply chain management: A framework for implementing 1. analytics and turning information into intelligence, Pearson Education, 2014.
- Michael Watson, Sara Lewis, Peter Cacioppi, Jay Jayaraman, Supply Chain Network Design: 2.
- Applying Optimization and Analytics to the Global Supply Chain, Pearson Education, 2013.

REFERENCES:

- Anna Nagurney, Min Yu, Amir H. Masoumi, Ladimer S. Nagurney, Networks Against Time: 2. Supply Chain Analytics for Perishable Products, Springer, 2013.
- Muthu Mathirajan, Chandrasekharan Rajendran, Sowmyanarayanan Sadagopan, Arunachalam Ravindran, Parasuram Balasubramanian, Analytics in Operations/Supply Chain Management, 3. I.K. International Publishing House Pvt. Ltd., 2016.
- Gerhard J. Plenert, Supply Chain Optimization through Segmentation and Analytics, CRC Press, 4. Taylor & Francis Group, 2014.

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Total : 45 Periods

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FINANCIAL ANALYTICS

Course Outcomes: Upon completion of this course, students will be able to

CO1 Perform financial analysis for decision making using Corporate Finance Analysis

- CO2 Perform financial analysis for decision making using Financial Market Analysis
- CO3 Perform financial analysis for decision making using Portfolio Analysis
- CO4 Perform financial analysis for decision making using Technical Analysis
- CO5 Perform financial analysis for decision making using Credit Risk Analysis

UNIT 1 CORPORATE FINANCE ANALYSIS

Basic corporate financial predictive modelling- Project analysis- cash flow analysis- cost of capital, Financial Break even modelling, Capital Budget model-Payback, NPV, IRR.

UNIT 2 FINANCIAL MARKET ANALYSIS

Estimation and prediction of risk and return (bond investment and stock investment) –Time seriesexamining nature of data, Value at risk, ARMA, ARCH and GARC

UNIT 3 PORTFOLIO ANALYSIS

Portfolio Analysis – capital asset pricing model, Sharpe ratio, Option pricing models- binomial model for options, Black Scholes model and Option implied volatility.

UNIT 4 TECHNICAL ANALYSIS

Prediction using charts and fundamentals – RSI, ROC, MACD, moving average and candle charts, simulating trading strategies. Prediction of share prices.

UNIT 5 CREDIT RISK ANALYSIS

Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.

TEXT BOOKS:

21CSM46

- 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.

REFERENCES:

- 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).
- 5. Mastering Python for Finance Paperback Import, 29 Apr 2015 by James Ma Weiming.

Total : 45 Periods

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21CEM51 SUSTAINABLE INFRASTRUCTURE DEVELOPMENT L

Preamble

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 1 SUSTAINABLE DEVELOPMENT GOALS

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 2 SUSTAINABLE INFRASTRUCTURE PLANNING

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 3 SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES

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.

UNIT 4 SUSTAINABLE CONSTRUCTION MATERIALS

Construction materials: Concrete, steel, glass, aluminium, timber and FRP - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Sustainable consumption – Ecoefficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility – Design for Environment Strategies, Practices, Guidelines, Methods, And Tools. Ecodesign 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 5 SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS

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



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Computing, Artificial Intelligences, Machine and Deep Learning, Fifth Generation (5G) Network services for maintenance .

Total: 45 Periods

TEXT BOOKS:

- 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.

REFERENCES:

- 1. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
- 2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2016.

eRESOURCES:

- 1. <u>https://www.unep.org/explore-topics/green-economy/what-we-do/sustainable-infrastructureinvestment.</u>
- 2. <u>https://www.iisd.org/savi/</u>

- 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.

21CEM52SUSTAINABLE AGRICULTURE AND ENVIRONMENTALLTPCMANAGEMENT3003

Preamble

To educate the students about the issues of sustainability in agroecosystems, introduce the concepts and principles of agroecology as applied to the design and management of sustainable agricultural systems for a changing world.

UNIT 1 AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS

Ecosystem definition - Biotic *Vs.* abiotic 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 2 SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT

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 3 WATER MANAGEMENT

Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture -Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water -Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use

UNIT 4 ENERGY AND WASTE MANAGEMENT

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 5 EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS

Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies

TEXT BOOKS:

- 1. Approaches to Sustainable Agriculture Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
- 2. Natural bioactive products in sustainable agriculture, Singh, J. &Yadav, A.N., Springer, 2020

REFERENCES:

- 1. Organic Farming for Sustainable Agriculture, Nandwani, D., Springer, 2016
- 2. Principles of Agronomy for Sustainable Agriculture, Villalobos, F.J. & Fereres, E., Springer, 2016

eRESOURCES:

- 1. <u>https://link.springer.com/book/10.1007/978-981-13-6830-1</u>
- 2. <u>https://www.worldwildlife.org/industries/sustainable-agriculture</u>

Total : 45 Periods

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- CO1 Have an in-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 to promote an ecological use of resources
- CO4 Develop energy and waste management plans for promoting sustainable agriculture in nonsustainable farming areas
- CO5 Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem

Preamble

The primary objective of this course is to impart knowledge of biomaterials and their properties The Fundamentals aspects and significance of ofbioceramics, Biopolymers & bionanomaterials and their applications

UNIT 1 INTRODUCTION TO BIOMATERIALS

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 typescrystal 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 2 BIO POLYMERS

Molecular structure of polymers -Molecular weight - Types of polymerization techniques-Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials - Polyethylene -Polymethylmethacrylate (PMMA-Polylactic acid (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers -Polyurethan- reactions polymers for medical purposes -Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications

UNIT 3 BIO CERAMICS AND BIOCOMPOSITES

General properties- Bio ceramics -Silicate glass - Alumina (Al2O3) -Zirconia (ZrO2)-Carbon- Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites- Polymer Matrix Compsite(PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite (MMC)- glass ceramics - Orthopedic implants-Tissue engineering scaffolds

UNIT 4 METALS AS BIOMATERIALS

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 osteointegration-medical application-corrosion of metallic implants - biological tolerance of implant metals

UNIT 5 NANOBIOMATERIALS

Meatllicnanobiomaterials-Nanopolymers-Nanoceramics-Nanocomposites -Carbon based nanobiomaterials - transport of nanoparticles- release rate-positive and negative effect of nanosizenanofibres-Nano and micro features and their importance in implant performance-Nanosurface and coats-Applications nanoantibiotics-Nanomedicines- Biochips - Biomimetics- BioNEMs -Biosensor-Bioimaging/Molecular Imaging- challenges and future perspective.

Total : 45 Periods

TEXT BOOKS:

- 1. C. MauliAgrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani "Introduction to Biomaterials Basic Theory with Engineering Applications" Cambridge University Press, 2014.
- Buddy D.Ratner and Allan S.Hoffman Biomaterials Science "An Introduction to Material in 2. Medicine" Third Edition, 2013.

REFERENCES:

- VasifHasirci, NesrinHasirci "Fundamentals of Biomaterials" Springer, 2018 1.
- DevarajanThangadurai, JeyabalanSangeetha, Ram Prasad "Functional Bionanomaterials" springer, 2. 2020.

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eRESOURCES:

- 1. <u>https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6273984/</u>
- 2. <u>https://sustainablebiomaterials.org/</u>

- CO1 Students will gain familiarity with Biomaterials 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 Bioceramics and Biocomposite materials
- CO4 Students gain knowledge on metals as biomaterials
- CO5 Student gains knowledge on the importance of nanobiomaterials in biomedical applications.

L Т Р 21CEM54 MATERIALS FOR ENERGY SUSTAINABILITY 3 0 A

Preamble

The primary objective of this course is to familiarize the students about the challenges and demands of energy sustainability. To provide fundamental knowledge about electrochemical devices and the materials used and various types of fuel cell. The studentswill learn about novel materials and their usage in photovoltaic application a nd basic principles of various types Supercapacitors and the materials used.

UNIT 1 SUSTAINABLE ENERGY SOURCES

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 2 ELECTROCHEMICAL DEVICES

Electrochemical Energy - Difference between primary and secondary batteries - Secondary battery (Liion battery, Sodium-ion battery, Li-S battery, Li-O2 battery, Nickel Cadmium, Nickel Metal Hydride) -Primary battery (Alkaline battery, Zinc-Carbon battery) - Materials for battery (Anode materials -Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials - S, LiCoO2, LiFePO4, LiMn2O4) - Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)

UNIT 3 FUEL CELLS

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 oxide supported platinum catalysts) - Anatomy of fuel cells (gas diffusion layer, catalyst layer, flow field plate, current conductors, bipolar plates and monopolar plates).

UNIT 4 PHOTOVOLTAICS

Physics of the solar cell – Theoretical limits of photovoltaic conversion – bulk crystal growth of Si and wafering for photovoltaic application - Crystalline silicon solar cells - thin film silicon solar cells multijunction solar cells – amorphous silicon based solar cells – photovoltaic concentrators – Cu(InGa)Se2 solar cells - Cadium Telluride solar cells - dye sensitized solar cells - Perovskite solar cells - Measurement and characterization of solar cells - Materials used in solar cells (metallic oxides, CNT films, graphene, OD fullerenes, single-multi walled carbon nanotubes, two-dimensional Graphene, organic or Small molecule-based solar cells materials _ copper-phthalocyanine and perylenetetracarboxylicbis - benzine - fullerenes - boron subphthalocyanine- tin (II) phthalocyanine)

UNIT 5 SUPERCAPACITORS

Supercapacitor -types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell-parameters of supercapacitor-Faradaic and non - Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite-conductive polypyrrole hydrogels -Different types of nanocomposites for the SC electrodes (carbon-carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

Total : 45 Periods

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TEXT BOOKS:

- 1. Materials for Supercapacitor applications; B.Viswanathan. M.AuliceScibioh
- 2. Recent advances, practical challenges, and perspectives of intermediate temperature solid oxide fuel cell cathodes Amanda Ndubuisi, Sara Abouali, Kalpana Singh and VenkataramanThangadurai, J. Mater. Chem. A, 2022.

REFERENCES:

- 1. Functional materials for sustainable energy applications; John A. Kilner, Stephen J. Skinner, Stuart J. C. Irvine and Peter P. Edwards.
- 2. Hand Book of Fuel Cells: Fuel Cell Technology and Applications, Wolf Vielstich, Arnold Lamm, Hubert Andreas Gasteiger, Harumi Yokokawa, Wiley, London 2003.

eRESOURCES:

- 1. <u>https://www.nature.com/collections/pwybcfjfhb</u>
- 2. <u>https://mse.stanford.edu/research-impact/research-overview/materials-sustainability</u>

- 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 supercapacitors and the performance of various materials

21CEM55

GREEN TECHNOLOGY

L T P C 3 0 0 3

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Total: 45 Periods

Preamble

To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability.

UNIT 1 PRINCIPLES OF GREEN CHEMISTRY

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 2 POLLUTION TYPES

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 3 GREEN REAGENTS AND GREEN SYNTHESIS

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 4 DESIGNING GREEN PROCESSES

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 5 GREEN NANOTECHNOLOGY

Nanomaterials 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

TEXT BOOKS:

- 1. Green chemistry metrics Alexi Lapkin and david Constable (Eds) ,Wiley publications,2008
- 2. Green Chemistry An introductory text M. Lancaster, RSC, 2016.

REFERENCES:

- 1. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017
- 2. Green technology and design for the environment, Samir B. Billatos, Nadia A. Basaly, Taylor & Francis, Washington, DC, ©1997

eRESOURCES:

- 1. <u>https://greenly.earth/en-us/blog/ecology-news/everything-you-need-to-know-about-green-</u> technology-in-2022
- 2. <u>https://unacademy.com/content/kerala-psc/study-material/science-technology/green-technology/</u>

- 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

21CEM56 ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS L T P C 3 0 0 3

Preamble

To understand and study the complexity of the environment in relation to pollutants generated due to industrial activity

UNIT 1 ENVIRONMENTAL MONITORING AND STANDARDS

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 2 MONITORING OF ENVIRONMENTAL PARAMETERS

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 airsampling of flue gas.

UNIT 3 ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING

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 4 ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISKASSESSMENT

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 5 AUTOMATED DATA ACQUISITION AND PROCESSING

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.

TEXT BOOKS:

- 1. Environmental monitoring Handbook, Frank R. Burden, © 2002 by The McGraw-Hill Companies, Inc.
- 2. Handbook of environmental analysis: chemical pollutants in the air, water, soil, and soild wastes / PradyotPatnaik, © 1997 by CRC Press, Inc

REFERENCES:

- 1. H. H. Willard, L. L. Merit, J. A. Dean and F. A. Settle, Instrumental Methods of Analysis, CBP Publishers and Distributors, New Delhi, 1988.
- 2. Heaslip, G. (1975) Environmental Data Handling. John Wiley & Sons. New York.

eRESOURCES:

- 1. <u>https://onlinecourses.nptel.ac.in/noc22_ch33/</u>
- 2. <u>https://unece.org/environmental-monitoring</u>

Total : 45 Periods

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- 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 The various ways of raising environmental awareness among the people.
- CO6 Know the standard research methods that are used worldwide for monitoring the environment.

UNIT 4 RENEWABLE ENERGY TECHNOLOGY

Renewable Energy – Sources and Potential – Technologies for harnessing from Solar, Wind, Hydro, Biomass and Oceans - Principle of operation, relative merits and demerits

UNIT 5 ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT

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, Road map for ethanol blending, Energy Efficiency and Energy Mix

TEXT BOOKS:

- 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. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012

REFERENCES:

- 1. DhandapaniAlagiri, Energy Security in India Current Scenario, The ICFAI University Press, 2006.
- 2. M.H. Fulekar, BhawanaPathak, R K Kale, "Environment and Sustainable Development" Springer,2016

eRESOURCES:

- 1. https://inis.iaea.org/collection/NCLCollectionStore/_Public/42/067/42067676.pdf
- 2. https://www.seforall.org/universal-integrated-energy-plans

Course Outcomes: Upon completion of this course, 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.

21CEM57 **INTEGRATED ENERGY PLANNING FOR SUSTAINABLE** Т L DEVELOPMENT 3 0

Preamble

To create awareness on the energy scenario of India with respect to world and also to understand the fundamentals of energy sources, energy efficiency and resulting environmental implications of energy utilisation

UNIT 1 ENERGY SCENARIO

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 2 ENERGY AND ENVIRONMENT

Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

UNIT 3 SUSTAINABLE DEVELOPMENT

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.

Total : 45 Periods



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21CEM58 ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT L T P C 3 0 0 3

Preamble

To understand the types of energy sources, energy efficiency and environmental implications of energy utilisation and also to create awareness on energy audit and its impacts

UNIT 1 ENERGY AND ENVIRONMENT

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 2 ENERGY AUDITING

Need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments

UNIT 3 ENERGY EFFICIENCY IN THERMAL UTILITIES

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 thermocompression

UNIT 4 ENERGY CONSERVTION IN ELECTRICAL UTILITIES

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 5 SUSTAINABLE DEVELOPMENT

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 : 45 Periods

TEXT BOOKS:

- 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 A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, "Energy and the Environment", 4th Edition, Wiley, 2022

REFERENCES:

- 1. M.H. Fulekar, BhawanaPathak, R K Kale, "Environment and Sustainable Development" Springer, 2016
- 2. Robert A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, "Energy and the Environment", 4th Edition, Wiley, 2022

eRESOURCES:

- 1. <u>https://www.seforall.org/energy-efficiency-for-sustainable-development</u>
- 2. https://www.sciencedirect.com/science/article/abs/pii/S0360544221026141

Course Outcomes: Upon completion of this course, 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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INTRODUCTION TO DATA SCIENCE

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Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Discuss about data science process for making business decisions.
- CO2 Understand different types of data and the concept of Normal Distributions and Standard (z) Scores for data analysis.
- CO3 Demonstrate the usage of statistical inference and regression models for a given application.
- CO4 Describe different types of machine learning approaches for analyzing business problems.
- CO5 Apply tools and techniques to handle large volumes of data in practical scenarios.

UNIT 1 INTRODUCTION

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 2 DESCRIBING DATA

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 3 DESCRIBING RELATIONSHIPS

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 r2 –multiple regression equations –regression towards the mean.

UNIT 4 MACHINE LEARNING

The modeling process – Types of machine learning – Supervised learning – Unsupervised learning - Semi-supervised learning- Classification, regression – Clustering – Outliers and Outlier Analysis

UNIT 5 HANDLING LARGE DATA

Problems – techniques for handling large volumes of data – programming tips for dealing with large data sets- Case studies: Predicting malicious URLs, Building a recommender system – Tools and techniques needed – Research question – Data preparation – Model building – Presentation and automation.

Total : 45 Periods

TEXT BOOKS:

- 1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
- 2. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.
- 3. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.

REFERENCES:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

e-RESOURCES:

- 1. https://nptel.ac.in/courses/106106179
- 2. https://www.coursera.org/learn/foundations-of-data-science

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VCET, B.E-CSE, R2018 Ver. – 4, Curriculum and Syllabus

21CSM62 PRINCIPLES OF ARTIFICIAL INTELLIGENCE L T P

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain intelligent agent frameworks and search strategies used in decision making.
- CO2 Apply problem solving techniques and obtain search spaces for partially defined and unknown environments.
- CO3 Apply game playing theory and constraint satisfaction problem solving techniques for a given application
- CO4 Perform logical reasoning and derive inferences using FOL forward chaining and backward chaining
- CO5 Perform probabilistic reasoning under uncertainty using Bayesian inference networks

UNIT I INTELLIGENT AGENTS

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

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

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

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

Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.

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

e-RESOURCES:

1. https://nptel.ac.in/courses/106106126

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Total: 45 Periods

21CSM63 DATA WAREHOUSING AND DATA MINING

Course Outcomes: Upon completion of the course, the students should be able to:

- CO1 Design a Data warehouse system and perform business analysis with OLAP tools.
- CO2 Apply suitable pre-processing and visualization techniques for data analysis
- CO3 Apply frequent pattern and association rule mining techniques for data analysis
- CO4 Apply appropriate classification and clustering techniques for data analysis
- CO5 Apply various classification and clustering techniques using tools

UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE 9 ANALYTICAL PROCESSING (OLAP)

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT II DATA MINING – INTRODUCTION

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III DATA MINING - FREQUENT PATTERN ANALYSIS

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

UNIT IV CLASSIFICATION AND CLUSTERING

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

UNIT V WEKA TOOL

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database - Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, —Data Mining Concepts and Techniquesl, Third Edition, Elsevier, 2012.

REFERENCES:

- 1. Alex Berson and Stephen J.Smith, —Data Warehousing, Data Mining & OLAPI, Tata McGraw Hill Edition, 35th Reprint 2016.
- 2. K.P. Soman, Shyam Diwakar and V. Ajay, —Insight into Data Mining Theory and Practicell, Eastern Economy Edition, Prentice Hall of India, 2006.
- 3. Ian H.Witten and Eibe Frank, —Data Mining: Practical Machine Learning Tools and Techniques^{II}, Elsevier, Second Edition.

e-RESOURCES:

- 1. https://nptel.ac.in/courses/106105174
- 2. https://www.opensourceforu.com/2017/01/an-introduction-to-weka/

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Total: 45 Periods

Course Outcomes: Upon completion of this course, students will be able to:

Differentiate between supervised, unsupervised, semi-supervised machine learning approaches CO1

MACHINE LEARNING TECHNIQUES

- Discuss the decision tree algorithm and overcome the problem of over fitting. CO2
- Discuss and apply the back propagation algorithm and genetic algorithms to various problems. CO3
- Apply the concept of Instant based learning to solve business problems. CO4
- Analyze and apply advanced machine learning approaches for performing data analytics. CO5

UNIT I **INTRODUCTION**

Learning Problems - Perspectives and Issues - Concept Learning - Version Spaces and Candidate Eliminations - Inductive bias - Decision Tree learning - Representation - Algorithm - Heuristic Space Search.

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS

Neural Network Representation - Problems - Perceptrons - Multilayer Networks and Back Propagation Algorithms - Advanced Topics - Genetic Algorithms - Hypothesis Space Search - Genetic Programming -Models of Evaluation and Learning.

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING

Bayes Theorem - Concept Learning - Maximum Likelihood - Minimum Description Length Principle -Bayes Optimal Classifier - Gibbs Algorithm - Naïve Bayes Classifier - Bayesian Belief Network - EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

INSTANT BASED LEARNING UNIT IV

K- Nearest Neighbour Learning - Locally weighted Regression - Radial Basis Functions - Case Based Learning.

UNIT V **ADVANCED LEARNING**

Learning Sets of Rules - Sequential Covering Algorithm - Learning Rule Set - First Order Rules - Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

TEXT BOOKS:

Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013. 1.

REFERENCES:

- Ethem Alpaydin, -Introduction to Machine Learning (Adaptive Computation and 1. Machine Learning), The MIT Press 2004.
- Stephen Marsland, --Machine Learning: An Algorithmic Perspective, CRC Press, 2009. 2.

e-RESOURCES:

https://nptel.ac.in/courses/106106126 1.

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Total: 45 Periods

Course Outcomes: Upon completion of this course, students will be able to:

- Understand the design of systems using human knowledge and/ or behavior as a basis. **CO1**
- Explore traditional as well as new technologies for knowledge acquisition and representation CO2

EXPERT SYSTEMS

- Describe different methods of inference involved in expert systems CO3
- Discuss the problem of uncertainty while incorporating artificial intelligence, expert, and CO₄ decision systems into society.
- CO5 Design an expert system for a given scenario.

INTRODUCTION TO EXPERT SYSTEMS UNIT I

Overview, problem domain and knowledge domain, the advantages of an expert system, general stages in the development of an expert system, general characteristics of an expert system, history and uses of expert systems today, rule-based expert systems, procedural and nonprocedural paradigms, characteristics of artificial neural systems.

UNIT II REPRESENTATION OF KNOWLEDGE

The study of logic, difference between formal logic and informal logic. Knowledge representation, semantic nets, translate semantic nets into PROLOG, limitations of semantic nets, schemas, frames and their limitations, , propositional and first order predicate logic, quantifiers, limitations of propositional and predicate logic.

UNIT III METHODS OF INFERENCE

Trees, lattices, and graphs, state and problem spaces, AND-OR trees and goals, methods of inference, rules of inference, resolution rule of inference, resolution systems, and deduction, shallow and causal reasoning, additional methods of Inference, Meta knowledge, the Markov decision process.

REASONING UNDER UNCERTAINTY UNIT IV

Overview, types of errors attributed to uncertainty, features of classical probability, experimental and subjective probabilities, compound and conditional probabilities, hypothetical reasoning and backward induction, temporal reasoning, Markov chains, odds of belief, sufficiency and necessity, role of uncertainty in inference chains, implications of combining evidence.

UNIT V **DESIGN OF EXPERT SYSTEMS**

Overview, stages in the development of an expert system, types of errors in development stages, knowledge engineer role in expert systems, life cycle of an expert system.

TEXT BOOKS:

- 1. J. Giarratano and G. Riley, "Expert Systems -- Principles and Programming". 4th Edition, PWS Publishing Company, 2004.
- Peter Jackson, Introduction to Expert Systems, Addison Wesley Longman, 1999. ISBN0-2. 20187686-8.

REFERENCES:

- Durkin, J., Expert systems Design and Development, Macmillan, 1994 1.
- Elias M. Awad, Building Expert Systems, West Publishing Company 1996 2.
- Gonzalez and D. Dankel, "The Engineering of Knowledge-Based Systems", Prentice Hall, 1994. 3.
- Nikolopoulos, "Expert Systems", Marcel Dekker Inc. 1997. ISBN 0 8247 9927 5. 4.

e-RESOURCES:

https://nptel.ac.in/courses/106106126 1.

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Total : 45 Periods

21CSM66 COGNITIVE SCIENCE AND ANALYTICS

- CO1 Understand the underlying theory behind cognition from materialism to mental Science.
- CO2 Apply suitable Logical Representation and Reasoning to the cognition elements computationally
- CO3 Use probabilistic programming language to implement mathematical functions through WebPPL
- CO4 Develop applications using cognitive inference model and generative models for interactions
- CO5 Develop applications using cognitive learning model to learn new things faster.

UNIT 1 PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE

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 2 COMPUTATIONAL INTELLIGENCE

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision- Case Study on reasoning algorithms

UNIT 3 PROBABILISTIC PROGRAMMING LANGUAGE

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Co-routines: Functions that receive continuations – Enumeration- Case Study on Mathematical functions using WebPPL.

UNIT 4 INFERENCE MODELS OF COGNITION

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference-Case Study on Conditional inference learning model and Generative Model

UNIT 5 LEARNING MODELS OF COGNITION

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models- Case Study on hierarchical model and Mixture model.

TEXT BOOKS:

- 1. Vijay V Raghavan, Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
- 2. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020

REFERENCES:

- 1. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
- 2. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences", The MIT Press, 1999.

e-RESOURCES:

- 1. https://onlinecourses.nptel.ac.in/noc20_hs29/preview, "Introduction to Cognitive Psychology", By Prof. Naveen Kashyap, IIT Guwahati.
- 2. https://onlinecourses.nptel.ac.in/noc22_ee122/preview, "Cognition and its computation", Prof. Sharba Bandyopadhyay and Prof. Rajlakshmi Guha , IIT- Kharagpur.

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Total: 45 Periods

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Course Outcomes: Upon completion of this course, students will be able to:

Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications CO1 of these concepts.

GAMIFICATION

- Discuss the use of Nash Equilibrium for decision making problem. CO2
- Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic CO3 concepts given a real world situation.
- Identify some applications that need aspects of Bayesian Games to perform decision making. CO4
- Discuss the purpose of Gamification concepts and apply in real world applications. CO5

UNIT I **INTRODUCTION**

Introduction — Making rational choices: basics of Games — strategy — preferences — payoffs — Mathematical basics — Game theory — Rational Choice — Basic solution concepts-noncooperative 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).

GAMES WITH PERFECT INFORMATION UNIT II

Games with Perfect Information — Strategic games — prisoner's dilemma, matching pennies - Nash equilibria —mixed strategy equilibrium — zero-sum games

UNIT III GAMES WITH IMPERFECT INFORMATION

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**

Non-cooperative Game Theory — Self-interested agents — Games in normal form — Analyzing games: from optimality to equilibrium — Computing Solution Concepts of Normal — Form Games — Computing Nash equilibria of two-player, zero-sum games —Computing Nash equilibria of twoplayer, general- sum games — Identifying dominated strategies

GAMIFICATION UNIT V

Gamification Basics- The Business Value of Gamification -Design And Motivation- Player-Centric Gamification Design- Design Choices - Operant Conditioning - Self-Determination Theory - Behavioral Economics — Applications— Gamification for Marketing— Gamification at Work- Gamification and Learning— Gamification for Behavior Change.

TEXT BOOKS:

- M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2012. 1.
- M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013 2.
- N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, Algorithmic Game Theory. Cambridge 3. University Press, 2007.
- Kevin Werbach and Daniel Hunter, for the Win: How Game Thinking Can Revolutionize Your Business 4. (Wharton Digital Press, 2012)

REFERENCES:

- A.Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004. 1.
- YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, 2. Cambridge University Press 2008.
- Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, "Game Theory in Wireless and 3. Communication Networks", Cambridge University Press, 2012
- Y.Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific 4.

e-RESOURCES:

https://nptel.ac.in/courses/110104063 1.

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Total : 45 Periods