SRI VENKATESWARA COLLEGE OF ENGINEERING,

(An Autonomous Institution, Affiliated to Anna University, Chennai – 600025)

B. E. Computer Science and Engineering

CURRICULUM AND SYLLABUS

REGULATION – 2022

CHOICE BASED CREDIT SYSTEM

SRI VENKATESWARA COLLEGE OF ENGINEERING,

(An Autonomous Institution, Affiliated to Anna University, Chennai – 600025)

REGULATIONS 2022

B. E COMPUTER SCIENCE AND ENGINEERING

CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Computer Science and Engineering program will prepare its graduates:

1. **Professional Excellence and Problem-Solving:** Graduates will be able to demonstrate technical competence and innovative problem-solving skills in computer science and engineering, successfully contributing to industry, academia, and entrepreneurship at national and global levels.

2. **Continuous Learning and Ethical Practice:** Graduates will nurture a culture of lifelong learning, innovation, and ethical integrity, continually enhancing their expertise in computer science and engineering throughout their career and to deliver impactful solutions that adeptly meet the evolving needs of society.

3. **Leadership and Social Responsibility:** Graduates will become effective leaders and collaborators, capable of driving innovation, solving complex engineering problems, managing projects responsibly, and contributing positively to societal betterment.

PROGRAM OUTCOMES (POs)

PO GRADUATE ATTRIBUTES

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

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

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

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and **interpretation** of

data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineeringactivities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilitiesrelevant to the professional engineering practice.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Design and develop software applications using programming languages following software engineering principles to ensure efficiency, scalability, optimization and ethical integrity, leveraging contemporary tools such as Cloud Computing, DevOps, and Agile development practices.
2. Apply data analytics, machine learning, and artificial intelligence techniques to process data, derive insights, solve complex problems, and mitigate security threats to computer systems and networks, ensuring the protection of information.

PEO's – PO's& PSO's MAPPING: (Example)

POs	PEOs		
	I	II	III
1.	✓	✓	✓
2.		✓	✓
3.	✓	✓	✓
4.	✓		
5.	✓	✓	✓
6.		✓	
7.		✓	
8.	✓	✓	
9.	✓	✓	✓
10.	✓		
11.	✓	✓	✓
12.	✓		✓
PSO1	✓		✓
PSO2	✓	✓	✓

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REGULATIONS 2022

CHOICE BASED CREDIT SYSTEM

B.E. COMPUTER SCIENCE AND ENGINEERING

CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS I AND VIII

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	IP22151	Induction Programme (Common to all Branches)		-	-	-	-	-	Nil	F
Theory Subjects										
2.	HS22151	Tamil language and Heritage of Ancient Tamil Society (Common to all Branches)	HS	1	0	0	1	1	NIL	F
3.	HS22152	Communicative English (Common to all Branches)	HS	3	0	0	3	3	NIL	F
4.	MA22151	Applied Mathematics I (Common to all Branches except MR)	BS	3	1	0	4	4	NIL	F
5.	PH22151	Applied Physics (Common to AD, CS, EE, EC, IT)	BS	3	0	0	3	3	NIL	F
6.	CY22151	Applied Chemistry (Common to AD, CS, EE, EC, IT)	BS	3	0	0	3	3	NIL	F
7.	EE22151	Basic Electrical and Electronics Engineering (Common to all Branches except CH, EE, EC)	ES	3	0	0	3	3	NIL	F
8.	IT22101	Programming for Problem Solving (Common to IT, AD, CS, EE, EC)	ES	3	0	0	3	3	NIL	F
Practical Subjects										
9.	PH22161	Physics Laboratory (Common to all Branches except BT)	BS	0	0	2	1	2	NIL	F
10.	EE22111	Basic Electrical and Electronics Engineering Laboratory (Common to all Branches except EC)	ES	0	0	2	1	2	NIL	F
11.	IT22111	Programming for Problem Solving Laboratory (Common to IT, AD, CS, EE, EC)	ES	0	0	3	1.5	3	NIL	F
			Total	**19**	**1**	**7**	**23.5**	**27**	**-**	**-**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
Theory Subjects										
1.	HS22251	Science and Technology in Ancient Tamil Society (Common to all Branches)	HS	2	0	0	2	2	NIL	F
2.	HS22252	Technical English (Common to all Branches)	HS	3	0	0	3	3	NIL	F
3.	MA22251	Applied Mathematics II (Common to all Branches except MR)	BS	3	1	0	4	4	NIL	F
4.	ME22251	Technical Drawing (Common to AD, CS, IT)	BS	1	0	2	2	3	NIL	F
5.	CS22201	Python For Data Science (Common to CS & AD)	PC	3	0	2	4	5	NIL	F
6.	CS22202	Digital Principles and System Design (Common to CS & AD)	PC	3	0	0	3	3	NIL	F
7.	CS22203	Object Oriented Programming	PC	3	0	0	3	3	NIL	F
Practical Subjects										
8.	CS22211	Digital Principles and System Design Laboratory	PC	0	0	3	1.5	3	NIL	F
9.	CS22212	Object Oriented Programming Laboratory	PC	0	0	3	1.5	3	NIL	F
			Total	**18**	**1**	**10**	**24**	**29**	-	-

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
Theory Subjects										
1.	MA22353	Discrete Mathematics (Common to CS & IT)	BS	3	1	0	4	4	Nil	F
2.	AD22301	Artificial Intelligence (Common to AD & CS)	PC	3	0	0	3	3	Nil	F
3.	CS22301	Database Management Systems (Common to CS & AD)	PC	3	0	0	3	3	Nil	F
4.	CS22302	Datamining and Data warehousing (Common to CS & AD)	PC	3	0	0	3	3	Nil	F
5.	CS22303	Data Structures	PC	3	0	0	3	3	Nil	F
6.	CS22304	Microprocessor and Computer Architecture	PC	3	0	0	3	3	Nil	F
Practical Subjects										
7.	CS22311	Database Management Systems Laboratory (Common to CS & AD)	PC	0	0	3	1.5	3	Nil	F
8.	CS22312	Data Structures Laboratory	PC	0	0	3	1.5	3	Nil	F
9.	CS22313	Microprocessor Laboratory	PC	0	0	3	1.5	3	Nil	F
			Total	**18**	**1**	**9**	**23.5**	**28**	-	-

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
Theory Subjects										
1.	MA22454	Probability and Queuing Theory (Common to CS and IT)	BS	3	1	0	4	4	Nil	F
2.	CS22401	Operating Systems (Common to CS and AD)	PC	3	0	0	3	3	Nil	F
3.	CS22402	Machine Learning Techniques (Common to CS and AD)	PC	3	0	0	3	3	Nil	F
4.	CS22403	Design and Analysis of Algorithms	PC	3	0	0	3	3	Nil	F
5.	CS22409	Java Programming: Theory and Practices	PC	3	0	2	4	5	Nil	F
6.	GE22451	Environmental Sciences and Sustainability (Common to All Branches)	BS	3	0	0	3	3	Nil	F
Practical Subjects										
7.	CS22411	Operating Systems Laboratory (Common to CS and AD)	PC	0	0	3	1.5	3	Nil	F
8.	CS22412	Artificial Intelligence and Machine Learning Laboratory	PC	0	0	3	1.5	3	Nil	F
			Total	**18**	**1**	**8**	**23**	**27**	**-**	**-**

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
Theory Subjects										
1.	CS22501	Computer Networks (Common to CS and AD)	PC	3	0	0	3	3	Nil	F
2.	CS22502	Software Engineering (Common to CS & AD)	PC	3	0	0	3	3	Nil	F
3.	CS22503	User Interface Tools and Techniques	PC	3	0	0	3	3	Nil	F
4.	CS22504	Theory of Computation	PC	3	0	0	3	3	Nil	F
5.	****	Professional Elective I	PE	3	0	0	3	3	Nil	M
6.	****	Open Elective I	OE	3	0	0	3	3	Nil	M
7.	****	Mandatory Course	MC	3	0	0	0	3	Nil	M
Practical Subjects										
8.	CS22511	Computer Networks Laboratory (Common to CS and AD)	PC	0	0	3	1.5	3	Nil	F
9.	CS22512	User Interface Tools and Techniques Laboratory	PC	0	0	3	1.5	3	Nil	F
10.	HS22511	Interview and Career Skills Laboratory (Common to All)	EEC	0	0	3	2	3	Nil	F
			Total	**21**	**0**	**9**	**23**	**30**	**-**	**-**

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
Theory Subjects										
1.	CS22601	Cryptography and Network Security (Common to CS and AD)	PC	3	0	0	3	3	Nil	F
2.	CS22602	Software Project Management	PC	3	0	0	3	3	Nil	F
3.	AD22501	Internet of Things and Applications (Common to AD and CS)	PC	3	0	0	3	3	Nil	F
4.	CS22603	Cloud Computing	PC	3	0	0	3	3	Nil	F
5.	CS22604	Compiler Design	PC	3	0	0	3	3	Nil	F
6.	****	Professional Elective II	PE	3	0	0	3	3	Nil	M
7.	****	Open Elective II	OE	3	0	0	3	3	Nil	M
Practical Subjects										
8.	CS22611	Cryptography and Network Security Laboratory (Common to CS and AD)	PC	0	0	3	1.5	3	Nil	F
9.	CS22612	Cloud Computing Laboratory	PC	0	0	3	1.5	3	Nil	F
10.	CS22613	Internship	EEC	-	-	-	2	-	Nil	M
			Total	**21**	**0**	**6**	**26**	**27**	-	-

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
Theory Subjects										
1.	CS22701	Ethics for Computer Professionals (Common to CS and AD)	PC	3	0	0	3	3	Nil	M
2.	****	Professional Elective III	PE	3	0	0	3	3	Nil	M
3.	****	Professional Elective IV	PE	3	0	0	3	3	Nil	M
4.	****	Professional Elective V	PE	3	0	0	3	3	Nil	M
5.	****	Professional Elective VI	PE	3	0	0	3	3	Nil	M
			Total	**15**	**0**	**0**	**15**	**15**	**-**	**-**

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
Practical Subjects										
1.	CS22811	Project Work	EEC	0	0	20	10	20	Nil	F
			Total	**0**	**0**	**20**	**10**	**20**	**-**	**-**

PROFESSIONAL ELECTIVE (PE) COURSES : VERTICALS

VERTICAL 1: SPECIAL ELECTIVES GROUP*

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	SE22001	Financial Statement Analysis (Common to All branches)	SE	3	0	0	3	3	Nil	M
2.	SE22002	Introduction to Securities Market (Common to All branches)	SE	3	0	0	3	3	Nil	M
3.	SE22003	Option Trading Strategies (Common to All branches)	SE	3	0	0	3	3	Nil	M
4.	SE22004	Corporate Finance (Common to All branches)	SE	3	0	0	3	3	Nil	M
5.	SE22005	Managerial Economics (Common to All branches)	SE	3	0	0	3	3	Nil	M
6.	SE22006	Project Management (Common to All branches)	SE	3	0	0	3	3	Nil	M
7.	SE22007	Mathematics for AI & ML (Common to All branches)	SE	3	0	0	3	3	Nil	M

*Refer General Curriculum and Syllabus

VERTICAL 2: DATA ANALYTICS

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	CS22021	Exploratory Data Analysis	PE	3	0	0	3	3	Nil	M
2.	CS22022	Distributed Databases and Analysis	PE	3	0	0	3	3	Nil	M
3.	CS22023	Mining Massive Datasets	PE	3	0	0	3	3	Nil	M
4.	CS22024	Text and Speech Processing	PE	3	0	0	3	3	Nil	M
5.	CS22025	Image and Video Analytics	PE	3	0	0	3	3	Nil	M
6.	CS22026	Social Network Engineering	PE	3	0	0	3	3	Nil	M
7.	CS22027	Web Information Search and Analytics	PE	3	0	0	3	3	Nil	M
8.	CS22028	MLOps: Machine Learning Operations	PE	3	0	0	3	3	Nil	M
9.	CS22020	Capstone Project	PE	0	0	4	2	4	Nil	M

VERTICAL 3: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	CS22031	Knowledge Engineering	PE	3	0	0	3	3	Nil	M
2.	AD22601	Reinforcement Learning Techniques	PE	3	0	0	3	3	Nil	M
3.	CS22032	Deep Neural Networks	PE	3	0	0	3	3	Nil	M
4.	CS22033	Recommendation Systems	PE	3	0	0	3	3	Nil	M
5.	CS22034	Robotics Process Automation	PE	3	0	0	3	3	Nil	M
6.	CS22035	Information Retrieval Methodologies	PE	3	0	0	3	3	Nil	M
7.	CS22036	Computer Vision	PE	3	0	0	3	3	Nil	M
8.	CS22037	Explainable AI	PE	3	0	0	3	3	Nil	M
9.	CS22030	Capstone Project	PE	0	0	4	2	4	Nil	M

VERTICAL 4: INFORMATION SECURITY AND CYBER SECURITY

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	CS22041	Information Security System	PE	3	0	0	3	3	Nil	M
2.	CS22042	Ethical Hacking	PE	3	0	0	3	3	Nil	M
3.	CS22043	5G Security and Challenges	PE	3	0	0	3	3	Nil	M
4.	CS22044	Cyber Security	PE	3	0	0	3	3	Nil	M
5.	CS22045	Malware Analysis	PE	3	0	0	3	3	Nil	M
6.	CS22046	Blockchain Technologies	PE	3	0	0	3	3	Nil	M
7.	CS22047	Identity Management and Access Models	PE	3	0	0	3	3	Nil	M
8.	CS22048	Digital Forensics	PE	3	0	0	3	3	Nil	M
9.	CS22040	Capstone Project	PE	0	0	4	2	4	Nil	M

VERTICAL 5: CLOUD COMPUTING AND IOT

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	CS22051	Virtualization Techniques	PE	3	0	0	3	3	Nil	M
2.	CS22052	DevOps and Containerization	PE	3	0	0	3	3	Nil	M
3.	CS22053	Cloud Services Management	PE	3	0	0	3	3	Nil	M
4.	CS22054	Cloud Application Development and Management	PE	3	0	0	3	3	Nil	M
5.	CS22055	Edge and Fog Computing	PE	3	0	0	3	3	Nil	M
6.	CS22056	Software Defined Networks	PE	3	0	0	3	3	Nil	M
7.	CS22057	Security and Privacy in Cloud	PE	3	0	0	3	3	Nil	M
8.	CS22058	IoT Automation	PE	3	0	0	3	3	Nil	M
9.	CS22050	Capstone Project	PE	0	0	4	2	4	Nil	M

VERTICAL 6: MULTIMEDIA SYSTEMS

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	CS22061	Principles of Multimedia Systems (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
2.	CS22062	Multimedia Data Compression and Storage (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
3.	CS22063	Multimedia Network Technology (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
4.	CS22064	Multimedia Databases (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
5.	CS22065	Digital Image Processing Techniques (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
6.	CS22066	Introduction to 3D Printing and Design: Theory and Practices (Common to CS and AD)	PE	2	0	2	3	3	Nil	M
7.	CS22067	Pattern Recognition (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
8.	CS22068	Augmented and Virtual Reality Programming: Theory and Practices (Common to CS, AD and IT)	PE	2	0	2	3	3	Nil	M
9.	CS22060	Capstone Project (Common to CS and AD)	PE	0	0	4	2	4	Nil	M

VERTICAL 7: FULL STACK DEVELOPMENT

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	CS22071	Agile Methodologies (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
2.	CS22072	Web Application Development and Deployment (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
3.	CS22073	C# and .NET Framework (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
4.	CS22074	Frontend and Middleware Technologies (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
5.	CS22075	Software Testing and Quality Assurance (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
6.	CS22076	Server Side Programming (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
7.	CS22077	Advanced User Interface Technologies (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
8.	CS22078	Web 3.0 and Metaverse (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
9.	CS22070	Capstone Project (Common to CS and AD)	PE	0	0	4	2	4	Nil	M

VERTICAL 8: DIVERSIFIED GROUP – I

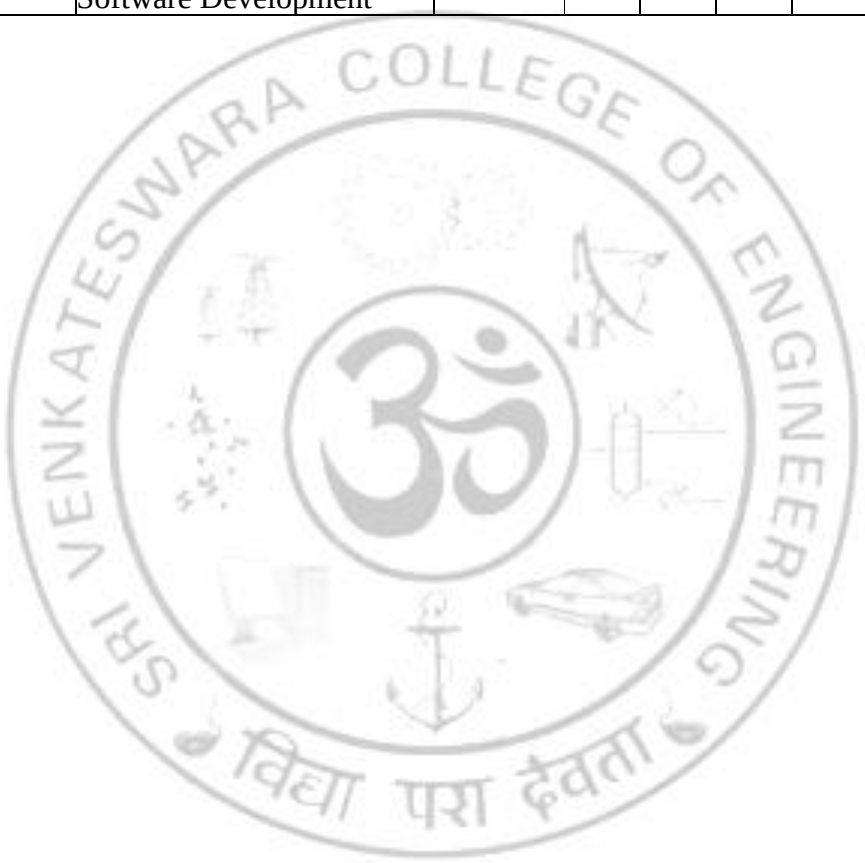
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	CS22081	Unix Internals (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
2.	CS22082	Distributed Computing (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
3.	CS22083	Quantum Computing (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
4.	CS22084	High Performance Computing (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
5.	CS22085	Graph Theory (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
6.	CS22086	Resource Management Techniques (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
7.	CS22087	Risk Analytics (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
8.	CS22088	Mobile Application Development (Common to CS and AD)	PE	3	0	0	3	3	Nil	M

OPEN ELECTIVE

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	OE22501	Basic Operating Systems	OE	3	0	0	3	3	Nil	M
2.	OE22502	Basics on Cyber Security and Ethical Hacking	OE	3	0	0	3	3	Nil	M
3.	OE22503	Introduction to Internet of Things	OE	3	0	0	3	3	Nil	M
4.	OE22504	Multimedia and Animation Techniques	OE	3	0	0	3	3	Nil	M
5.	OE22505	Python Programming	OE	3	0	0	3	3	Nil	M
6.	OE22506	Analytical Foundations	OE	3	0	0	3	3	Nil	M
7.	OE22507	Artificial Intelligence Basics	OE	3	0	0	3	3	Nil	M
8.	OE22508	Database Systems and Applications	OE	3	0	0	3	3	Nil	M
9.	OE22509	Internet Programming	OE	0	0	0	3	3	Nil	M
10.	OE22510	Introduction to Cloud and Big Data Analytics	OE	3	0	0	3	3	Nil	M
11.	OE22511	Introduction to Data Structures	OE	3	0	0	3	3	Nil	M
12.	OE22512	Machine Learning Tools and Techniques	OE	3	0	0	3	3	Nil	M

VALUE ADDED COURSES

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS
				L	T	P	C	
1.	VD22001	GO Programming	VD	2	0	0	0	2
2.	VD22002	SCALA Programming	VD	2	0	0	0	2
3.	VD22003	Power BI	VD	2	0	0	0	2
4.	VD22004	Generative AI For Software Development	VD	2	0	0	0	2



VALUE ADDED COURSES*

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS
				L	T	P	C	
1.	VC22001	Basics of Entrepreneurship Development (Common to all branches)	VC	2	0	0	0	2
2.	VC22002	Advances in Entrepreneurship Development (Common to all branches)	VC	2	0	0	0	2
3.	VC22003	Communicative German (Common to all branches)	VC	2	0	0	0	2
4.	VC22004	Communicative Hindi (Common to all branches)	VC	2	0	0	0	2
5.	VC22005	Communicative Japanese (Common to all branches)	VC	2	0	0	0	2
6.	VC22006	Design Thinking and Prototyping laboratory (Common to all branches)	VC	2	0	0	0	2

*Refer General Curriculum and Syllabus

MANDATORY COURSES*

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS
				L	T	P	C	
1.	MC22001	Indian Constitution (Common to all branches)	MC	3	0	0	0	3
2.	MC22002	Essence of Indian Traditional Knowledge (Common to all branches)	MC	3	0	0	0	3
3.	MC22003	Gender Sensitization (Common to all branches)	MC	3	0	0	0	3

*Refer General Curriculum and Syllabus

GENERAL ELECTIVES*

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS
				L	T	P	C	
1.	GN22001	Introduction to NCC for Engineers (Common to all branches)	GN	2	0	2	0	4
2.	GN22002	Yoga and physical culture (Common to all branches)	GN	0	0	2	0	2
3.	GN22003	Introduction to Fine arts (Common to all branches)	GN	2	0	0	0	2

*Refer General Curriculum and Syllabus

SUMMARY

Sl.No	Category	Credits in Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences including Management Studies(HS)	4	5							9
2	Basic Science Courses (BS)	11	6	4	7					28
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/ computer etc (ES)	8.5	4							12.5
4	Professional Core courses (PC)		9	19.5	16	15	18	3		79.5
5	Professional Elective courses relevant to chosen specialization/branch (PE)					3	3	12		18
6	Open subjects - Electives from other technical and /or emerging subjects (OE)					3	3			6
7	Project work, seminar and internship in industry or elsewhere (EEC)					2	2		10	14
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition] (MC)					3				3
	Total	23.5	24	23.5	23	23	26	15	10	168

HS22151

தமிழ் மொழியும் தமிழர் மரபும்
TAMIL LANGUAGE AND HERITAGE OF TAMILS

(Common to all Branches)

L	T	P	C
1	0	0	1

பாடத்தின்நோக்கங்கள் :

- தமிழ் மொழியின் தோற்றம் பற்றியும், திணை கருத்துக்கள் வாயிலாக வாழ்வியல் முறைகளை பற்றியும் கற்றுக் கொள்வார்கள்.
- இந்திய தேசிய சுதந்திர இயக்கத்தில் தமிழர்களின் பங்களிப்பு மற்றும் தமிழர்களின் மேலாண்மை முறைகளை பற்றியும் கற்றுக் கொள்வார்கள்.

OBJECTIVES:

- They will learn about the origin of the Tamil language and the ways of life through five types of lands.
- They will also learn about the contribution of Tamils in the Indian National Freedom Movement and the management methods of Tamils.

அலகு 1 தமிழுக்கும் தொழில்நுட்பக் கல்விக்கும் உள்ள தொடர்பு **3**

மொழி மற்றும் பாரம்பரியம்: இந்தியாவில் உள்ள மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழில் செம்மொழி இலக்கியம் - உ.வே.. சாமிநாதய்யர். ஆறுமுகநாவலர் ஆகியோரின் பங்களிப்பு – தொழில் நுட்பக் கல்வியில் தமிழ் மொழியின் முக்கியத்துவம்.

UNIT I LANGUAGE AND HERITAGE

Language families in India – Dravidan Languages – Tamil as a Classical language – Classical Literature in Tamil – Contribution of U. Ve. Saminathaiyar. Arumuka Navalar – Importance of Tamil language in technical education.

அலகு 2 திணை கருத்துக்கள் **9**

திணை கருத்துக்கள்: -ஐந்து வகை நிலங்கள், விலங்குகள், கடவுள்கள், தொழில், வாழ்க்கை முறைகள், இசை, நடனம், உணவு முறை, தமிழர்களின் தாவரங்கள் மற்றும் விலங்கினங்கள் – தொல்காப்பியம் மற்றும் சங்க இலக்கியங்களில் இருந்து அகம் மற்றும் புரம் கருத்து – தமிழ் பற்றிய அறம் கருத்து – கல்வி மற்றும் எழுத்தறிவு சங்க காலம் – சங்ககாலத்தின் பண்டைய நகரங்கள் மற்றும் துறைமுகங்கள் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – சோழர்களின் வெளிநாட்டு வெற்றி.

UNIT II THINAI CONCEPTS

Five types of lands, animals, Gods, occupation, life styles, music, dance , food style, Floara and Fauna of Tamils - Agam and puram concept from Tholkappiyam and Sangam Literature – Aram concept of Tamil – Education and Literacy during Sangam Age – Ancient cities and Ports of Sangam Age – Export and Import during Sangam Age - Overseas Conquest of Choloas.

அலகு 3 தமிழரின் மரபு **3**

இந்திய தேசிய சுதந்திர இயக்கம் மற்றும் இந்திய கலாச்சாரத்திற்கு தமிழர்களின் பங்களிப்பு:- சுப்ரமணிய பாரதி, வாஞ்சிநாதன், சுப்பிரமணிய சிவா, வீரபாண்டிய கட்ட பொம்மன், வா..ஊ சிதம்பரம் பிள்ளை, தீரன் சின்னமலை, மருது பாண்டிய சகோதரர்கள், பூலி தேவர், திருப்பூர் குமரன், வீரமங்கை வேலு நாச்சியார் - ,தமிழர் இலக்கியங்களில் மேலாண்மை கருத்துக்கள் (கி. மு. 500 முதல் கி. பி 200 வரை) – அகநானூறு, புறநானூறு, திருக்குறள் ஆகியவற்றில் மேலாண்மைக் கருத்துகள்.

UNIT -3 HERITAGE OF TAMILS

Contribution of Tamils to Indian National Freedom Movement and Indian Culture: Contributions of Subramanya Bharathi, Vanchinathan, Subramaniya Siva, Veerapandiya Kattabomman, V O Chidambaram Pillai, Dheeran Chinnamalai, The Maruthu Pandiyar, Puli Thevar, Tiruppur Kumaran, Veera Mangai Velunachiyar.

TOTAL (L:15): 15 PERIODS

பாடநெறி முடிவுகள் :
OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	மாணவர்கள் தமிழ் மொழித் தோற்றம் பற்றித் தெரிந்து கொள்வார்கள். Students will learn about the origin of the Tamil language	1
CO2	தமிழர்களின் வாழ்வியல் முறைகளைத் தெரிந்து கொள்வார்கள். They will know the ways of life of Tamils.	2
CO3	தமிழர்களின் சுதந்திர போராட்ட வீரர்களை பற்றியும், மேலாண்மைகளை பற்றியும் தெரிந்து கொள்வார்கள். They will know about the freedom fighters of Tamils and the management of Tamils	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

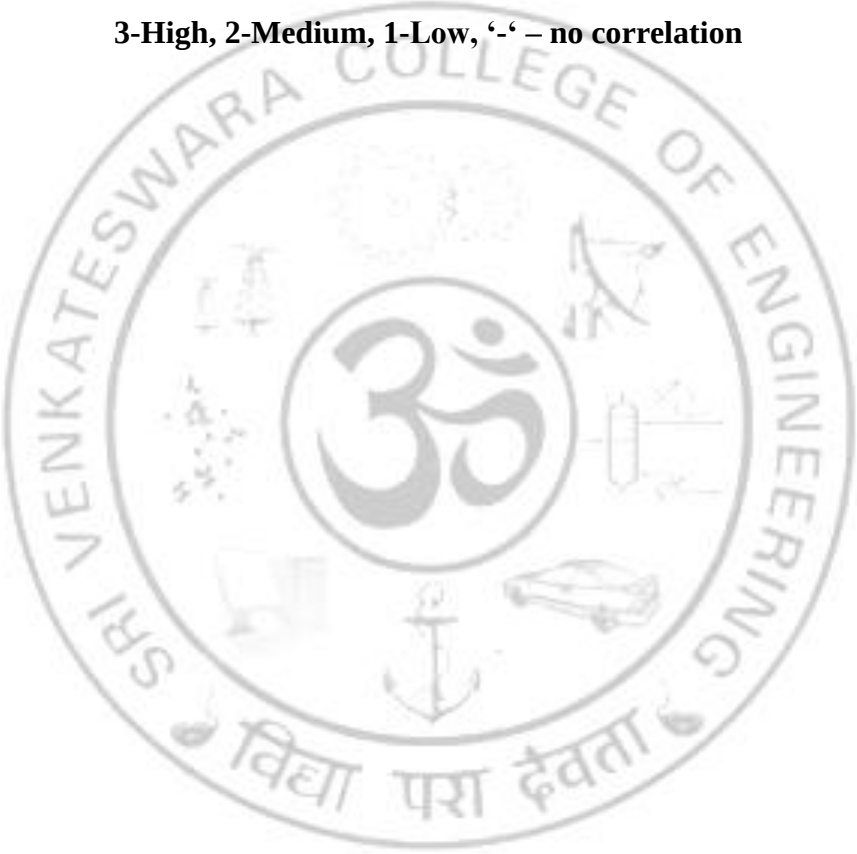
பாடநூல்கள்:
REFERCENCES:

1. **பொன். முத்துகுமாரன்** (2002), "தமிழ் மரபு", காந்தளகம், 68, அண்ணா சாலை, சென்னை 600 002
2. **பி. டிஸ்ரீனிவாச ஐயங்கார்** (தமிழக்கமும் திறனாய்வும்) **புலவர் கா. கோவிந்தன்** (1988), "தமிழர் வரலாறு (முதல் பகுதி)", திருநெல்வேலி தென்னிந்திய சைவ சித்தாந்த நூற்பதிப்பு கழகம் ,154, TTK சாலை, சென்னை 18.
3. **டாக்டர். கே. கே. பிள்ளை** (2009), "தமிழக வரலாறு மக்களும் பண்பாடும்", உலக தமிழாராய்ச்சி நிறுவனம், தரமணி , சென்னை 600113
4. **முனைவர். ச. இராஜேந்திரன்** (2004), "தமிழில் சொல்லாக்கம்", தஞ்சாவூர் தமிழ் பல்கலைக் கழகம் வெளியீடு

COURSE ARTICULATION MATRIX:

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	3	-	3	3	2	-	3	3	-	2	-	-
2	-	-	3	2	3	3	-	1	3	3	-	-	-	-
3	-	-	3	2	3	3	2	-	3	3	-	2	-	-

3-High, 2-Medium, 1-Low, '-' – no correlation



HS22152 **COMMUNICATIVE ENGLISH**

(Common to all Branches)

L	T	P	C
3	0	0	3

OBJECTIVES

- Enable learners to interact fluently on everyday social contexts.
- Train learners to engage in conversations in an academic/scholarly setting.
- Instil confidence in learners to overcome public speaking barriers.
- Develop learners' ability to take notes and in the process, improve their listening skills
- Enhance learners' reading skill through reading text passages for comprehension and contemplation.
- Improve learners' skills to write on topics of general interest and drafting correspondences for general purposes.

UNIT I **9**

Listening - short video clips - conversational scenes form movies, celebrities' speeches /interviews. Speaking - several ways of introducing oneself at several situations, introducing others at several situations, inviting people for several occasions, describing people and their places. Reading - short comprehension passages - making inferences, critical analysis. Writing - completing the incomplete sentences - developing hints from the given information. Grammar - Wh-Questions and Yes or No questions - Parts of speech. Vocabulary development - prefixes - suffixes - articles - countable / uncountable nouns.

UNIT II **9**

Listening - customer care voice files, short narratives - identifying problems and developing telephone etiquettes. Speaking - speaking over skype/ whatsapp, making business calls, making self-recorded informative videos, inquiring about a concept/activity, describing a concept/activity. Reading - reading the headlines on news magazines - slogans and taglines from advertisements. Writing - free writing - writing - headlines, slogans and taglines individual inspirations. Grammar- conjunctions, idioms, phrases, quotes. Vocabulary development - guessing the meanings of words in different contexts.

UNIT III **9**

Listening - courtroom scenes from movies, debates and talks from news channels, notes taking. Speaking - language and tone for arguments, discussion, deliberation, contemplation, expressing opinions, reacting to different situations in an alien country. Reading - language used in instruction manuals of household appliances, cookery and other basic instructions. Writing- understanding the structure of texts - use of reference words, discourse markers- coherence, rearranging the jumbled sentences. Grammar - adjectives - degrees of comparison, framing direct and indirect questions. Vocabulary development - concise approach, single word substitution.

UNIT IV **9**

Listening - Sports commentaries, advertisements with users' criticisms; Speaking - for social causes, for promoting a concept, negotiating and bargaining; Reading - review of a product, movie, movement or a system; Writing - writing for advertisements, selling a product; Grammar – Tenses - Simple Past, Present and Future, Continuous - Past, Present and Future; Vocabulary Development - synonyms, antonyms and phrasal verbs.

UNIT V **9**

Listening - video lectures, video demonstration of a concept; Speaking – presenting papers/concepts, delivering short speeches, discourses on health, suggesting natural home remedies, cleanliness, civic sense and responsibilities; Reading - columns and articles on home science; Writing - correspondences of requests, basic enquiry/observation and basic complaints; Grammar - modal verbs, perfect tenses - Vocabulary development - collocations.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Acquire adequate vocabulary for effective communication	**3**
CO2	Listen to formal and informal communication and read articles and infer meanings from specific contexts from magazines and newspapers.	**3**
CO3	Participate effectively in informal/casual conversations; introduce themselves and their friends and express opinions in English.	**4**
CO4	Comprehend conversations and short talks delivered in English.	**6**
CO5	Write short write-ups and personal letters and emails in English	**6**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERCENCES:

1. Department of English, Anna University. "Mindscapes: English for Technologists and Engineers", Orient Blackswan, Chennai, 2012.
2. Downes, Colm, "Cambridge English for Job-hunting", Cambridge University Press, New Delhi, 2008.
3. Murphy, Raymond, "Intermediate English Grammar with Answers", Cambridge University Press, 2000.
4. Thomson, A.J., "Practical English Grammar 1 & 2", Oxford, 1986.

Web Link:

1. http://www.usingenglish.com
2. http://www.uefap.com3
3. https://owl.english.purdue.edu/owl/
4. www.learnenglishfeelgood.com/esl-printables-worksheets.html

Software

1. Face2Face Advance - Cambridge University Press, 2014
2. English Advance Vocabulary - Cambridge University Press
3. IELTS test preparation - Cambridge University Press 2017
4. Official Guide to the TOEFL Test With CD-ROM, 4th Edition
5. CAMBRIDGE Preparation for the TOEFL TEST - Cambridge University Press, 2017

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

3-High, 2-Medium, 1-Low, '-' – no correlation

MA22151 **APPLIED MATHEMATICS – I**

(Common to all Branches except MR)

L	T	P	C
3	1	0	4

OBJECTIVES

- Compute eigen values and eigen vectors and use in diagonalization and in classifying real quadratic forms.
- Study differential calculus and its applications to relevant Engineering problems.
- Compute derivatives using the chain rule or total differentials.
- Understand the rotation of two dimensional geometry using definite integrals.
- Acquaint with the Mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES **12**

Eigen values and Eigen vectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigen vectors – Statement and Applications of Cayley-Hamilton Theorem –Diagonalization of matrices– Reduction of a quadratic form into canonical form by orthogonal transformation-Nature of quadratic forms.

UNIT II APPLICATION OF DIFFERENTIAL CALCULUS **12**

Curvature and radius of Curvature– Centre curvature – Circle of curvature –Evolutes– Envelopes-Evolute as Envelope of Normals.

UNIT III DIFFERENTIAL CALCULUS FOR SEVERAL VARIABLES **12**

Limits and Continuity - Partial derivatives – Total derivatives – Differentiation of implicit functions – Jacobians and properties– Taylor's series for functions of two variables – Maxima and Minima of functions of two variables –Lagrange's method of undetermined multipliers.

UNIT IV APPLICATION OF DEFINTE INTEGRALS **12**

Integration by Parts-Bernoulli's formula for integration- Definite integrals and its Properties- Solids of Revolution- Disk Method- Washer Method- Rotation about both x and y axis and Shell method.

UNIT V MULTIPLE INTEGRALS **12**

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

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

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Solve the Eigen value problems in matrices.	**2**
CO2	Apply the basic notion of calculus in Engineering problems and to tackle for different geometries	**2**
CO3	Perform calculus for more than one variable and its applications in Engineering problems.	**2**
CO4	Apply definite integrals for design of three dimensional components	**2**
CO5	Evaluate multiple integral in Cartesian and polar coordinates.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Erwin Kreyszing, Herbert Kreyszing, Edward Norminton, "Advanced Engineering Mathematics", 10th Edition, John Wiley, (2015).
2. Grewal .B.S, Grewal .J.S "Higher Engineering Mathematics",43rd Edition, Khanna Publications, Delhi, (2015).

REFERCENCES

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", 9th edition, Laxmi Publications Pvt. Ltd., 2014.
2. Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education,(2016).
3. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2013).

Web Link:

1. https://home.iitk.ac.in/~peeyush/102A/Lecture-notes.pdf
2. https://www.sydney.edu.au/content/dam/students/documents/mathematics-learning-entre/integration-definite-integral.pdf

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	-	-	-	-	-	-	-	-	3	2	-
2	3	3	2	-	-	-	-	-	-	-	-	3	-	-
3	3	3	2	-	-	-	-	-	-	-	-	3	-	1
4	3	3	2	-	-	-	-	-	-	-	-	3	-	-
5	3	3	2	-	-	-	-	-	-	-	-	3	-	1

3-High, 2-Medium, 1-Low, '-' – no correlation

PH22151 **APPLIED PHYSICS**

(Common to AD, CS, EE, EC, IT)

L	T	P	C
3	0	0	3

OBJECTIVES

- To enhance the fundamental knowledge in Physics and its applications relevant to various Streams of Engineering and Technology

UNIT I LASERS AND FIBER OPTICS 9

Lasers: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Nd-YAG laser – CO_2 Laser – Exceimer Laser – Applications. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, and mode) – losses associated with optical fibers–Fiber optic communication - fibre optic sensors: pressure and displacement - Endoscope.

UNIT II QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation)- deduction of Wien's and Rayleigh Jean's law – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent wave equations – particle in a one-dimensional - three dimensional potential box–Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals

UNIT III CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – interplanar distances- coordination number and packing factor for SC, BCC, FCC, HCP and Diamond structure (qualitative) - crystal imperfections: point defects, line defects – Burger vectors, stacking faults

UNIT IV WAVES AND OSCILLATIONS 9

Travelling waves, Wave equation for string ,Energy and momentum , Resonance Superposition & Reflection, Standing waves, Harmonic oscillations, Damped harmonic motion- Forced oscillations, amplitude resonance - Expression for Resonant frequency, Electrical analogy of mechanical oscillations, Quality factor and sharpness of resonance, Electrical analogy of mechanical oscillators

UNIT V ELECTROMAGNETIC WAVES 9

Maxwell's Equations. Vector and Scalar Potentials. Plane waves in Dielectric media. Poynting Theorem and Poynting Vector.- Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, EM Wave Propagation in Unbounded Media, Plane EM waves

through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Develop an understanding about photonics and Fiber Optic communication system	**2**
CO2	Acquire the knowledge of Quantum mechanics	**3**
CO3	Classify and demonstrate the fundamentals of crystals and their defects.	**3**
CO4	Gain knowledge in waves and oscillations	**2**
CO5	Enable to explore the theory of electromagnetic waves and its propagation	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Gaur R.K., Gupta S.L, "Engineering Physics", Dhanput Publications, 2015.
2. Shatendra Sharma, Jyotsna Sharma, "Engineering Physics", Pearson, 2006.
3. Rajendran V, "Engineering Physics", Tata McGraw Hill, 2009.
4. Arumugam M, "Materials Science", Anuradha Publications, 2015.

REFERCENCES:

1. David Halliday, Robert Resnick, Jearl Walker, "Principles of Physics", 10th Edition, Wiley,2015.
2. Peter Atkins, Julio De Paula, "Physical Chemistry",10th Edition., Oxford University Press,2014.
3. Arthur Beiser, Shobhit Mahajan, Rai Choudhury S,"Concepts of Modern Physics", 7th Edition, McGraw Hill Education, 2017.
4. Raghavan V, "Materials Science and Engineering", PHI Learning Pvt. Ltd., 2010

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	-	-	2	2	-	-	-	1	-	-	1	-
2	3	3	2	2	2	2	-	-	-	1	-	2	-	1
3	3	-	-	-	-	-	-	-	-	1	-	-	1	-
4	3	-	2	-	-	-	-	-	-	1	-	-	-	-
5	3	3	2	2	2	-	-	-	-	1	-	2	-	2

3-High, 2-Medium, 1-Low, '-' – no correlation

CY22151 **APPLIED CHEMISTRY**

(Common to AD, CS, EE, EC, IT)

L	T	P	C
3	0	0	3

OBJECTIVES

- To make the students conversant with basics of electrochemistry and batteries.
- To develop an understanding of the laws of photochemistry and its basics.
- To acquaint the students with the basics of nanomaterials, their properties and uses.
- To acquire the basic knowledge on sensors which are essential for the software engineers for develop new devices.
- To enable the students to understand the types of instruments for material analysis and their working principle.

UNIT I ELECTROCHEMISTRY 9

Electrodes and electrochemical cells – electrode potential, standard electrode potential, single electrode potential and its determination, types of electrodes – calomel, quinhydrone and glass electrode. Nernst equation - Determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Batteries – Primary (dry cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery) and next generation batteries.

UNIT II PHOTOCHEMISTRY 9

Laws of photochemistry – Grotthuss-Draper law, Stark–Einstein law and Lambert Beer Law – determination iron by spectrophotometer. Quantum efficiency – Photo processes – internal conversion, inter-system crossing, fluorescence, phosphorescence and photo-sensitization-quenching of fluorescence and its kinetics, Stern-Volmer relationship. Applications of photochemistry.

UNIT III NANOCHEMISTRY 9

Basics and scale of nanotechnology, different classes of nanomaterials, Distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Synthesis of nanomaterials, fabrication (lithography) and its applications – Basics of nanophotonics and quantum confined materials (surface plasmon resonance).

UNIT IV CHEMICAL SENSOR 9

Sensors, sensor science and technology, types of sensors. Chemical Sensors – characteristics and elements. Electrochemical sensors – voltammetry, potentiometric sensors, amperometric sensors, polarization techniques.

UNIT V INSTRUMENTATION TECHNIQUES 9

Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental method - Electromagnetic radiation-UV-visible and IR spectroscopy: principles, instrumentation (Block diagram only) and applications. Separation techniques chromatography: Gas chromatography, liquid chromatography -importance of column technology (packing, capillaries), separation based on increasing number of factor (volatility, solubility, interactions with stationary phase, size)

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Describe the electrolytic and electrochemical cell, various fundamental aspects of electrochemistry and batteries	**2**
CO2	Interpret the photochemical reactions and their applications	**2**
CO3	Differentiate the nano and bulk materials, their synthesis and its applications in various fields.	**3**
CO4	Acquire the basic knowledge on chemical sensors to develop an interdisciplinary approach among the students which are essential for the software engineers	**1**
CO5	Develop theoretical principles of UV-visible and IR spectroscopy and separation techniques	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Jain P.C. and Monica Jain, "Engineering Chemistry", DhanpatRai Publishing Company (P) Ltd., New Delhi, 2010.
2. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
3. B.K.Sharma, "Instrumental Methods of Chemical Analysis", 28th Edition, Goel Publishing House, 2012.
4. Skoog, D.A. Holler F.J. Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India.

REFERCENCES:

1. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
2. B.R. Puri, L.R. Sharma, M.S. Pathania., "Principles of Physical Chemistry" Vishal Publishing Company, 2008.

3. John Vetelino, AravindReghu, Introduction to Sensors , Taylor & Francis Group, CRC Press, 1st edition, 2010.
4. Peter Gründler, Chemical Sensors, An Introduction for Scientists and Engineers, Springer-Verlag Berlin Heidelberg 2007.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	2	-	-	-	-	-	-	-	3	1	1
2	3	3	-	-	-	3	3	-	-	-	-	3	-	-
3	3	3	3	-	-	3	3	1	-	-	-	3	-	1
4	3	3	3	-	1	3	3	-	-	-	-	3	-	1
5	3	3	-	2	-	3	3	-	-	-	-	3	1	-

3-High, 2-Medium, 1-Low, '-' – no correlation

EE22151 **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

(Common to all Branches except CH, EE, EC)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basic theorems used in Electrical circuits.
- To educate on the different concepts and functions of electrical machines.
- To introduce electron devices and its applications.
- To explain the principles of digital electronics.
- To impart knowledge on the principles of measuring instruments.

UNIT I ELECTRICALCIRCUITS **9**

Ohm's Law – Kirchhoff's Laws - Steady State Solution of DC Circuits using Mesh and Nodal Analysis -Introduction to AC Circuits - Waveforms and RMS Value - Power and Power factor - Single Phase and Three Phase AC Balanced Circuits.

UNIT II ELECTRICAL MACHINES **9**

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single phase induction Motor, Single Phase Transformer.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS **9**

Characteristics of PN Junction Diode - Zener Effect - Zener Diode - LED, Photo diode and its Characteristics-Half Wave and Full Wave Rectifiers-Voltage Regulation. Bipolar Junction Transistor-Common Emitter Configuration, Characteristics and CE as an Amplifier - Photo transistors

UNIT IV DIGITAL ELECTRONICS **9**

Number System Conversion Methods–Simplification of Boolean Expression using K-Map – Half and Full Adders – Flip-Flops – Shift Registers - SISO, SIPO, PISO, PIPO and 4-bit Synchronous and Asynchronous UP Counters.

UNIT V MEASURING INSTRUMENTS **9**

Types of Signals: Analog and Digital Signals- Construction and working Principle of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters. Instrumentation Amplifier, – R-2R ladder Type D/A Converter - Flash Type and Successive Approximation Type A/D Converter.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Compute the electric circuit parameters for simple problems	**2**
CO2	Understand the construction and characteristics of different electrical machines.	**1**
CO3	Describe the fundamental behavior of different semiconductor devices and circuits.	**2**
CO4	Design basic digital circuits using Logic Gates and Flip-Flops.	**3**
CO5	Analyze the operating principle and working of measuring instruments.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020.
2. SedhaR.S., "A Text Book of Applied Electronics", S.Chand&Co., 2014.

REFERCENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics Engineering", Tata McGraw Hill, 2013.
2. MehtaVK,"Principles of Electronics", S. Chand &CompanyLtd, 2010.
3. M. Morris Mano, "Digital Logic & Computer Engineering", Prentice Hall of India, 2004.
4. Mahmood Nahvi and Joseph A.Edminister,"Electric Circuits", Schaum' Outline Series, McGraw Hill, Fourth Edition, 2007.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	-	-	2	-	-	-	-	2	-	-
2	3	3	3	3	-	-	2	-	-	-	-	2	-	-
3	3	3	3	3	-	-	2	-	-	-	-	2	-	-
4	3	3	3	3	-	-	2	-	-	-	-	2	-	-
5	3	3	3	3	-	-	2	-	-	-	-	2	-	-

3-High, 2-Medium, 1-Low, '-' – no correlation

IT22101 **PROGRAMMING FOR PROBLEM SOLVING**
(Common to IT, AD, CS, EE, EC)

L	T	P	C
3	0	0	3

OBJECTIVES

- Learn the organization of a digital computer.
- Learn to think logically and write algorithms or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION TO PROBLEM SOLVING 9

Simple model of a Computer – Hardware – Software – Data Representation, Introduction to Computer Networks and Internet, Problem Solving Techniques – Bottom up design and top down design - applications, Introduction to Algorithms and Flow Chart

Suggested Activities: Case study – Understanding the analysis and design of the Student Management System (SMS).

UNIT II C PROGRAMMING BASICS 9

Introduction to 'C' programming – structure of a 'C' program – Conversion of simple algorithm to program. Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

Suggested Activities: Case study: Dataset creation and Grade calculation in SMS

UNIT III ARRAYS AND STRINGS 9

Array: declaration, initialization. Multi dimensional arrays. Strings: Strings vs Character arrays, string operations

Suggested Activities - Grade sheet generation in SMS

UNIT IV FUNCTIONS AND STRUCTURES 9

Need for Modular programming, Functions: definition, call, arguments, call by value. Call by reference, Recursion. structures and unions: Need, declaration, Accessing Structure elements, Arrays of structures

Suggested Activities: Redesigning SMS in terms of modules

UNIT V POINTERS AND FILE HANDLING IN C 9

Pointers : Introduction, pointers to primitive datatypes, pointers to user defined datatypes: arrays and structures, array of pointers, Dynamic Memory Allocation. Files: Read/Write of binary and text files. Preprocessor directives

Suggested Activities: Mange I/O in SMS using Files

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Identify input and output from the real word problem scenarios	**3**
CO2	Represent the design flow using Flow-charts and application logic using pseudo code	**3**
CO3	Apply appropriate programming constructs to implement a given design using C.	**3**
CO4	Debug and customize an existing software developed in C	**5**
CO5	Develop a modularized software application In C for the given user requirements	**6**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Pradip Dey, Manas Ghosh, "Programming in C", First Edition, Oxford University Press, 2018.
2. R G Dromey, "How to Solve it using Computer", Pearson,2006.

REFERCENCES:

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.
3. Byron S Gottfried, "Programming with C", Schaum's Outlines, Third Edition, Tata McGrawHill, 2010
4. Reema Thareja, "Programming in C", 2nd ed., Oxford University Press, 2016

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	3	-	-	-	-	-	-	3	-	-	2	2	-
2	1	3	-	-	-	-	-	-	3	-	-	2	2	1
3	1	-	3	2	1	-	-	-	3	-	-	2	3	-
4	1	-	3	2	1	-	-	-	3	-	-	2	-	3
5	1	-	3	2	1	-	-	-	3	-	-	2	1	3

3-High, 2-Medium, 1-Low, '-' – no correlation

PH22161 **PHYSICS LABORATORY**

(Common to all Branches except BT)

L	T	P	C
0	0	2	1

OBJECTIVES

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS

1. a) Determination of Wavelength, and particle size using Laser.
   b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of Young's modulus by Non uniform bending method.
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
7. Determination of Rigidity modulus of a given wire -Torsional Pendulum
8. Energy band gap of a Semiconductor
9. Determine the Hysteresis loss of a given Specimen
10. Calibration of Voltmeter & Ammeter using potentiometer.

TOTAL (P:30): 30 PERIODS

REFERENCES:

1."Physics Laboratory practical manual", 1st Revised Edition by Faculty members, 2018.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Name of the equipment	Requirement for a batch of 30 students
1.	Laser Source	6
2.	Numerical aperture and acceptance angle Kit	6
3.	Ultrasonic interferometer	6
4.	Spectrometer	6
5.	Mercury Vapour Lamp	6
6.	Lee's Disc apparatus	6
7.	Hot Plate	6
8.	Travelling Microscope	6
9.	Cary Foster's Bridge	6
10.	Torsional Pendulum	6

11.	Band Gap equipment's	6
12.	Hystersis apparatus	6
13.	Potentiometer	6

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Analyze the physical principle involved in the various instruments; also relate the principle to new application.	**4**
CO2	Comprehend the Experiments in the areas of optics, mechanics and thermal physics to nurture the concepts in all branches of Engineering.	**3**
CO3	Apply the basic concepts of Physical Science to think innovatively and also improve the creative skills that are essential for engineering.	**3**
CO4	Evaluate the process and outcomes of an experiment quantitatively and qualitatively	**3**
CO5	Extend the scope of an investigation whether or not results come out as expected	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	3	2	-	-	-	3	1	-	2	2	-
2	3	3	-	3	-	2	-	-	3	1	-	2	2	-
3	3	3	2	3	2	2	-	-	3	1	-	2	1	2
4	3	3	-	3	-	-	-	-	3	1	-	2	-	-
5	3	3	-	3	2	-	-	-	3	1	-	2	-	1

3-High, 2-Medium, 1-Low

EE22111 **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY**
(Common to all Branches except EC)

L	T	P	C
0	0	2	1

OBJECTIVES

- To provide exposure to the students with hands on experience in basic of Electrical and Electronics wiring connection and measurements.
- To introduce the students to Electrical Machines and basic laws of Electrical Circuits.

LIST OF EXPERIMENTS

1. Wiring – Residential house wiring and Stair case wiring.
2. (a) AC Analysis- Measurement of electrical quantities–voltage, current, power, and power factor using RLC.
   (b) Study of three phase system.
3. Energy conservation - Measurement and comparison of energy for incandescent lamp and LED lamp.
4. (a) Identification of circuit components (Resistor, Capacitor, Diode and BJT) and soldering practice.
   (b) Signal Measurement- Measurement of peak to peak, RMS, average, period, frequency of signals using CRO.
5. (a) VI Characteristics of Solar photovoltaic panel.
   (b) Design of Solar PV Array and Battery sizing for Residential solar PV system.
6. Design a 5V/12V Regulated Power Supply using FWR and IC7805 / IC7812.
7. DC Analysis- Verification of Ohm's Law and Kirchhoff's Laws.
8. Study of Transformer and motor characteristics.

TOTAL (P:30): 30 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

ELECTRICAL:

S.No	Description of Equipment	Quantity Required (R)
1	Assorted electrical components for house wiring	15
2	Electrical measuring instruments	10
3	Incandescent lamp and LED lamp	8
4	Power Tools: (a) Range Finder (b) Digital Live-wire detector	Each 2 Nos.
5	LED Lamp 8W and 16 W	Each 2 Nos.

6	Transformer	1
7	DC Motor	1

ELECTRONICS:

S.No	Description of Equipment	Quantity Required (R)
1	Soldering guns	10
2	Assorted electronic components for making circuits	50
3	Small PCBs	10
4	Multimeters	10
5	Photovoltaic panel 5W/10W	2
6	Light Source for PV Panel	1
7	5V/12V Regulated Power Supply	3
8	CRO	3
9	Function Generator	3
10	Regulated Power Supply	3
11	Measuring Instruments	10

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Wiring of basic electrical system and measurement of electrical parameters.	**4**
CO2	Verify the basic laws of Electric circuits and select various Electrical Machines.	**4**
CO3	Construct electronic circuits and design solar photovoltaic system.	**4**
CO4	Apply the concept of three-phase system.	**4**
CO5	Construct a fixed voltage regulated power supply.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	-	-	-	-	2	-	-	2	-	-
2	3	3	3	3	-	-	-	-	2	-	-	2	-	-
3	3	3	3	3	-	-	-	-	2	-	-	2	-	-
4	3	3	3	3	-	-	-	-	2	-	-	2	-	-
5	3	3	3	3	-	-	-	-	2	-	-	2	-	-

3-High, 2-Medium, 1-Low

IT22111 **PROGRAMMING FOR PROBLEM SOLVING LABORATORY**

(Common to IT, AD, CS, EE, EC)

L	T	P	C
0	0	3	1.5

OBJECTIVES

- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

LIST OF EXPERIMENTS

1. Usage of Basic Linux commands
2. C Programming using Simple statements and expressions.
3. Scientific problem solving using decision making and looping.
4. Simple programming for one dimensional and two dimensional arrays.
5. Solving problems using Strings
6. C Programming using Pointers
7. C Programming using user defined functions (Pass by value and Pass by reference)
8. C Programming using Recursion
9. C Programming using structures and union
10. C Programming using enumerated data types
11. C Programming using macros and storage classes
12. C Programming using Files
13. Develop modularized application for any one of the following scenarios Scenarios:
    - Student Management System
    - Stock Management System
    - Banking Application
    - Ticket Reservation System

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Hardware/Software Requirements (For a batch of 30 students)

Computer with Windows/Linux OS and C compiler -30 No.s

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply appropriate programming constructs to solve problems.	**3**
CO2	Design, implement, test and debug programs that use the basic features of C.	**5**
CO3	Design modularized applications in C to solve real world problems.	**6**
CO4	Use C pointers and dynamically allocated memory to solve complex problems	**4**
CO5	Apply file operations to develop solutions for real-world problems	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	3	-	-	-	-	-	-	3	-	-	2	2	1
2	1	3	-	-	-	-	-	-	3	-	-	2	-	-
3	1	-	3	2	1	-	-	-	3	-	-	2	2	1
4	1	-	3	2	1	-	-	-	3	-	-	2	-	2
5	1	-	3	2	1	-	-	-	3	-	-	2	1	1

3-High, 2-Medium, 1-Low

HS22251 **அறிவியல் மற்றும் தொழில்நுட்பத்தில் தமிழ்**
SCIENCE AND TECHNOLOGY IN ANCIENT TAMIL SOCIETY

(Common to all Branches)

L	T	P	C
2	0	0	2

பாடத்தின்நோக்கங்கள் :

- **அறிவியலில் தமிழின் பயன்பாடு பற்றி தெரிந்து கொள்வார்கள்.**
- **தொழில்நுட்பத்தில் தமிழ் பாரம்பரியத்தின் தாக்கம் பற்றி அறிந்து கொள்வார்கள்.**

OBJECTIVES:

- They will know about the use of Tamil in science.
- Learn about the impact of Tamil heritage on technology.

அலகு 1 அறிவியல் தமிழ் **6**

கருவி உருவாக்கம் – ஆராய்ச்சி மேம்பாடு – கல்வி வளர்ச்சி – அறிவியல் தமிழ் சொற்கள் உருவாக்கம்.

UNIT I SCIENTIFIC TAMIL

Tool Development - Research Development - Educational Development - Scientific Tamil words Creation.

அலகு 2 தொழில்நுட்பத்தில் தமிழ் **24**

வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பம் : சங்க காலத்தில் கட்டுமானப் பொருட்கள் – சோழர்களின் பெரியகோவில்கள் மற்றும் பிற வழிபாட்டுதலங்கள் – பல்லவர்களின் சிற்பங்கள் மற்றும் கோவில்கள் (மாமல்லபுரம்) - நாயக்கன் கால கோவில்கள் (மதுரை மீனாட்சி அம்மன் கோவில்), திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள்.

உற்பத்தி தொழில் நுட்பம் : கப்பல் கட்டும் கலை, உலோகவியல் ஆய்வுகள், தங்கம், தாமிரம், இரும்பு பற்றிய அறிவு – தொல்பொருள் சான்றுகள் – சுட்டக் களிமண் மணிகள், சங்கு மணிகள், எலும்பு மணிகள்.

விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பம் : அணைகள், ஏரிகள், குளங்கள், மதகுகள், சோழர் கால குமுழி தூம்பு ஆகியவற்றின் முக்கியத்துவம் – கால்நடை பராமரிப்பு, கால்நடைகளின் பயன்பாட்டிற்காக வடிவமைக்கப்பட்ட கிணறுகள். விவசாயம் மற்றும் வேளாண் செயலாக்கம் – கடல் பற்றிய அறிவு – மீன் பிடித்தல், முத்து குளித்தல், சங்கு சேகரித்தல்.

தமிழ் கணினி: அறிவியல் தமிழ் வளர்ச்சி – தமிழ் கணினி, தமிழ் புத்தகங்களின் டிஜிட்டல்மயமாக்கல், தமிழ் டிஜிட்டல் நூலகம், தமிழ் மென்பொருள் உருவாக்கம் – தமிழ் மெய் நிகர் அகாடமி – சொற்குவை திட்டம்.

தமிழின் எதிர்காலமும் தகவல் தொழில்நுட்பமும்- உலகமயமாக்கலும் தகவல் தொழில்நுட்பமும் – கணினிக்கு தமிழ் கற்று கொடுத்தல் – தமிழ்மொழித் தொழில்நுட்பத்தில் வளங்கள்.

UNIT II TAMIL IN TECHNOLOGY

Design and Construction Technology : Building materials in Sangam age – Great temples of Cholas and other workship places – Sculptures and Temples of Pallavas (Mamallapuram) – Temples of Nayakas period (Madurai Meenakshi amman temple), Thirumalai Nayakar Mahal, Chetti Nadu Houses.

Manufacturing Technology : Art of Ship building, Metallurgical studies, Knowledge about Gold, Copper, Iron – Archeological evidences – Terracotta beads, Shell beads, Bone beads.

Agriculture and Irrigation Technology: Dams, Tank, ponds, sluice, Significance of Kumuzhi Thoompu of Cholas period- Animal Husbandry, Wells designed for cattle use. Agriculture and Agro processing, - Knowledge about Sea – Fisheries, Pearl, Conche diving.

Tamil Computing : Development of Scientific Tamil – Tamil Computing, Digitization of Tamil books, Tamil Digital Library, Development of Tamil Softwares – Tamil virtual Academy – Sorkuvai project. Future of Tamil and Information Technology- Globalization and Information Technology- Teaching Tamil for Computer-Resources in Tamil Language Technology.

TOTAL (L:30): 30 PERIODS

பாடநெறி முடிவுகள் :
OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	அறிவியலில் தமிழ் மொழியின் பயன்பாடு பற்றி தெரிந்து கொள்வார்கள் They will know about the use of Tamil language in science	2
CO2	பல்வேறு தொழில்நுட்பத்தில் தமிழ்மொழியின் தாக்கம் பற்றி அறிந்து கொள்வார்கள் They will learn about the influence of Tamil language in various technologies	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

பாடநூல்கள்:
REFERCENCES:

1. டாக்டர், வா.செ .குழந்தைசாமி (1985), "அறிவியல் தமிழ்" , பாரதி பதிப்பகம், 126/108, உஸ்மான் சாலை, தியாகராய நகர் , சென்னை 600017.
2. சுப. திண்ணப்பன், (1995), "கணினியும் தமிழ் கற்பித்தலும்", புலமை வெளியீடு, 38-B மண்ணத்நதோட்டத் தெரு, ஆழ்வார்பேட், சென்னை 600018.
3. மு. பொன்னவைக்கோ, (2003), "வளர்தமிழில் அறிவியல் – இணையத் தமிழ்", அனைத்திந்திய அறிவியல் தமிழ்க் கழகம், தஞ்சாவூர் 615 005.
4. துரை. மணிகண்டன், (2008), "இணையமும் தமிழும்", நல்நிலம் பதிப்பகம், 7-3, சிமேட்லி சாலை, தியாகராய நகர், சென்னை 600 017.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	3	2	3	3	2	2	3	3	-	2	-	-
2	-	-	3	2	3	3	2	-	3	3	-	2	-	-

3-High, 2-Medium, 1-Low, '-' – no correlation

HS22252

TECHNICAL ENGLISH

(Common to all Branches)

L	T	P	C
3	0	0	3

OBJECTIVES

- To enable learners to define and understand technical communication and scientific writing.
- To expose learners to nuances of seminar presentation, group discussion, and public speaking.
- To expose learners to writing for scientific purposes.
- To expose learners to drafting correspondences for business purposes.
- To expose learners to writing for documenting purposes.
- To enable students to have a holistic understanding of job interviews and recruiting process.

UNIT I **9**

Listening - AV files pertaining to manufacturing processes of products, scientific documentaries; **Speaking** - syllable division and word stress, intonation, sharing opinions; **Reading** - news articles related to science and technology; **Writing** - definitions, instruction, recommendation, data interpretation, resume; **Grammar** - tenses and their aspects, sentence connectors - discourse markers, sequential words, active and passive voice, subject-verb agreement.

UNIT II **9**

Listening - AV pertaining to marketing strategies, peer reading and pronunciation; **Speaking** - turn taking, sharing opinions; conducting and attending a meeting, understanding the nuances of spoken communication among internal audience and external audience; **Reading** - analytical documents, descriptive documents; **Writing** - fliers, brochures, resume - letter of application, checklists; **Grammar** - modal verbs, clauses - types and uses, conditional clauses, articles.

UNIT III **9**

Listening - AV related to how to use components, scientific description, **Speaking** - speaking for motivation and initiation, speaking at a seminar presentation; **Reading** - scientific journals, papers; **Writing** - Technical descriptions - process description, purpose and function, PowerPoint, Google forms, user manuals; **Grammar** - phrasal verbs, prepositions, technical and scientific affixes.

UNIT IV **9**

Listening - scientific debates, crisis management; **Speaking** - handling conflicts, speaking about the loss of benefits, progress or decline of business, identifying the connotative meanings, **Reading**- documented evidences of uses and functions of a product, review of a product, **Writing** - memos, follow-up letters, reports - proposal, project, progress reports, sales reports, reports on industrial visits, executive summary. **Grammar** - reported speech and tag questions, sentence structure - comparative, imperative, cause and effect, infinitive of result.

UNIT V **9**

Listening - AV of Group discussions, panel discussions, face to face interviews for recruitment purposes; **Speaking**- speaking at group discussions, interviewing a personality, answering at the interviews; **Reading** - WebPages of topnotch engineering companies, **Writing** - blogging, e-mails, letter of complaint, minutes of the meeting; **Grammar** - one word substitution, collocations, better word/sentence substitution (rephrasing the content/improvising ideas).

TOTAL (L:45): 45 PERIODS

Suggested Activities [task based] - case study, guest lectures as models, problem solving, understanding teamwork.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Understand the nuances of technical communication and scientific writing	**3**
CO2	Present papers and give seminars	**6**
CO3	Discuss in groups and brainstorm	**6**
CO4	Draft business correspondences and write for documenting purposes	**6**
CO5	Face job interviews with confidence	**6**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERCENCES

1. Department of English, Anna University. "Mindscapes: English for Technologists and Engineers", Orient Blackswan, Chennai, 2012.
2. Downes, Colm, "Cambridge English for Job-hunting", Cambridge University Press, New Delhi, 2008.
3. Murphy, Raymond, "Intermediate English Grammar with Answers", Cambridge University Press, 2000.
4. Thomson, A.J., "Practical English Grammar 1 & 2", Oxford, 1986.
5. Herbert A J, "The Structure of Technical English", Longman, 1965.

Web Link:

1. http://www.usingenglish.com
2. http://www.uefap.com3
3. https://owl.english.purdue.edu/owl/
4. www.learnenglishfeelgood.com/esl-printables-worksheets.html

Software

1. Face2Face Advance - Cambridge University Press, 2014
2. English Advance Vocabulary - Cambridge University Press
3. IELTS test preparation - Cambridge University Press 2017
4. Official Guide to the TOEFL Test With CD-ROM, 4th Edition
5. CAMBRIDGE Preparation for the TOEFL TEST - Cambridge University Press, 2017

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

3-High, 2-Medium, 1-Low, '-' – no correlation

MA22251 **APPLIED MATHEMATICS – II**

(Common to all Branches except MR)

L	T	P	C
3	1	0	4

OBJECTIVES

- Acquire the concepts of vector calculus needed for problems in all engineering disciplines and compute different types of integrals using Green's, Stokes' and Divergence theorems.
- Skilled at the techniques of solving ordinary differential equations that model engineering problems.
- Extend their ability of using Laplace transforms to create a new domain in which it is easier to handle the problem that is being investigated.
- Explain geometry of a complex plane and state properties of analytic functions.
- Understand the standard techniques of complex variable theory so as to apply them with confidence in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.

UNIT I VECTOR CALCULUS **12**

Gradient, divergence and curl - Directional derivative - Vector identities – Irrotational and solenoidal vector fields - Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's theorem in a plane, Gauss divergence theorem and Stokes'theorem (excluding proofs) – Verification and application in evaluating line, surface and volume integrals.

UNIT II ORDINARYDIFFERENTIAL EQUATIONS AND ITS APPLICATIONS **12**

Differential equations of first order – Equations of the first order and first degree – Linear equations – Higher order linear differential equations with constant coefficients - Method of variation of parameters - Cauchy's and Legendre's linear equations - Simultaneous first order linear equations with constant coefficients – Applications of Linear differential equations – Oscillatory electrical circuit – Deflection of beams.

UNIT III LAPLACE TRANSFORM **12**

Conditions for existence - Transform of elementary functions - Transforms of unit step function and impulse functions – Basic properties – Shifting theorems - Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Initial and final value theorems - Transform of periodic functions. Inverse Laplace transforms - Convolution theorem – Application to solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV ANALYTIC FUNCTIONS **12**

Analytic functions - Necessary and sufficient conditions (Cauchy-Riemann equations) - Properties of analytic function - Harmonic conjugates - Construction of analytic functions - Conformal mapping –

Mapping by functions W = Z + C, CZ, 1/Z, Z^2 – Joukowski's transformation- Bilinear transformation.

UNIT V COMPLEX INTEGRATION 12

Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's series expansions - Singular points - Residues - Cauchy's Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semi-circular contour.

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

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Interpret the fundamentals of vector calculus and execute evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems.	**3**
CO2	Solve first order linear, homogeneous differential equations and use series solution method to solve second order differential equations.	**3**
CO3	Determine the methods to solve differential equations using Laplace transforms and Inverse Laplace transforms.	**3**
CO4	Explain Analytic functions and Categorize transformations.	**3**
CO5	Perform Complex integration to evaluate real definite integralsusing Cauchy integral theorem and Cauchy's residue theorem.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Erwin Kreyszing, Herbert Kreyszing, Edward Norminton, "Advanced Engineering Mathematics", 10th Edition, John Wiley, (2015).
2. Grewal .B.S, Grewal .J.S "Higher Engineering Mathematics",43rd Edition, Khanna Publications, Delhi, (2015).

REFERCENCES

1. Dass, H.K., and Rajnish Verma, "Higher Engineering Mathematics", S.Chand Private Ltd., 2011.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2013).
3. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", 9th edition, Laxmi Publications(p) Ltd., 2014.

Web Link:

1. https://nptel.ac.in/courses/111/105/111105134/
2. https://nptel.ac.in/courses/111/105/111105121/

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	-	-	-	-	-	-	-	-	-	3	-	-
2	3	3	2	-	-	-	-	-	-	-	-	3	-	-
3	3	3	2	-	-	-	-	-	-	-	-	3	-	-
4	3	3	-	-	-	-	-	-	-	-	-	3	-	-
5	3	3	-	-	-	-	-	-	-	-	-	3	-	-

3-High, 2-Medium, 1-Low, '-' – no correlation

ME22251 **TECHNICAL DRAWING**

(Common to AD, CS, IT)

L	T	P	C
1	0	2	2

OBJECTIVES

- This course will introduce the students to build their ability to read drawings and interpret the position and form of simple geometries.

UNIT 0 **CONCEPTS AND CONVENTIONS AND GEOMETRIC CONSTRUCTION (NOT FOR EXAM)** **2**

Importance of drawing in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning. Geometric construction - to draw perpendiculars, parallel lines, divide a line and circle, to draw equilateral triangle, square, regular polygons.

UNIT I **CONICS, CYCLOID, AND INVOLUTES** **7**

Geometric construction - Curves used in engineering practices: Conics - Construction of parabola and hyperbola by eccentricity method - Construction of ellipse by Concentric circle method - Drawing of tangents and normal to the above curves - Construction of cycloid in a straight line only - Drawing of tangents and normal to the above curve. Construction of involutes of square, pentagon and circle - Drawing of tangents and normal to the above involutes.

UNIT II **PROJECTION OF LINES AND PLANE SURFACES** **9**

Orthographic projection – First angle projection - 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.

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

UNIT III **PROJECTION OF SOLIDS** **9**

Projection of simple solids like prisms, pyramids, cylinder, cone when the axis is inclined to one of the principal planes and parallel to the other by rotating object method.

UNIT IV **DEVELOPMENT OF SURFACES** **9**

Development of Surfaces – Development of lateral surfaces of simple solids - Parallel line Development – Prisms, Cylinder - Radial line development – Pyramids and Cone.

UNIT V **ORTHOGRAPHIC AND ISOMETRIC PROJECTION** **9**

Isometric view of simple solids -Free Hand Drawing - Orthographic Projection - Orthographic views of simple blocks from their Isometric view

TOTAL (L:15 + P:30): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	***Construct*** conic sections, cycloid and involutes as per drawing standards.	**3**
CO2	***Draw*** orthographic projections of lines and plane surfaces.	**2**
CO3	***Sketch*** orthographic projections of simple solids.	**2**
CO4	***Develop*** the lateral surfaces of simple solids.	**2**
CO5	***Sketch*** the orthographic projections of a given isometric view using free hand.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Dhananjay M. Kulkarni, A.P. Rastogi, Ashoke K. Sarkar, "Engineering Graphics with AutoCAD", PHI Learning Private Ltd., 2009.
3. Venugopal K. and Prabhu Raja V., "Engineering Drawing + AutoCAD", New Age International (P) Limited, 6th edition, 2022

REFERCENCES

1. Dhananjay A Jolhe, "Engineering Drawing with an Introduction to AutoCAD", Tata McGraw-Hill Publishing Company Limited., 2008
2. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
4. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.

Web Link:

1. https://nptel.ac.in/courses/112105294
2. https://nptel.ac.in/courses/112103019

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	-	-	-	-	-	-	1	-	-	-	-
2	-	-	-	-	-	-	-	-	-	2	-	-	-	-
3	-	-	-	-	-	-	-	-	-	2	-	-	-	-
4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

3-High, 2-Medium, 1-Low, '-' – no correlation

CS22201 **PYTHON FOR DATA SCIENCE**

(Common to CS & AD)

L	T	P	C
3	0	2	4

OBJECTIVES

The Student should be made to:

- Acquire knowledge on the mathematical background for understanding data science.
- Learn the basics of Python programming.
- Be familiar in performing array manipulation using NumPy.
- Understand the concepts of storing, retrieving and manipulating data using Pandas.
- Create appealing plots to understand the trend and pattern of data in the simple and efficient way.

UNIT I STATISTICS FOR DATA SCIENCE **9**

Descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates.

UNIT II INTRODUCTION TO PYTHON **9**

Types and Operation: Numeric Types, String Fundamentals, List and Dictionaries, Tuples, Files, Statements: Assignments, Expressions, if tests, while and for loops, Functions: Function Basics, Scopes, Arguments, Modules: Module Coding Basics, Module Packages.

UNIT III INTRODUCTION TO NUMPY **9**

Understanding Data Types in Python, The Basics of NumPy Arrays, Computation on NumPy Arrays: Universal Functions, Aggregations: Min, Max, and Everything in Between Computation on Arrays, Comparisons, Masks, and Boolean, Fancy Indexing, Sorting Arrays, Structured Data: NumPy's Structured Arrays.

UNIT IV DATA MANIPULATION WITH PANDAS **9**

Installing and Using Pandas, Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat and Append, Combining Datasets: Merge and Join, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance Pandas: eval() and query().

UNIT V VISUALIZATION WITH MATPLOTLIB **9**

Matplotlib, Simple Line Plots, Simple Scatter, Visualizing Errors, Density and Contour Plots, Histograms, Binnings, and Density, Customizing Plot Legends, Customizing Colorbars, Multiple Subplots, Text and Annotation, Customizing Ticks, Customizing Matplotlib: Configurations and

Stylesheets, Three-Dimensional Plotting in Matplotlib, Geographic Data with Basemap, Visualization with Seaborn.

LIST OF EXPERIMENTS: **30**

1. Write a python program to perform all statistical operations using statistics package.
2. Write a python program to remove the punctuations from the string.
3. Write a python function to print the sum of numbers if and only if the number is even.
4. Write a python module to perform binary search.
5. Write a python program to create a structured array using NumPy containing employee details such as employee name, department, designation and salary. Now sort by name, if the salary is greater than 25000.
6. Write a python program to create structured arrays using NumPy containing student details such as student name, register number, marks in 5 subjects. Apply aggregation function to implement the following:
   i. Find the total marks, average marks of each student.
   ii. Identify the maximum and minimum mark subjectwise.
   iii. Find the topper of the class.
   iv. Find the pass percentage for each subject.
   v. Find the class pass percentage.
7. Write a python program to create a dataframe using pandas. Perform the following operations on the dataframe.
   i. Data Selection
   ii. Data Indexing
   iii. Handling missing data in nominal attributes
   iv. Handling missing data in numeric attributes
   v. Grouping operations
8. Write a python program to implement the following plots using Matplotlib
   i. Line plot
   ii. Scatter plot
   iii. Density plot
   iv. Box plot
   v. Histogram

TOTAL (L:45 + P:30): 75 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Students will be able to understand the mathematical foundation for data science.	**2**
CO2	Students will be able to solve computational problems in python.	**3**
CO3	Students will be able to handle python arrays using NumPy package.	**3**
CO4	Students will be able to manipulate data using Pandas.	**3**
CO5	Students will be able to understand the pattern of data by graphical displays using Matplotlib.	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, Sixth Edition, Wiley Publication, 2016.
2. Mark Lutz, Learning Python, Fifth Edition, O'Reilly Publication, 2013. (Revised in 2020)
3. Jake VanderPlas, Python Data Science Handbook - Essential Tools for Working with Data, Second Edition, O'Reilly Publication, 2022.
4. Wes McKinney, Python for Data Analysis, Third Edition, O'Reilly Publication, 2022.
5. David Beazley and Brian K. Jones, Python Cookbook, Third Edition, O'Reilly Publication, 2013.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3							3	3		3		3
2	3	3	3						3			3	3	3
3	3	3	2						2	3		3	3	
4	3	3										3		3
5	3	3								3		3	3	

3-High, 2-Medium, 1-Low, '-' – no correlation

CS22202 **DIGITAL PRINCIPLES AND SYSTEM DESIGN**

(Common to CS & AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand various number systems, different methods are used for the simplification of Boolean functions.
- To design and implement a system that uses combinational logic for the given specification; Simulate combinational logic systems using Verilog or VHDL
- To design and implement a synchronous sequential system for the given specification; Simulate sequential logic systems using Verilog or VHDL.
- To design and implement memory accessing systems and systems using PLA, PAL.
- To use RTL notation for describing register operations in a clocked sequential circuit.

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES **9**

Digital Systems - Binary Numbers - Number Base Conversions - Complements of Numbers - Introduction to Boolean Algebra and Boolean Functions - Canonical and Standard Forms - Digital Logic Gates - Integrated Circuits

UNIT II COMBINATIONAL CIRCUITS **9**

Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders and Encoders – Multiplexers and De-Multiplexers – Tri-State Gates – HDL Models of Combinational Circuits

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC **9**

Introduction - Latches and Flip Flops – Analysis of Clocked Sequential Circuits and Design Procedures – State Diagram, State Table - State Reduction & Assignment - Shift Registers – Ripple Counters – Synchronous Counters

UNIT IV MEMORY AND PROGRAMMABLE LOGIC **9**

RAM - Memory Decoding – Error Detection and Correction - ROM – Programmable Logic Array – Programmable Array Logic

UNIT V DESIGN AT THE REGISTER TRANSFER LEVEL **9**

Introduction - RTL Notation - RTL Description - Algorithmic State Machine - Design Example (ASMD Chart) - Design of Sequential Binary Multiplier

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Students will be able to learn the different types of number systems and simplification of Boolean functions	**1**
CO2	Students will be able to understand various logic gates and their usage	**2**
CO3	Students will be able to study, analyze and design various combinational circuits and its implementation using VHDL	**4**
CO4	Students will be able to understand the different type of memory and their structures	**2**
CO5	Students will be able to study, analyze of RTL notation register operations in a clocked sequential circuit	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. "Digital Design with An Introduction to Verilog HDL, VHDL and System Verilog" by M. Morris Mano and Michael D. Ciletti, 6th Edition, Pearson, 2017.

REFERCENCES

1. John F. Wakerly, "Digital Design Principles and Practices", Fourth Edition, Pearson Education,2007
2. Charles H. Roth Jr, "Fundamentals of Logic Design", Fifth Edition – Jaico Publishing House, Mumbai, 2003
3. Donald D. Givone, "Digital Principles and Design", Tata Mcgraw Hill, 2003
4. Kharate G. K., "Digital Electronics", Oxford University Press, 2010.
5. http://www.learnabout-electronics.org/Digital/dig44.php

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	-	-	-	-	-	-	-	-	3	3	3
2	3	3	3	-	3	-	-	-	-	-	-	-	2	3
3	3	3	3	-	3	-	-	-	-	-	-	-	3	3
4	3	3	3	-	-	-	-	-	-	-	-	3	3	2
5	3	3	3	-	3	-	-	-	-	-	-	3	3	3

3-High, 2-Medium, 1-Low, '-' – no correlation

CS22203 OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand object-oriented methodology, the approach to modular and reusable software systems
- To learn how to abstract a problem in an object oriented style
- To learn object oriented programming, basics to advanced level, using C++
- To understand file handling in C++
- To use the Standard Template Library (STL)

UNIT I OBJECT-ORIENTED PROGRAMMING BASICS 9

Object oriented programming - need - procedural languages - object oriented approach. Characteristics of object oriented languages - objects – classes – inheritance –reusability - polymorphism and overloading. Introduction to C++ – classes – access specifiers – function and data members – default arguments – function overloading – friend functions – const and volatile functions - static members – objects – pointers and objects – constant objects – nested classes.

UNIT II COMPILE TIME POLYMORPHISM 9

Constructors – default constructor – Parameterized constructors – Constructor with dynamic allocation – Copy constructor – destructors – operator overloading – overloading through friend functions – overloading the assignment operator – type conversion.

UNIT III RUNTIME POLYMORPHISM 9

Inheritance – public, private, and protected derivations – multiple inheritance - virtual base class – abstract class – Runtime polymorphism – virtual functions – pure virtual functions – RTTI.

UNIT IV TEMPLATES AND EXCEPTION 9

Function templates- class templates - linked list class using templates - storing user defined data types - UML and templates. Exceptions - simple exception - multiple exceptions - exceptions with the Distance Class - exceptions with arguments.

UNIT V FILES AND STANDARD TEMPLATE LIBRARY 9

Streams and formatted I/O – I/O manipulators - file handling – random access – object serialization. Introduction to the STL - algorithms - sequence containers - iterators - specialized iterators - associative containers - strong user-defined objects - function objects

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Apply the concepts of data abstraction, encapsulation and inheritance for problem solutions. Critically analyze the problem and apply Object Oriented Concepts for practical problem solving.	**2**
CO2	Develop applications with function and operator overloading.	**3**
CO3	Develop programs with reusability.	**3**
CO4	Design and implement generic classes with C++ templates and handle exceptions.	**3**
CO5	Handle large data set using file I/O and use STL.	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. B. Trivedi, “Programming with ANSI C++”, Second Edition, Oxford University Press, 2012.

REFERCENCES

1. Ira Pohl, “Object oriented programming using C++”, Second Edition, Pearson Education Asia, 2012.
2. Bjarne Stroustrup, "The C++ programming language", Fourth Edition, Addison Wesley, 2013.
3. Robert Lafore, “Object-Oriented programming in C++”, Fourth Edition, SAMS, 2001.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	-	-	-	-	-	-	3	3	3
2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	3	3	3

3-High, 2-Medium, 1-Low, ‘-‘ – no correlation

CS22211 DIGITAL PRINCIPLES AND SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES

- To be an adjunct to the "Digital System Design" Course through hands-on experience with design, construction, and implementation of digital circuits like combinational / sequential
- To provide the capability to understand and to simulate digital circuits through Xilinx

LIST OF EXPERIMENTS

1. Verification of logic gates
2. Verification of Boolean theorems
3. Combinational Circuits-Implementation of arbitrary functions and code converters.
4. Design and implementation of Binary adder/subtractor.
5. Design and implementation of Parity generator/checker.
6. Design and implementation of magnitude comparator.
7. Design and implementation of seven segment display
8. Design and implementation of applications using multiplexers.
9. Study and Implementation of Flip-Flops.
10. Design and implementation of shift registers.
11. Design and implementation of synchronous and asynchronous counters
12. Coding combinational circuits using hardware description language. (HDL s/w required)
13. Coding sequential circuits using HDL. (HDL s/w required)
14. Design and implementation of simple digital System(Mini Project)

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Digital Trainer Kits
2. Breadboard and components
3. PC s – with Xilinx for HDL
4. IC tester-1

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to understand the working of various logic gates.	**2**
CO2	Students will be able to understand the various combinational circuits and their applications.	**2**
CO3	Students will be able to study, analyze and design sequential circuits	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	-	-	-	-	-	3	-	-	3	3	3
2	3	3	3	-	3	-	-	-	3	-	-	-	2	3
3	3	3	3	-	3	-	-	-	3	-	-	-	3	3

3-High, 2-Medium, 1-Low

CS22212 **OBJECT ORIENTED PROGRAMMING LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES

- To understand object-oriented methodology, the approach to modular and reusable software systems
- To learn how to abstract a problem in an object oriented style

LIST OF EXPERIMENTS

1. Programs Using Functions
   - Functions with default arguments
   - Implementation of Call by Value, Call by Address and Call by Reference
2. Classes with objects, member functions and Constructors
   - Classes with primitive data members
   - Classes with arrays as data members
   - Classes with pointers as data members – String Class
   - Classes with constant data members
   - Classes with data members and member functions
3. Compile time Polymorphism
   - Operator Overloading including Unary and Binary Operators
   - Operator Overloading including friend functions
   - Function Overloading
4. Runtime Polymorphism
   - Inheritance
   - Virtual functions
   - Virtual Base Classes
5. Function Templates
6. Class Templates
7. Exception Handling
8. File Handling
   - Sequential access
   - Random access
9. RTTI
10. Standard Template Library

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C++ compiler (or) Server with C++ compiler supporting 30 terminals or more.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to apply object-oriented programming concepts in problem solving.	3
CO2	Students will be able to do file operations, I/O operations and exception handling.	3
CO3	Students will be able to develop applications using the standard template library.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	-	-	-	3	-	-	3	3	3
2	3	3	3	3	-	-	-	-	3	-	-	3	3	3
3	3	3	3	3	-	-	-	-	3	-	-	3	3	3

3-High, 2-Medium, 1-Low

MA22353 **DISCRETE MATHEMATICS**

(Common to CS & IT)

L	T	P	C
3	1	0	4

OBJECTIVES

The Students should be made to:

- Extend student's Logical and Mathematical ability to deal with abstraction.
- Acquire basics of set theory, functions and counting ,apply them in day to day problems
- Understand the fundamental concepts of the Graph theory and Network connectivity
- Gain the concepts to identify structures of algebraic nature, prove and use properties about them.
- Learn relations, Lattice, Boolean algebras and their properties to comprehend problems in computer Science.

UNIT I LOGIC (9+3)

Propositional Logic- Connectives -– Propositional equivalences -Normal form –Predicates and Quantifiers – Nested Quantifiers -Validity of a well-formed formula– Rules of inference

UNIT II SET THEORY AND BASICS OF COUNTING (9+3)

Basic Concepts of Set Theory- Cartesian product- The Power Set – Functions- Composition of functions -Mathematical induction- The basics of counting - Inclusion and exclusion principle and its applications – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions.

UNIT III GRAPH THEORY (9+3)

Graphs and Graph models- Graph terminology and special types of Graphs – Matrix representation of Graphs and Graph isomorphism – connectivity – Eulerian and Hamiltonian Graphs

UNIT IV ALGEBRAIC STRUCTURES (9+3)

Algebraic structures with one binary operation – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Algebraic structures (Definitions and simple examples only) with two binary operation- Ring, Integral domain and field.

UNIT V LATTICES AND BOOLEAN ALGEBRA (9+3)

Relations -Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

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

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Acquire the concepts of set theory and logic to convert from informal language to logic expressions and test the validity of a program.	**4**
CO2	Apply the counting techniques to comprehend computer simulations	**2**
CO3	Develop graph theory tools to map day-to-day applications.	**3**
CO4	Expose to the concepts and properties of algebraic structures which provides solutions in design and analysis of algorithms.	**2**
CO5	Explore Boolean algebraic structures on numerous levels, the concepts needed to test the logic of a program.	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 8thEdition, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 2021.
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata Mc Graw Hill Pub. Co. Ltd, New Delhi, 53rd reprint 2018.

REFERCENCES

1. Ralph P.Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2018.
2. Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Seymour Lipschutz and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd reprint, 6th Edition, 2016.

WEB LINK:

1. https://home.iitk.ac.in/~arlal/book/mth202.pdf
2. https://archive.nptel.ac.in/courses/106/103/106103205

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	-	-	-	-	-	-	-	3	-	-
2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
3	3	3	3	3	-	-	-	-	-	-	-	3	-	-
4	3	3	-	-	-	-	-	-	-	-	-	3	-	-
5	3	3	3	2	-	-	-	-	-	-	-	3	-	-

3-High, 2-Medium, 1-Low, '-' – no correlation

AD22301 **ARTIFICIAL INTELLIGENCE**

(Common to AD & CS)

L	T	P	C
3	0	0	3

OBJECTIVES

The main objectives of this course are to:

- Learn the basic AI approaches to develop problem solving agent
- Learn game playing
- Perform knowledge representation in Logic
- Perform probabilistic reasoning under uncertainty
- Perform Planning and Controlling Uncertain movements in robots

UNIT I PROBLEM-SOLVING **9**

Foundations of Artificial Intelligence, History of Artificial Intelligence, State of the Art, Risk and Benefits of AI; Intelligent Agents – Agents and Environments, Concept of Rationality, Nature of Environments, Structure of Agents; Problem-solving – Problem-Solving Agents, Search Algorithms, Uninformed Search Strategies, Informed Search Strategies, Heuristic Functions

UNIT II ADVERSARIAL SEARCH **9**

Game Theory, Optimal Decisions in Games, Heuristic Alpha-Beta Tree Search, Monte Carlo Tree Search, Stochastic Games; Constraint Satisfaction Problems – Inference, Backtracking Search and Local Search and Structure of Problems

UNIT III KNOWLEDGE, REASONING AND PLANNING **9**

Logical Agents - Knowledge-based agents, Logic, Propositional Logic; First-Order Logic – Representation, Syntax and Semantics, Using First-Order Logic; Inference in First-Order Logic – Unification, Forward Chaining, Backward Chaining, Resolution

UNIT IV UNCERTAIN KNOWLEDGE AND REASONING **9**

Quantifying Uncertainty – Acting under Uncertainty, Inference using Full Joint Distributions, Bayes' Rule, Naive Bayes Model; Probabilistic Reasoning – Representing Knowledge in an Uncertain Domain, Semantics of Bayesian Networks, Exact Inference, Approximate Inference in Bayesian Networks; Probabilistic Reasoning Over Time – Inference in Temporal Models, Hidden Markov Models

UNIT V ROBOTICS **9**

Reinforcement Learning – Learning from Rewards, Passive and Active Reinforcement Learning, Policy Search, Applications; Robotics – Robots, Robots Hardware, Robotic Perception, Planning and Control, Planning Uncertain Movements, Reinforcement Learning in Robotics, Humans and Robots, Robotic Frameworks, Application Domains

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Apply intelligent agent frameworks for toy problems	**3**
CO2	Apply search algorithms for game playing	**3**
CO3	Perform logical reasoning	**3**
CO4	Perform probabilistic reasoning under uncertainty	**3**
CO5	Learn robotic frameworks for various application domains	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Stuart Russell and Peter Norvig, Artificial Intelligence : A Modern Approach, Pearson, 4th Edition, 2020

REFERCENCES

1. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education,2007
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013
5. https://nptel.ac.in/

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	3	3	3	-	-	-	-	-	-	3	3	3
2	3	3	3	-	3	-	-	-	-	-	-	3	3	3
3	3	-	3	-	3	-	-	-	-	-	-	3	3	3
4	3	-	3	3	3	-	-	-	-	-	-	3	3	3
5	3	3	3	-	3	-	-	-	-	-	-	3	3	3

3-High, 2-Medium, 1-Low, ‘-‘ – no correlation

CS22301

DATABASE MANAGEMENT SYSTEMS

(Common to CS & AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To learn the fundamentals of data models and to represent a database system using ER diagrams
- To learn the Relational Algebra, SQL queries and advanced SQL features
- To learn the concepts of Functional dependencies and Normalization
- To understand the fundamental concepts of transaction, concurrency and recovery processing
- To study the various data storage and indexing techniques and cloud databases

UNIT I DATABASE DESIGN **9**

Purpose of Database Systems - View of Data - Database System Architecture - Database Languages - Entity Relationship Model – Constraints - Entity Sets – Attributes – Keys - ER Diagrams - Design Issues – Extended ER Features - Introduction of Relational Model – ER Reduction to Relational Schemas

UNIT II RELATIONAL DATABASE MODELS **9**

Structure of Relational Databases – Schema Diagrams – Relational Query Languages - Relational Algebra – Integrity Constraints - Basic Queries in SQL – Set Operations – Aggregate Operations – Sub Queries - Joins – Views – Authorization – Advanced SQL – Triggers – Functions and Procedures– Embedded SQL – Dynamic SQL

UNIT III RELATIONAL DATABASE DESIGN **9**

Functional Dependencies and Keys – Closure of Functional Dependencies Set – Closure of attributes - Dependency Preservation - Decomposition using functional dependencies – Normalization – First Normal Form – Second Normal Form – Third Normal Form – Boyce Codd Normal Form – Multivalued Dependencies - Decomposition using Multivalued dependencies – Fourth Normal Form – Join Dependencies – Fifth Normal Form.

UNIT IV TRANSACTION MANAGEMENT **9**

Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Media Recovery – Two Phase Commit -- Save Points – Concurrency – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Recovery Isolation Levels

UNIT V DATA STORAGE TECHNIQUES **9**

Overview of Physical Storage Media – RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing - Cloud Databases

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Design database using Entity Relationship model and construct ER diagrams for enterprise databases	**2**
CO2	Construct queries using Relational Algebra and SQL with advanced features	**4**
CO3	Normalize the databases to reduce cost due to data redundancy	**3**
CO4	Analyze the basic issues of transaction processing and maintain consistency of the databases.	**3**
CO5	Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the modern databases	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", McGraw Hill, Seventh Edition, 2019.
2. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Pearson Education/Addison Wesley, Seventh Edition, 2021.

REFERCENCES

1. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Pearson Education, Fifth Edition, 2009.
2. C. J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", Pearson Education, Eighth Edition, 2006.
3. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition, 2004.
4. G.K. Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
5. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T. Snodgrass, V.S. Subrahmanian, Roberto Zicari, "Advanced Database Systems", Morgan Kaufmann publishers, 2006.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	2	-	-	-	-	-	-	3	-	3	3
2	3	3	3	3	-	-	-	-	-	-	-	-	3	2
3	3	3	3	3	-	-	-	-	-	-	-	-	3	2
4	3	3	3	3	-	-	-	-	-	-	-	-	3	3
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CS22302 DATAMINING AND DATAWAREHOUSING

(Common to CS & AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To introduce students to the basic concepts and techniques of Data Mining and various classification techniques.
- To understand frequent pattern and association rule mining techniques for data analysis.
- To understand and apply various clustering techniques.
- To understand data warehouse concepts, architecture and schema.
- To understand various types of online analytical processing techniques.

UNIT I DATA MINING INTRODUCTION AND CLASSIFICATION 9

Introduction to Data Mining-Need-Applications-Process-Techniques-Predictive modeling-Database segmentation, Link analysis and Deviation detection-Data Preprocessing-Classification-Introduction and Types of Classification-Input and Output Attributes-Working of Classification-Guidelines for Size and Quality of the Training Dataset-Decision Tree Classifier-Introduction, Building decision tree using Information gain-Building a decision tree with Gini Index-Naïve Bayes Method-Understanding Metrics to Assess the Quality of Classifiers.

UNIT II ASSOCIATION MINING 9

Introduction-Defining Association Rule Mining-Representations of Items for Association Mining-The Metrics to Evaluate the Strength of Association Rules-The Naïve Algorithm for Finding Association Rules-The Apriori Algorithm -Closed and Maximal Itemsets – The Apriori–TID Algorithm for Generating Association Mining Rules-Direct Hashing and Pruning-Dynamic Itemset Counting-Mining Frequent Patterns without Candidate Generation.

UNIT III CLUSTER ANALYSIS 9

Cluster Analysis-Introduction-Applications-Desired Features of Clustering-Distance Metrics-Major Clustering Methods-Partitioning Clustering-k-means clustering-Hierarchical Clustering Algorithms-Agglomerative clustering-Divisive clustering-Density-based clustering-DBSCAN algorithm-Strengths of DBSCAN algorithm-Weakness of DBSCAN algorithm.

UNIT IV DATA WAREHOUSING & DATA MODELING 9

Data Warehouse-Historical developments-Defining data warehousing-Data warehouse architecture-Benefits of data warehousing-Data Marts-Data warehouses versus OLTP: similarities and distinction-Data Warehouse Schema-Introduction to Data Warehouse Schema-Dimension-Measure-Fact Table-Multi-dimensional view of data-types-Star Schema-Snowflake Schema-Fact Constellation Schema.

UNIT V ONLINE ANALYTICAL PROCESSING 9

Introduction-Defining OLAP-OLAP applications-Features of OLAP-OLAP Benefits-Strengths of OLAP-Comparison between OLTP and OLAP-Differences between OLAP and data mining-Representation of Multi-dimensional Data-Data Cube-Improving efficiency of OLAP by pre-computing the queries-Types of OLAP Servers-Relational OLAP and MOLAP-Comparison of ROLAP and MOLAP-OLAP Operations.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand data mining concepts and apply classification techniques.	**2**
CO2	Do data analysis using frequent pattern and association rule mining techniques.	**3**
CO3	Students will be able to apply various clustering techniques.	**3**
CO4	Students will be able to understand data warehouse concepts, architecture and schema.	**2**
CO5	Students will be able to understand various types of online analytical processing techniques.	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Parteek Bhatia, Data Mining and Data Warehousing: Principles and Practical Techniques,Cambridge University Press,2019.

REFERCENCES

1. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
3. K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
4. Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition
5. Pang, N. T., Steinbach, M. and Kumar, V., "Introduction to Data Mining", Pearson Education

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	2	-	-	-	3	-	-	3	3	3
2	3	3	3	3	3	-	-	-	3	-	-	3	3	3
3	3	3	3	3	3	-	-	-	3	-	-	3	3	3
4	3	3	3	3	3	-	-	-	3	-	-	3	3	3
5	3	3	3	3	2	-	-	-	3	-	-	3	3	3

3-High, 2-Medium, 1-Low

CS22303 **DATA STRUCTURES**

L	T	P	C
3	0	0	3

OBJECTIVES

This course will develop the student's ability

- To understand the concepts of ADTs, Lists
- To Learn linear data structures – Stacks, and Queues
- To Learn and apply nonlinear data structures - Trees
- To Learn and apply and nonlinear data structures - Graphs
- To understand Sorting, Searching and Hashing algorithms

UNIT I LINEAR DATA STRUCTURES – LIST **9**

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – –Singly linked lists- Doubly-linked lists - Circularly linked lists – All operations (Insertion, Deletion, Merge, Traversal) - Applications of lists –Polynomial Manipulation – Radix sort.

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES **9**

Stack ADT – Operations - Applications - Conversion of Infix to postfix expression - Evaluating a postfix expression - Queue ADT – Operations - Circular Queue – deQueue – Applications of queues.

UNIT III NON LINEAR DATA STRUCTURES – TREES **9**

Tree ADT – Tree traversals - Binary Tree ADT – Expression trees – Applications of trees – Binary search tree ADT – AVL Trees – B-Tree – Heap (Priority Queues) – Binary heap.

UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS **9**

Graphs - Representation of Graphs; Depth First Search and Breadth First Search; Topological Sort; Shortest Path Algorithms - Dijkstra's Algorithm - All Pairs Shortest Path; Minimum Spanning Tree - Prim's Algorithm - Kruskal's Algorithm

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES **9**

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort – Shell Sort - Merge Sort - Quick Sort - Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Use list ADT for a variety of applications and classify them	**2**
CO2	Earn a thorough knowledge in Stack and Queue ADT and will appraise the applications in various real time scenarios.	**3**
CO3	Distinguish linear and non-linear data structures, and appraise the use of Tree ADT.	**3**
CO4	Appraise the usage of graph algorithms for various applications	**3**
CO5	Critically analyze the various hashing, searching and sorting algorithms.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2013.

REFERCENCES

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
2. Reema Thareja, Data Structures using C, Second Edition, Oxford Publishers, 2014
3. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, University Press, 2008

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	-	-	3	-	-	-	-	-	-	3	3
2	3	3	3	3	-	3	3	-	-	-	-	-	3	3
3	3	3	3	3	-	3	3	-	-	-	-	-	3	3
4	3	3	3	3	-	-	3	-	-	-	-	-	3	3
5	3	3	3	3	2	-	2	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CS22304 **MICROPROCESSOR AND COMPUTER ARCHITECTURE**

L	T	P	C
3	0	0	3

OBJECTIVES

- Study the functional units of computer and basic instructions
- Study the Architecture of 8086 microprocessor
- Learn the Multiprocessor Configuration
- Learn the interfacing of I/O circuits.
- Study about the Pipelining and Hazards

UNIT I INTRODUCTION **9**

Functional units- Input-Memory- ALU-Output-Control Unit- Operational concept – Bus Structure – Software- Performance-Memory and addresses-Memory operations.Instruction Sequencing- Register Transfer- Assembly Language –Instruction Execution- Straight line Sequencing- Branching- Condition codes-Generating Memory Address

UNIT II 8086 MICROPROCESSOR **9**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation

UNIT III MULTIPROCESSOR SYSTEM **9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure - Multiprocessor configurations – Features of Pentium Processor

UNIT IV I/O INTERFACING **9**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Case studies: Stepper Motor Interface, Traffic Light control, LED display.

UNIT V PIPELINING **9**

Basic Concepts- Data Hazards- Instruction Hazards- Influence on Instruction set-Data path and Control Considerations

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the flow of instructions and data	**2**
CO2	Design and implement programs on 8086 microprocessor.	**2**
CO3	Design Multiprocessor based System	**3**
CO4	Design I/O Interfacing circuits	**3**
CO5	Understand the advantages of pipelining and apply them effectively	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007
2. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", VI edition, McGraw-Hill Inc, 2012

REFERCENCES

1. Doughlas V. Hall, "Microprocessors and Interfacing, Programming and Hardware:, MH, 2012
2. David A. Patterson and John L. Hennessey, "Computer organization and design, The Hardware/Software Interface", Morgan kauffman /Elsevier, Fifth edition, 2014

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	3	-	3	-	-	-	-	-	-	3	2	3
2	2	-	3	-	3	-	-	-	-	-	-	3	2	3
3	2	-	3	-	3	-	-	-	-	-	-	3	3	3
4	3	-	3	-	3	-	-	-	-	-	-	3	3	3
5	2	-	3	-	3	-	-	-	-	-	-	3	3	3

3-High, 2-Medium, 1-Low

CS22311 **DATABASE MANAGEMENT SYSTEMS LABORATORY**

(Common to CS & AD)

L	T	P	C
0	0	3	1.5

OBJECTIVES

- To identify different issues involved in the design and implementation of a database system for real time applications
- To identify exact queries to extract information from the database
- To work with PL/SQL features

LIST OF EXPERIMENTS

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creation of Views, Synonyms, Sequence, Indexes, Save point.
4. Creating an Employee database to set various constraints.
5. Creating relationship between the databases.
6. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
7. Write a PL/SQL block that handles all types of exceptions.
8. Creation of Procedures.
9. Creation of database triggers and functions
10. Database Connectivity with Front End Tools
11. Case study of Big Data and NoSQL.
12. Mini project
    - Inventory Control System.
    - Material Requirement Processing.
    - Hospital Management System.
    - Railway Reservation System.
    - Personal Information System.
    - Web Based User Identification System.
    - Timetable Management System.
    - Hotel Management System

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE:
Standalone desktops 30 Nos. (or) Server supporting 30 terminals or more.

SOFTWARE:

OS: Fedora / Linux, Hadoop package.

Front end: VB/VC ++/JAVA or Equivalent,

Back end: Oracle / SQL / MySQL/ PostGress / DB2 or Equivalent.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Design and implement a database schema for given problem statement.	**2**
CO2	Develop PL/SQL blocks such as stored procedures, stored functions, cursors, packages	**3**
CO3	Make the database connectivity using front-end tools for various real time applications.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	-	-	-	-	3	-	3	-	3	3
2	3	-	3	3	-	-	-	-	3	-	3	-	3	3
3	3	-	3	3	3	-	-	-	3	-	3	-	3	3

3-High, 2-Medium, 1-Low

CS22312 **DATA STRUCTURES LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES

This course will develop the student's ability to

- Learn the applications of different linear data structures
- Getting exposure in implementing the different data structures and algorithms
- Understand the sorting, searching and hashing techniques

LIST OF EXPERIMENTS

1. Study of simple Node creation using pointers, structures and study of functions.
2. Implementation of Single Linked List - Array & PointerImplementation.
3. Creation of Stack using Array implementation and Pointer implementation.
4. Conversion of Infix expression into Postfix notation using stack.
5. Creation of Queue using Array implementation.
6. Construct a Binary Search Tree with Tree traversal Techniques – Preorder, Post order and In order.
7. Construct an AVL trees as a balanced search tree and perform the Single rotation.
8. Graph Traversal Algorithm Breadth-first search, Depth-first search.
9. Perform the single source shortest path using Dijkstra’s algorithm.
10. Construct the Minimum Spanning Tree using Kruskal's and Prim's algorithm.
11. Sorting - Insertion Sort, Bubble Sort and Quick Sort.
12. Hashing Implementation of Separate chaining and Open Addressing (Linear Probing)

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C/C++ compiler 30 Nos. (or) Server with C/C++ compiler supporting 30 terminals or more

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply linear data structures and nonlinear data structures to real world problems	3
CO2	Apply graph algorithms to various real time applications and demonstrate various graph algorithms	3
CO3	Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	-	-	3	-	-	3	-	-	-	3	3
2	3	3	3	3	-	3	3	-	3	-	-	-	3	3
3	3	3	3	3	-	3	3	-	3	-	-	-	3	3

3-High, 2-Medium, 1-Low

CS22313 **MICROPROCESSOR LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES

- Introduce ALP concepts and features
- Write ALP for arithmetic and logical operations and sorting
- Understand Interfacing of I/O Devices

LIST OF EXPERIMENTS

1. Movement of data using simple instructions
2. Arithmetic operations using simple instructions
3. Problem solving using simple instructions

Experiments using Intel 8086 Processor

4. Basic Arithmetic and Logical operations
5. Moving data without overlapping
6. Code conversion
7. Swapping data between blocks
8. Matrix operations.
9. Sorting
10. String manipulations and searching
11. Password checking
12. Digital clock
13. Stepper Motor Interfacing
14. Traffic Light Control Interfacing

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Equipment List

1) 8086 Microprocessor Trainer kits – 30 nos
2) Interfacing modules – 3 nos. Each
3) Desktop Computers – 15 nos

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Practice assembly language programming	**2**
CO2	Perform various arithmetic operations, sorting using 8086	**2**
CO3	Perform interfacing of I/O devices with processor	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	3	-	3	-	-	-	3	-	-	3	2	3
2	2	-	3	-	3	-	-	-	3	-	-	3	2	3
3	2	-	3	-	3	-	-	-	3	-	-	3	3	3

3-High, 2-Medium, 1-Low

MA22454 **PROBABILITY AND QUEUEING THEORY**

(Common to CS and IT)

L	T	P	C
3	1	0	4

OBJECTIVES

- To perform probability calculations for discrete and continuous random variables.
- To categorize discrete and continuous distributions by learning their properties.
- To compute and interpret correlation coefficient and regression describing association between two variables.
- To expose the fundamental concepts of random processes and related structures.
- To describe various key features of queuing systems.

UNIT I PROBABILITY AND RANDOM VARIABLES 9+3

Notion of Probability – Conditional Probability - Baye's Theorem - Random Variables - Discrete and Continuous Random Variables – Moments – Moment generating functions.

UNIT II SPECIAL DISTRIBUTIONS 9+3

Discrete Distributions - Binomial, Poisson, Geometric, Hypergeometric Distributions; Continuous Distributions - Uniform, Exponential, Gamma, Weibull and Normal Distributions and their properties.

UNIT III TWO - DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression for two variables– Transformation of random variables – Central Limit Theorem.

UNIT IV RANDOM PROCESS 9+3

Definition - Classification – Poisson Process – Markov Process – Discrete parameter Markov Chain – Chapman Kolmogorov equations – Limiting distributions - Birth and Death Processes.

UNIT V QUEUEING SYSTEMS 9+3

Characteristics of queuing systems - Little's Formula - Markovian queues – Single and multiple server queueing models – Queues with finite waiting rooms - Finite source models – Non- Markovian queues - M/G/1 queue – Pollaczek Khinchin formula.

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

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Extend and formalize the knowledge of probability theory and random variables.	**3**
CO2	Describe commonly used univariate discrete and continuous probability distributions and apply various distributions to solve real world problems.	**3**
CO3	Identify various distribution functions and acquire skills in handling situations involving more than one variable.	**3**
CO4	Analyse various classifications of Random Processes and characterize phenomena which evolve with respect to time in a probabilistic manner.	**3**
CO5	Understand the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Ibe. O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Edition Indian Reprint, 2010.
2. Gross. D. and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student edition, 2013.

REFERCENCES

1. Robertazzi, "Computer Networks and Systems: Queueing Theory and Performance Evaluation", Springer, 3rd Edition, Reprint 2011.
2. Taha H.A., "Operations Research", Pearson Education, Asia, 10th Edition, 2019.
3. Veerarajan. T, “Probability, Statistics and Random Processes”, McGraw Hill Publishers, 3rd Edition, 2013.
4. Hwei Hsu, "Schaum’s Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2013.
5. Yates R.D. and Goodman. D. J., "Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.

WEBLINKS:

1. https://www.analyticsvidhya.com/blog/2016/04/predict-waiting-time-queuing-theory/
2. https://www.informit.com/articles/article.aspx?p=1863432&seqNum=3

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2									2		
2	3	3	2									2		
3	3	3	2	2								2		
4	3	3	2	2								2		
5	3	3	2	2	2							2		

3-High, 2-Medium, 1-Low

CS22401 **OPERATING SYSTEMS**

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basics and functions of operating systems.
- To analyze scheduling algorithms and process synchronization
- To understand the concept of deadlocks and analyze various memory management schemes
- To be familiar with I/O management and file systems.
- To be familiar with the Influential Operating Systems

UNIT I INTRODUCTION **9**

Computer System - Organization and Architecture- Operating System Overview - Evolution of Operating System- Operating System Structures – Operating System Services - User and Operating System Interface - System Calls – System Programs - Design and Implementation - Operating System Generation and System Boot.

UNIT II PROCESS MANAGEMENT AND PROCESS SYNCHRONIZATION **9**

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication- CPU Scheduling - Scheduling criteria - Scheduling algorithms. Threads - Multithread Models – Threading issues. Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization – Monitors.

UNIT III DEADLOCK AND MEMORY MANAGEMENT **9**

Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock. Memory- Memory Partitioning - Memory Allocation Algorithms – Segmentation – Paging. Virtual Memory - Demand Paging – Copy on Write - Page Replacement Algorithms - Allocation of Frames – Thrashing.

UNIT IV STORAGE MANAGEMENT **9**

Mass Storage system – Disk Structure - Disk Scheduling and Management, File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT V INFLUENTIAL OPERATING SYSTEMS **9**

Feature Migration-Early Systems- Atlas- XDS-940- THE- RC 4000- CTSS- MULTICS- IBM OS/360- TOPS-20- MS/DOS- Macintosh Operating System- Mach-Case Study-The Linux System

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Infer the OS features and operations while working in operating system	**2**
CO2	Analyze various scheduling algorithms and process synchronization	**4**
CO3	Evaluate the performance of various memory management techniques	**5**
CO4	Design a simple file system and analyze the performance	**4**
CO5	Work with some popular operating systems like Linux, Windows	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERCENCES

1. Ramaz Elmasri, A. Gil Carrick, David Levine, “ Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7 th Edition, Prentice Hall, 2018
3. Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016
4. Neil Smyth, ―iPhone iOS 4 Development Essentials – Xcode, Fourth Edition, Payload media, 2011.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	2	2					3	2	3	1	1	2
2	2	2	3	1	1				2	1	1	2	2	2
3	1	3	2	2	1				2	2	1	1	1	2
4	1	3	3	3					1	2	1	2	1	2
5	3	1	2	1	1				3	2	3	2	2	1

3-High, 2-Medium, 1-Low

CS22402 **MACHINE LEARNING TECHNIQUES**

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basic concepts of machine learning and parametric estimation methods.
- To gain knowledge on supervised learning methods.
- To provide insights on unsupervised learning methods and ensemble models.
- To introduce basic graphical models and advanced machine learning techniques.
- To apply various metrics to evaluate the performance of the models.

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Machine learning concepts - Need for Machine Learning - Types of Machine Learning - Supervised Learning - Unsupervised Learning - Reinforcement Learning.

Leaning Theory - Learning Types - Computation Learning - Concept Learning - Design of learning system - Bias and Variance, Modelling - Learning frameworks.

UNIT II SUPERVISED LEARNING 9

Classification models - Naïve Bayes Classifier - K-Nearest Neighbor model - Perceptron - Backpropogation Algorithm - Multilayer Perceptron – Linear and Logistic Regression - Support Vector Machines.

UNIT III UNSUPERVISED LEARNING AND ENSEMBLE MODELS 9

Clustering - K-Means clustering - Hierarchical Clustering - Dimensionality Reduction - Principal Component Analysis (PCA) - Linear Discriminant Analysis (LDA). Ensemble Methods: Bagging - Boosting - Gradient boosting.

UNIT IV GRAPHICAL MODELS AND REINFORCEMENT LEARNING 9

Markov random fields - Hidden Markov Models - Representation - Learning - Decoding - Inference in graphical models - Monte Carlo models – Sampling.

Reinforcement Learning - Model Based - Model Free - Q learning - Introduction to Deep learning - Introduction to Evolutionary Computing.

UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 9

Guidelines for machine learning experiments - Cross Validation (CV) and Resampling – K-fold Cross Validation – Bootstrapping - Measuring classifier performance – Assessing a single classification algorithm – Comparing two classification algorithms – t test, McNemar's test.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Illustrate basics of the machine learning concepts and Learning theory	**2**
CO2	Demonstrate the usage of supervised learning models.	**3**
CO3	Demonstrate the usage of unsupervised learning models and ensemble models.	**3**
CO4	Illustrate the graphical models and graphical learning techniques.	**3**
CO5	Analyse the performance of machine learning models.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Sridhar S, Vijayalakshmi M, "Machine Learning", Oxford University Press, First Edition, 2021.
3. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

REFERCENCES

1. MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2018.
2. Peter Flach, "Machine Learning", First Edition, Cambridge University Press, 2012.
3. Tom Mitchell, "Machine Learning", First Edition, McGraw Hill, 1997.
4. Kevin P. Murphy. "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
5. Ameet V Joshi, "Machine Learning and Artificial Intelligence", Springer, 2020.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	3	2	2	2	2	2	3	3	2	2	2	2
2	3	3	3	2	3	2	2	2	2	3	3	3	3	3
3	3	3	3	3	3	2	2	2	2	3	3	3	3	3
4	3	3	3	3	3	2	2	2	3	3	3	3	3	3
5	2	3	3	3	2	2	2	2	3	3	3	2	2	2

3-High, 2-Medium, 1-Low

CS22403 DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES

- Analyze the asymptotic performance of various algorithms
- Design algorithms using divide and conquer approach
- Design algorithms using dynamic programming and greedy technique
- Understand the methods for iterative improvement and computational geometry
- Design algorithms using Backtracking and Brach and bound approach and learn about Class P, NP, NP-complete and NP-hard.

UNIT I INTRODUCTION **9**

The Role of Algorithms in Computing: Algorithms as a technology - Fundamentals of algorithmic problem solving – Analysis framework – Growth of functions: Asymptotic notation – Standard notations and common functions. Mathematical analysis of Non recursive and recursive algorithms- Insertion Sort algorithm and analysis – Brute force approach: Sequential search, Traveling Salesman Problem, Knapsack problem.

UNIT II DIVIDE AND CONQUER **9**

The Substitution Method for Solving Recurrences – The Recursion-Tree method for Solving Recurrences- The Master Method for Solving Recurrences – Merge sort, Quick sort algorithm and analysis – The maximum-sub array problem – Finding Closest Pair of Points.

UNIT III DYNAMIC PROGRAMMING, GREEDY TECHNIQUE AND STRING MATCHING ALGORITHMS **9**

Dynamic Programming: Knapsack Problem and memory functions, Longest common subsequence, Optimal Binary Search Tree, Warshall's and Floyd's Algorithm. Greedy Technique: Minimum Spanning Trees – Kruskal's and Prim's Algorithms, Single source Shortest Paths - Dijkstra's Algorithm, Huffman Trees. String Matching algorithms: The naïve approach, Rabin-Karp algorithm, Knuth- Morris-Pratt algorithm.

UNIT IV ITERATIVE IMPROVEMENT AND COMPUTATIONAL GEOMETRY **9**

Maximum Flow: Flow networks, Ford Fulkerson method, Maximum Bipartite matching – Linear Programming: Standard and Slack Forms, The Simplex Algorithm, Geometric Interpretation of Linear Programming - Computational Geometry: Line Segment Properties, Graham Scan, Jarvis's March.

UNIT V COPING WITH LIMITATIONS OF ALGORITHMIC POWER AND NP-COMPLETENESS **9**

Backtracking: N-Queen's problem, Subset-sum problem – Branch and bound: Knapsack problem, Traveling salesman problem - NP-completeness and the classes P and NP: Polynomial Time, Polynomial Time

Verification, Circuit Satisfiability, Formula satisfiability, 3-CNF satisfiability, The Clique Problem, Vertex Cover.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Analyze the running time of algorithms using asymptotic analysis.	**4**
CO2	Apply the divide-and-conquer techniques and analyze the running time of the algorithms in real-world problems.	**3**
CO3	Apply the dynamic programming and greedy paradigms and analyze the running time of the algorithms using those techniques.	**3**
CO4	Employ iterative improvement and computational geometry methods to solve engineering problems.	**3**
CO5	Describe the limitations of algorithm power and methods to cope with the limitations of algorithm power for various problems	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

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

REFERCENCES

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
2. Donald E. Knuth, "The Art of Computer Programming", Volumes 1& 3 Pearson Education, 2009.
3. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.
4. http://nptel.ac.in/

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	-	1	1	-	1	1	1	2	1	3
2	2	3	3	3	-	-	-	-	2	-	1	1	1	2
3	2	3	3	3	-	-	-	-	2	-	1	1	1	2
4	2	2	3	3	-	-	-	-	1	-	-	-	1	3
5	3	2	2	3	1	-	-	-	1	-	-	-	1	3

3-High, 2-Medium, 1-Low, '-' – no correlation

CS22409 JAVA PROGRAMMING: THEORY AND PRACTICES

L	T	P	C
3	0	2	4

OBJECTIVES

- To understand the basic concepts of object-oriented programming (OOP) and how they apply to Java.
- To be familiar with the fundamentals of Classes, Packages and Inheritance.
- To define and implement Interfaces and Exceptions in Java
- To understand and demonstrate I/O Streams and Multithreading concept.
- To design and build Graphical User Interface Application using Applet and JAVAFX

UNIT I INTRODUCTION TO OOP AND JAVA 9+6

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment – Java Source File - Structure – Compilation. Fundamental Programming Structures in Java – Comments, Data Types, Variables, Operators, Control Flow, Arrays - JavaDoc comments.

Suggested Activities :

Develop a Java program which initializes earning of an employee. The program should calculate the income tax to be paid by the employee as per the criteria given below:

SLAB RATE	IT RATE
Upto Rs.50000	NIL
Upto Rs.60000	10% on additional amount
Upto Rs.150000	20% on additional amount
Above Rs.150000	30% on additional amount

UNIT II CLASSES, PACKAGES AND INHERITANCE 9+6

Defining classes in Java – constructors, methods -access specifiers - static members – Package creation Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes –- Object cloning -inner classes.

Suggested Activities :

Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary

UNIT III INTERFACES , STRINGS AND EXCEPTION HANDLING 9+6

Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces -Exceptions - exception hierarchy - throwing and catching exceptions – built-

in exceptions, creating own exceptions- String Manipulations.

Suggested Activities :

- Write a java program to define an interface advancedArithmetic which contains a method signature int divisor sum(int n). Implement it in a class mycalculator to calculate sum of divisors of a number.
- Write a java program to check if two strings are anagrams of each other
- Write a java program to create your own exception as NeagtiveValueException whenever negative values are put in an array

UNIT IV I/O STREAMS AND MULTITHREADING 9+6

Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files. Differences between multi-threading and multitasking, thread life cycle, creating threads, Inter-thread communication.

Suggested Activities :

- Write a java program to copy the contents of one file to another using file stream.
- Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number

UNIT V JAVA APPLET AND JAVAFX 9+6

Introduction and Advantage of Applet-How to create and run an Applet and Applet Viewer-Life, cycle of Applet-Introduction to JAVAFX - Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – Menus – Basics – Menu – Menu bars – MenuItem.

Suggested Activities :

Develop Student management application using JavaFX controls, layouts and menus

TOTAL (L:45 + P:30): 75 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the fundamentals of Java programming including variables, data types, control structures and methods.	**2**
CO2	Apply the concepts of problems classes, objects, packages and inheritance to solve simple problems.	**3**
CO3	Create Java applications with Interfaces, Strings and Exception Handling mechanism.	**6**
CO4	Apply the concepts of streams and multithreaded model to solve real world problems	**3**
CO5	Apply the concepts of Applet, JavaFX components and controls for developing GUI based applications	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

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

REFERCENCES

1. Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
2. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018.
3. Steven Holzner, ―Java 2 Black book, Dreamtech press, 2011.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	1	3	1	3	-	-	-	3	2	2	2	3	1
2	2	1	3	2	1	-	-	-	2	1	1	3	3	3
3	3	3	1	2	2	-	-	-	3	2	1	2	3	1
4	3	1	2	2	2	-	-	-	1	2	1	3	3	1
5	1	1	2	3	2	-	-	-	3	2	1	2	3	3

3-High, 2-Medium, 1-Low

GE22451 **ENVIRONMENTAL SCIENCES AND SUSTAINABILITY**

L	T	P	C
3	0	0	3

(Common to All Branches)

OBJECTIVES

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution.
- To study and understand the various types of renewable sources of energy and their applications.
- To familiarize the concept of sustainable development goals, economic and social aspects of sustainability, recognize and analyze climate changes, and environmental management challenges.
- To inculcate and embrace sustainability practices, develop a broader understanding of green materials and energy cycles, and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENT AND BIODIVERSITY **9**

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– food chains, food webs and ecological pyramids, ecological succession. Biodiversity- types-genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: fragmentation and habitat loss, poaching of wildlife, human-wildlife conflicts – endangered and endemic species of India –conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION **9**

Definition, causes, effects and preventive measures of air, water and soil pollution. Marine and thermal pollution - causes, effects and control measures. Light and noise pollution - effect on flora and fauna. Nuclear pollution- Sources, effects and control measures. Disposal of radioactive wastes (Nuclear hazards). Pollution case studies. Role of an individual in the prevention of pollution. Solid, hazardous and E-waste management. Occupational health and safety management system (OHASMS). Environmental protection, Environmental protection acts, categorization of spices according to IUCN.

UNIT III RENEWABLE SOURCES OF ENERGY **9**

Energy resources: Growing energy needs, Nonrenewable resources – types, uses. Energy management and conservation - New energy sources, Need of new sources - geo suitability of establishing renewable energy sources, different types new energy sources. Applications of hydrogen energy, ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Role of an individual in conservation of energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT **9**

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols, Sustainable Development Goals-targets, indicators and intervention areas - Principles of green chemistry, Climate change- Global, Regional and local environmental issues and possible solutions-case studies - Role of non-governmental organization, Concept of carbon credit, carbon footprint - Environmental management in industry - A case study

UNIT V SUSTAINABILITY PRACTICES **9**

Zero waste and R concept, circular economy, ISO 18000 series, material life cycle assessment, environmental impact assessment. Wasteland reclamation, Sustainable habitat: green buildings, green materials, energy efficiency and energy audit, sustainable transports. Energy cycles, carbon cycle, emission and sequestration, Green engineering: sustainable urbanization- socio-economical and technological change. Rainwater harvesting, watershed management, environmental ethics: Issues and possible solutions.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Recognize the fundamental role of ecosystems and suggest an appropriate method for the conservation of biodiversity.	3
CO2	Describe the different types of pollution, their effects and strategies to control pollution.	3
CO3	Identify the various renewable energy resources and use the appropriate one thereby conserving non-renewable resources for future generation.	3
CO4	Explain the various goals of sustainable development applicable to suitable technological advancement and societal development.	2
CO5	Summarize the various sustainability practices, green materials, energy cycles, and the role of green engineering in sustainable urbanization.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 7th Edition, New Age International Publishers, 2022.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Pearson. 2011.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, CL Engineering, 2015.

6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERCENCES

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 3rd edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 3rd edition, 2021.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	-	-	-	3	3	2	-	2	-	1	-	-
2	3	-	-	-	-	3	3	2	-	2	-	2	-	-
3	3	-	1	-	-	3	3	1	-	2	-	1	-	-
4	3	-	-	-	-	3	3	3	-	2	-	2	-	-
5	3	-	-	-	-	3	3	3	-	2	-	2	-	-

3-High, 2-Medium, 1-Low

CS22411 **OPERATING SYSTEMS LABORATORY**

(Common to CS and AD)

L	T	P	C
0	0	3	1.5

OBJECTIVES

- To install Linux operating systems and understanding the basics of Unix command and shell programming.
- To implement various various Memory management and Storage management strategies.
- To implement Process Management techniques

LIST OF EXPERIMENTS

1. Installation of Linux operating system
2. Implement UNIX commands and Shell Programming
3. Process Management using System Calls : Fork, Exit, Getpid, Wait, Close
4. Write C programs to Implement the various File Organization Techniques
5. Implement the following File Allocation Strategies using C programs
    a. Sequential b. Indexed c. Linked
6. Write C programs for the implementation of FCFS disk scheduling algorithm
7. Write C programs to implement the various CPU Scheduling Algorithms
8. Implement the Inter-Process communication strategy
9. Implement Mutual Exclusion by Semaphore
10. Write a C programs to avoid Deadlock using Banker's Algorithm
11. Write a C program to Implement Deadlock Detection Algorithm
12. Write C program to implement Threading
13. Implement the Paging and SegmentationTechniques using C program
14. Write C programs to implement the following Memory Allocation Methods
    a. First Fit b. Worst Fit c. Best Fit
15. Write C programs to implement the various Page Replacement Algorithms

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C / C++ / Java / Equivalent complier 30 Nos.

Server with C / C++ / Java / Equivalent complier supporting 30 terminals.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Define and implement UNIX Commands,	**1**
CO2	Experiment the various Memory management and Storage management strategies.	**3**
CO3	Demonstrate Process Management techniques	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	3	1	1				1	3	3	3	2	1
2	3	1	1	2	2				3	2	1	1	3	1
3	3	3	2	1	2				3	3	1	2	2	2

3-High, 2-Medium, 1-Low

CS22412 **ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES

- To implement search strategies for toy and real-world problem
- To construct knowledge base and perform inferencing using First-order Logic
- To learn to implement supervised and unsupervised machine learning algorithms on standard datasets and evaluate the performance.
- To compare the performance of different ML algorithms and select the suitable one based on the application.

LIST OF EXPERIMENTS

1. Implement **exhaustive search** for Tic-Tac-Toe game
2. Implement **Breadth First Search** and **Depth First Search** for Water Jug problem
3. Implement **A*** algorithm to find the shortest path
4. Implement **Minimax** algorithm for Tic-Tac-Toe game
5. Study of **Prolog** Commands
6. Implement **Forward Chaining and Backward chaining** using First Oder Logic
7. Implement **Linear Regression** model to predict the house price and evaluate the error rate and R^2 value.
8. Implement **Naïve Bayes Classifier** using the iris data set for building the model and apply this knowledge to classify a new sample.
9. Implement **decision tree based ID3 algorithm** using the diabetes data set for building the decision tree and apply this knowledge to classify a new sample.
10. Implement **Multilayer Perceptron** model to classify a set of documents and measure the accuracy, precision, and recall.
11. Implement **XGBoost Regression** to predict the car prices. Analyze the performance of the model by applying various metrics.

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE:

Standalone desktops – 30 Nos. (or) Server supporting 30 terminals or more

SOFTWARE:

Prolog, Python compiler in Ubuntu OS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Implement search strategies for toy and real-world problems	**3**
CO2	Apply supervised and unsupervised machine learning algorithms on standard datasets and evaluate the performance.	**3**
CO3	Assess and compare the performance of different ML algorithms and select the suitable one based on the application.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	2	2	2	2	2	2	2	3	3	3	3
2	3	2	3	3	2	2	2	2	3	3	3	2	3	3
3	3	3	3	3	3	2	2	2	2	3	3	2	2	3

3-High, 2-Medium, 1-Low

CS22501 **COMPUTER NETWORKS**

(Common to CS and IT)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the concepts of computer network and Internet.
- To be familiar with real time applications of networks.
- To learn the Transport Layer, flow control and congestion control algorithms.
- To be exposed to various addressing schemes and routing protocols.
- To understand the link, physical layers and error detection-correction of data.

UNIT I INTRODUCTION TO COMPUTER NETWORK & INTERNET 9

What is Internet-The Network Edge-The Network Core- Delay, Loss, and Throughput in Packet Switched Networks- Protocol Layers and Their Service Models – Top Down Vs Bottom Up Approach- Networks Under Attack- History of Computer Networking and the Internet.

UNIT II APPLICATION LAYER 9

Principles of Network Applications- The Web and HTTP- File Transfer: FTP- Electronic Mail in the Internet- DNS—The Internet's Directory Service- Peer-to-Peer Applications- Basic operating system utilities: ping, traceroute, dig, lsof - Socket Programming: Creating Network Applications.

UNIT III TRANSPORT LAYER 9

Introduction and Transport-Layer Services- Multiplexing and De-multiplexing- Connectionless Transport: UDP- Principles of Reliable Data Transfer- Connection-Oriented Transport: TCP- Principles of Congestion Control- TCP Congestion Control, Network assisted congestion control.

UNIT IV NETWORK LAYER 9

Introduction- Virtual Circuit and Datagram Networks- What's Inside a Router- The Internet Protocol (IP): IPv4 and IPv6, Addressing, Forwarding, Fragmentation and Reassembly in the Internet- Challenges of IPv6- Routing Algorithms- Routing in the Internet- Broadcast and Multicast Routing.

UNIT V DATALINK & PHYSICAL LAYERS 9

Introduction to the Link Layer- Error-Detection and Correction Techniques- Multiple Access Links and Protocols- Switched Local Area Networks- Link Virtualization: A Network as a Link Layer- Wireless Links and Network Characteristics- Wireless LANs- Physical Layer: Digital Transmission – Multiplexing and Spread Spectrum - Transmission Media.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to understand the concepts of computer networks and Internet.	**2**
CO2	Students will be able to categorize different application layer level protocols based on user's request.	**2**
CO3	Students will be able to apply the knowledge of addressing scheme and various routing protocols in data.	**3**
CO4	Students will be able to examine the flow of information from one node to another node in the network.	**4**
CO5	Students will be able to distinguish the link, physical layers and error detection-correction of data.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", 8th Edition, Pearson Education, 2021.

REFERCENCES

1. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, McGrawHill, 2011.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.
3. Andrew S. Tanenbaum; David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall publisher, 2010.
4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	-	-	-	-	-	-	-	-	2	-	-
2	3	3	2	-	-	-	-	-	-	-	-	2	-	-
3	3	3	2	2	-	-	-	-	-	-	-	2	-	-
4	3	3	2	2	-	-	-	-	-	-	-	2	-	-
5	3	3	2	2	2	-	-	-	-	-	-	2	-	-

3-High, 2-Medium, 1-Low

CS22502 **SOFTWARE ENGINEERING**

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand generic models to structure the software development process.
- Understand fundamental concepts of requirements engineering and Analysis modeling.
- Understand the major considerations for enterprise integration and deployment.
- Learn various testing and maintenance measures.
- Learn the concepts of Software Quality Assurance and Risk Management.

UNIT I SOFTWARE PROCESS AND PROJECT MANAGEMENT 9

Software Engineering Process Paradigms- Phases and models of Software Development lifecycle- Project management Process and Project Metrics - Software estimation Empirical estimation models- planning Risk analysis -Software project scheduling and Tracking.

UNIT II REQUIREMENTS ANALYSIS AND MODELING 9

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

UNIT III SOFTWARE DESIGN 9

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

UNIT IV TESTING AND PRODUCT METRICS 9

Software testing fundamentals - Internal and external views of Testing-white box testing- basis path testing-control structure testing-black box testing- Testing Methodologies - System Testing and Debugging - Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

UNIT V RISK MANAGEMENT AND QUALITY MANAGEMENT 9

Risk Management- Reactive vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan - Quality Management: Quality concepts, software quality assurance, statistical software quality assurance, software reliability, Reverse Engineering and Reengineering.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Student will be to identify the key activities in managing a software project.	**3**
CO2	Student will be able to compare different process models. Concepts of requirements engineering and Analysis Modelling.	**2**
CO3	Student will be able to apply systematic procedure for software design and deployment.	**3**
CO4	Student will be able to compare and contrast the various testing and product metrics.	**3**
CO5	Student will be able to recognize the concepts of Software Quality Assurance, Risk Management and Reverse Engineering.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.

REFERCENCES

1. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
2. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.
3. Stephen R. Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	1	-	-	-	-	-	-	-	-	-	2	-
2	2	2	3	2	-	-	-	-	-	-	-	-	3	-
3	3	-	1	-	-	-	-	-	-	-	-	-	1	-
4	1	2	2	3	-	-	-	-	-	-	-	-	2	-
5	2	2	3	-	-	-	-	-	-	-	-	-	1	-

3-High, 2-Medium, 1-Low

CS22503 USER INTERFACE TOOLS AND TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the concepts and architecture of the World Wide Web.
- To understand and practice Markup Language.
- To understand Embedded Dynamic Scripting on Client-side Internet Programming.
- To understand and practice Web Scraping and user interface design.
- To understand and practice Server-side JS Framework.

UNIT I INTRODUCTION TO WWW 9

Introduction to Computer networks - Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol – Chat - Overview of HTTP, HTTP request – response – Generationof dynamic web pages.

UNIT II UI DESIGN 9

HTML5: What is HTML5 - Features of HTML5 – Semantic Tags – New Input Elements and tags - Media tags (audio and video tags) – Designing Graphics using Canvas API - Drag and Drop features – Geolocation API - Web storage (Session and local storage).

CSS3: What is CSS3 –Features of CSS3 – Implementation of border radius, box shadow, image border, custom web font, backgrounds - Advanced text effects(shadow) - 2D and 3D Transformations - Transitions to elements - Animations to text and elements

UNIT III INTRODUCTION TO JAVASCRIPT AND XML 9

Introduction - Core features - Data types and Variables - Operators, Expressions and Statements - Functions & Scope - Objects - Array, Date and Math related Objects - Document Object Model - Event Handling –Browser Object Model - Windows and Documents - Form handling and validations. Object-Oriented Techniques in JavaScript - Classes – Constructors and Prototyping – JSON - Introduction to XML & AJAX .

UNIT IV INTRODUCTION TO WEB SCRAPING AND HCI 9

What is Web scraping - Why to do Web Scraping - Programming languages - Download & Installation of Python - Scraping data from Website using Python- Human Computer Interaction-How to design Systems- How to design Screens.

UNIT V INTRODUCTION TO SERVER-SIDE JS FRAMEWORK – NODE.JS 9

Introduction - What is Node JS – Architecture – Feature of Node JS - Installation and setup - Creating web servers with HTTP (Request & Response) – Event Handling - GET & POST implementation - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Students will develop the concepts of concepts and architecture of the World Wide Web.	**3**
CO2	Students will need to analyse Web scraping operations and to acquire knowledge about interface design.	**4**
CO3	Students will be able to the interface Client-side validation using scripting languages and open source JavaScript libraries.	**5**
CO4	Students will be to accomplish and explore markup languages features and create interactiveweb pages using them.	**2**
CO5	Students will be able to develop the knowledge about functionalities of Client-side and Server-side JS frameworks.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Web Technologies - A Computer Science Perspective-Jeffrey C. Jackson, 4th Edition, 2007.
2. Krasimir Tsonev,"Node.js by Example", Packt Publishing, 2015.

REFERCENCES

1. An Introduction to web development and Programming – Michael Mendez Suny Fredonia, 2014.
2. David Flanagan, "Java Script:The Definitive Guide, Sixth Edition", O'Reilly Media, 2011.
3. Sandro Pasquali, "Mastering Node.js", First Edition, Packt Publishing, 2013.
4. Matt Frisbie,"Angular2 Cookbook", First Edition, Packt Publishing, 2017.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	-	-	-	-	-	-	3	-	3	3
2	3	-	3	3	-	-	-	-	-	-	3	-	3	3
3	3	-	3	3	3	-	-	-	-	-	3	-	3	3
4	3	3	3	3	3	-	-	-	-	-	3	-	3	3
5	2	3	3	3	3	-	-	-	-	-	2	-	3	3

3-High, 2-Medium, 1-Low

CS22504 **THEORY OF COMPUTATION**

L	T	P	C
3	0	0	3

OBJECTIVES

The student should be made to:

- Understand the various Computing models like Finite State Machine, Pushdown Automata and Turing Machine.
- Learn the various equivalences of Computing Models.
- Learn Formalism, regular expressions and types of grammars.
- Understand the Simplification methods and Normal Forms for grammars.
- Understand equivalence and various properties of the computing models. Be aware of Decidability and Un-decidability of various problems.

UNIT I FINITE AUTOMATA AND REGULAR LANGUAGES 11

Central concepts of Automata – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions. Regular expressions – Algebraic laws for Regular Expressions - Finite Automata and Regular expressions – Pumping Lemma for Regular languages - Equivalence and Minimization of Automata.

UNIT II CONTEXT FREE GRAMMARS AND PUSHDOWN AUTOMATA 9

Types of Grammars. Context Free Grammars - Parse Trees – Ambiguity in Grammars and Languages. Pushdown Automata- Definitions – Moves – Instantaneous Descriptions – Acceptance by Final State - Acceptance by Empty Stack - Equivalence of Pushdown automata and CFG- Deterministic Pushdown Automata.

UNIT III CLOSURE PROPERTIES AND TURING MACHINES 9

Normal Forms for CFG – Chomsky Normal Form (CNF) – Greibach Normal Form (GNF) - Pumping lemma for CFL- Closure properties of Regular languages. Closure properties of CFL. Definitions of Turing Machines – Programming Techniques for Turing machine – Multi head, Multi tape and Non Deterministic Turing Machines - The Halting problem - Chomskian hierarchy of languages.

UNIT IV UNDECIDABILITY 8

Recursive and recursively enumerable languages - A language that is not Recursively Enumerable – An undecidable problem that is RE- Undecidable problems about Turing Machine – Post's Correspondence Problem –The classes P and NP - NP completeness -Polynomial time reductions- Tractable and Intractable problems.

UNIT V RECENT TRENDS AND APPLICATIONS OF AUTOMATA 8

L-systems - Cellular Automata -DNA Computing - Membrane Computing. Applications of Automata – Digital Circuit Design, Control systems, Processor Design, String matching, Compiler design, Databases, Network protocol design, Cryptography and Cyber security, Computational Biology, Natural Language Processing, Artificial Intelligence, Game theory, Robotics and Autonomous Systems.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	The student will be able to design and build Finite Automata and solve problems on regular expressionsand regular languages.	**4**
CO2	The student can formulate and design Pushdown Automata for the given context freelanguages and context free grammars.	**4**
CO3	The student can design and construct the Turing machine for pattern matching and computation of basic integer functions.	**4**
CO4	The student will be able to infer the limitations of computers, interpret the answer to what kind of problems can be computed and what cannot be computed by a computer.	**3**
CO5	The student will be able to skillfully demonstrate the recent trends and applications of Automata in real world scenarios.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson Education, 2008.

REFERENCES

1. Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory andComputation", Pearson Education 2009.
2. Elaine A. Rich, "Automata, Computability and Complexity: Theory and Applications" First Edition, Pearson Education, 2007.
3. J. Martin, "Introduction to Languages and the Theory of computation" Third Edition, Tata McGraw Hill, 2007.
4. Peter Linz, "An Introduction to Formal Language and Automata", Third Edition, NarosaPublishers, New Delhi, 2002.
5. Thomas A. Sudkamp," An Introduction to the Theory of Computer Science, Languages and Machines", Third Edition, Pearson Education, 2007.

6. Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997

7. H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education, 2003.

8. Hopcroft J.E., and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", First Edition, Pearson Education, 2008.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	2	2	-	-	1	2	1	2	1	3
2	3	3	3	3	2	2	-	-	1	2	1	2	1	3
3	3	3	3	3	2	1	-	-	1	1	1	2	1	3
4	3	3	3	3	-	1	-	-	-	-	-	1	1	3
5	3	3	3	3	-	2	3	2	1	2	2	2	3	3

3-High, 2-Medium, 1-Low

CS22511 **COMPUTER NETWORKS LABORATORY**

(Common to CS and AD)

L	T	P	C
0	0	3	1.5

OBJECTIVES

- To learn socket programming.
- To be familiar with simulation tools.
- To have hands on experience on various networking protocols.

LIST OF EXPERIMENTS

1. Write a program to implement
   a) Bit Stuffing
   b) CRC.
2. Study of Socket Programming and Client-Server model
3. Applications using TCP Sockets
   a) Date and Time server & client
   b) Echo server & client, etc
   c) Chat
   d) File transfer
4. Applications using UDP Sockets
   a) DNS
5. Simulation of Stop and Wait Protocol and Sliding Window Protocol.
6. Simulation of ARP /RARP protocols.
7. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
8. Write a program to implement RMI (Remote Method Invocation)
9. Write a program to implement subnetting and find the subnet for a given IP.
10. Using Cisco Packet Tracer, do the following
    a) Establish a Local Area Network (LAN) with 4 hosts and a switch/Hub
    b) Connect two LANs using multi-router topology with static routes
11. Study of Network simulator (NS)and Simulation of Congestion Control Algorithms using NS
12. Perform a case study about the following routing algorithms to select the network path with its optimum and economical during data transfer.
    a) Link State routing protocol
    b) Distance vector routing protocol

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C / C++ / Java / Equivalent complier 30 Nos.
Network simulator like NS2/ NS3/ Glomosim/OPNET/ Equivalent/ Wireshark.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to demonstrate various simulation tools.	3
CO2	Students will be able to gain the knowledge and implement various protocols used at different layers.	3
CO3	Students will be able to understand the major software and hardware technologies used on computer networks.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	3	1	1	-	-	-	1	3	3	3	2	1
2	3	1	1	2	2	-	-	-	3	2	1	1	3	1
3	3	3	2	1	2	-	-	-	3	3	1	2	2	2

3-High, 2-Medium, 1-Low

CS22512 **USER INTERFACE TOOLS AND TECHNIQUES LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES

- Be familiar with Web page design using HTML 5 and style sheets CSS 3
- Be familiar with the Web scraping using Python and its installation process.
- Be exposed in Client Server applications along with NodeJS installation and Setup

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 hotspots in that map
    c. Show all the related information when the hotspots 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 and save an XML document at the server, which contains 10usersInformation.
    a. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document.

TypeScript & Servlets

4. Write programs in Java using sockets to implement the following:
    a. HTTPrequest
    b. FTP
    c. SMTP
    d. POP3
5. Write a program in Java for creating simple chat application with datagram sockets and datagram packets.
6. Create a job search platform utilizing Web scraping.
7. Set up a project using Node.js and NPM
8. Using the Data in HTML and Check your data types
9. Adding Handshaking (Call-and-Response)
10. Connecting from the Browser to the Node Program

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

- Java, Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, IDE: Eclipse Neon
- Editor: Notepad++, Browsers :IE, Chrome, Mozilla Firefox browsers (Latest Version), NodeJS (Latest Version)
- Windows 8 or 10 (or higher)

HARDWARE:

- Standalone desktops 30 Nos
- Pentium P5, 3 GHz or higher
- 8 GB (or higher) RAM, 100 GB (or higher) HD

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will develop the concepts of Web pages using HTML/XML and style sheets.	3
CO2	Students will be able to the interface dynamic web pages using server side scripting.	3
CO3	Students will be able to develop the applications with XML.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	2	2	2	2	2	2	2	3	3	3	3
2	3	2	3	3	2	2	2	2	3	3	3	2	3	3
3	3	3	3	3	3	2	2	2	2	3	3	2	2	3

3-High, 2-Medium, 1-Low

HS22511 **INTERVIEW AND CAREER SKILLS LABORATORY**

(Common to All)

L	T	P	C
0	0	3	2

OBJECTIVES

- Build confidence and develop learners' language proficiency.
- Better learners' performance in competitive examinations.
- Improve learners' employability skills.
- Develop entrepreneurship skills.
- Expose learners to the use of professional English.

UNIT I LISTENING AND SPEAKING SKILLS **12**

Conversation Skills – types small talk, face to face and telephonic, formal and informal conversations – skills in presenting ideas and collating information during conference calls (one –to one and technical group / team) – academic and workplace situations – conversing with faculty/visiting faculty/guests/officials/employers and employees – group discussion – etiquette and dos and don'ts, turn taking –presentation skills – seminars and projects using digital tools; mock interview – etiquette and dos and don'ts – audio-visual interface for enhancement of listening and speaking skills. IELTS and TOEFL (Listening related exercises)

UNIT II READING / SPEED READING, CRITICAL THINKING AND WRITING SKILLS **12**

Reading Comprehension – general and scientific texts/articles/case studies from different or relevant fields of study for analysis and critical thinking; employability skills – writing job applications – cover letter accompanying résumé – types of business letters and email writing and etiquette; writing reports – statement of purpose – writing articles for publication style and format – creating blogs or company profiles – speed reading of voluminous reports / documents and exacting necessary information and abstract preparation including dissemination. IELTS and TOEFL(Reading related exercises)

UNIT III ENGLISH FOR PROFESSIONAL EXAMINATIONS **12**

Sentences, paragraphs and reading comprehension – vocabulary building – general and technical terms – contextual meaning – spelling – subject specific words – usage and user specific terminology. IELTS and TOEFL(Grammar and verbal exercises)

UNIT IV ENTREPRENEURSHIP SKILLS **9**

Introduction to entrepreneurship - fundamentals of entrepreneurial skills - developing leadership qualities and team work;– marketing strategies microcosmic and macrocosmic levels of product sales and survey – sector / industry appraisal and appreciation (review and understanding state of the nation / economy / environment / sector reports published) interaction and understanding the role of multilateral financial / institutional / industrial agencies such as World Bank, ADB, UNDP, CII - Influencing in Business Meetings - Active Listening and responding - Role-play - Strengthening – Negotiating/ Argumentative and Persuasive Skills - Defend a character/idea or attack it. - Networking Skills -

engaging strangers in a conversation - introducing themselves, making small talk.

TOTAL : 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Develop approaches for mastering international English language tests such as IETLS and TOEFL, as well as national-level competitive exams.	**6**
CO2	Make presentations and participate in Group Discussions.	**6**
CO3	Face interviews with confidence and develop strategies for negotiating job offers.	**6**
CO4	Build effective resumes, cover letters and professional emails to enhance job application success.	**6**
CO5	Explore strategies for scaling and growing entrepreneurial ventures.	**6**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Business English Certificate Materials, Cambridge University Press.
2. Graded Examinations in Spoken English and Spoken English for Work downloadable materials from Trinity College, London.
3. International English Language Testing System Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on Managing Time and Stress.
5. Personality Development (CD ROM), Times Multimedia, Mumbai.

WEB SOURCES

1. http://www.slideshare.net/rohitjsh/presentationon group discussion
2. http://www.washington.edu/doit/TeamN/present_tips.html
3. http://www.oxforddictionaries.com/words/writingjobapplications
4. http://www.kent.ac.uk/careers/cv/coveringletters.html
5. http://www.mindtools.com/pages/article/newCDV_34.html

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

3-High, 2-Medium, 1-Low

CS22601 **CRYPTOGRAPHY AND NETWORK SECURITY**

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand OSI security architecture, Classical Encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.
- Understand various Private and Public Key cryptographic algorithms.
- To learn about hash functions and digital signature algorithms.
- Understand about Authentication Applications and System Security.
- Acquire knowledge in various network security models.

UNIT I INTRODUCTION & NUMBER THEORY **9**

Services, Mechanisms and attacks-the OSI security architecture- 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. Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).

UNIT II PRIVATE & PUBLICKEYCRYPTOGRAPHY **9**

Simplified DES - Data Encryption Standard(DES)-Block cipher principles - Double DES- Triple DES - Advanced Encryption Standard (AES)- Blowfish-RC5 algorithm- block cipher modes of operation. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange - Elliptic curve cryptography – Diffie and Hellman key exchange using Elliptical Curve – Elgamal Cryptosystem using ECC.

UNIT III HASH FUNCTIONS ANDDIGITAL SIGNATURES **9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols: DSS – EI Gamal – Schnorr – RSA- Elliptical curves- NIST Digital Signature Algorithms.

UNIT IV SECURITY PRACTICE &SYSTEMSECURITY **9**

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 – Secured Coding - OWASP/SANS Top Vulnerabilities.

UNIT V E-MAIL, IP &WEBSECURITY 9

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the Source-Message Integrity-Non-Repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: Secure Socket layer & Transport Layer Security.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Solve problems in number theory and its concepts.	**3**
CO2	Compare various Cryptographic Techniques.	**4**
CO3	Implement various Authentication algorithms.	**3**
CO4	Design Secure applications.	**3**
CO5	Inject secure coding in the developed applications.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. William Stallings, Cryptography and Network Security, 6 th Edition, Pearson Education, September 2016.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security”, Prentice Hall of India, 2002.

REFERCENCES

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.
3. Charles Pfleeger, “Security in Computing”, 4 th Edition, Prentice Hall of India, 2006.
4. Ulysess Black, “Internet Security Protocols”, Pearson Education Asia, 2000.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	2	2	-	-	-	-	3	2	3	1	1	2
2	2	2	3	1	1	-	-	-	2	1	1	2	2	2
3	1	3	2	2	1	-	-	-	2	2	1	1	1	2
4	1	3	3	3	-	-	-	-	1	2	1	2	1	2
5	3	1	2	1	1	-	-	-	3	2	3	2	2	1

3-High, 2-Medium, 1-Low

CS22602 **SOFTWARE PROJECT MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVES

- To outline the need for Software Project Management.
- To highlight different techniques for software cost estimation and activity planning.
- Understand how to apply schedule and cost control techniques for project monitoring including contract management.
- To Understand the Techniques of Software quality standards and its metrics.
- Learn about how to find suitable project organization structure, leadership, decision and motivation styles, proper safety and ethical practices and be responsible to the society.

UNIT I PROJECT EVALUATION & EVALUATION TECHNIQUES 9

Software Project Definitions Software Project Categorization, Importance of Software Project Management , Software VS other projects, Stakeholders, Project Success and Failure, Software project Activities, Practices & Standards, Selecting Process Models, software maintenance model - Estimation & Evaluation Techniques: Business Case & Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques-Risk Analysis for Project Evaluation, Program management, Project effort and cost estimation.

UNIT II PROJECT PLANNING AND RISK MANAGEMENT 9

Project Planning: Stepwise planning, Identification of Project product and activities (PBS & PFD), Activity based approach (WBS), Sequencing and Scheduling of Activities, Precedence Network Diagram: AON and AOA conventions, Network Planning, CPM technique.

UNIT III PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.

UNIT IV SOFTWARE QUALITY STANDARDS 9

Software Quality: Testing and Software Reliability, Basic software quality parameters and its metrics, ISO and CMMI Quality management models, Quality Assurance Techniques, QA Monitoring and Measurement.

UNIT V LEADERSHIP AND ETHICS IN PROJECTS 9

Organizational Behavior, Safety and Ethics: Role of a Project Manager, Project Management Models, Selecting the right person for a job, Motivation and Teamwork (Taylor's model, expectancy theory), The Oldham-Hackman job characteristic model , Leadership styles, Stress, Health and Safety,

Professional Ethics- Organization & Project team Structure: Working in Groups, Decision Making, Organizational structure and Communication Plans.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply project Evaluation techniques and Cost Estimation Methods	**3**
CO2	Identify issues that could lead to project success or failure and Risk management Techniques	**2**
CO3	Apply project management concepts through working in a group as team leader	**3**
CO4	Apply quality models in software projects for maintaining software quality and Reliability	**3**
CO5	Learned about Employee and Organization responsibilities of Software project	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", 6th Edition, Tata McGraw Hill, 2017.

REFERCENCES

1. Royce, "Software Project Management", Pearson Education, 1999.
2. Robert K. Wysocki, Effective Software Project Management, Wiley, 2009.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3	2	-	-	1	-	1	2	2	3	-	1	2
2	2	2	1	-	-	1	2	1	2	2	3	2	1	2
3	3	2	1	-	-	1	3	1	2	2	3	1	1	2
4	2	1	2	2	2	2	-	-	-	-	2	2	3	3
5	3	1	-	-	-	-	-	-	-	-	1	2	1	-

3-High, 2-Medium, 1-Low

AD22501 **INTERNET OF THINGS AND ITS APPLICATIONS**

(Common to AD and CS)

L	T	P	C
3	0	0	3

OBJECTIVES

- To introduce the terminology, technology and its applications.
- To introduce the Raspberry PI platform, that is widely used in IoT applications.
- To introduce the concept of SDN and NFV with necessary protocols.
- To introduce IoT design methodology and application development.
- To apply the concept of Internet of Things in the real world scenario.

UNIT I INTRODUCTION TO INTERNET OF THINGS 9

Definition and characteristics of IoT, Physical design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT functional blocks, IoT communication Models, IoT communication API's, IoT enabling Technologies Wireless sensor networks, Cloud Computing, Big Data Analytics, Communication protocols, embedded systems. IoT Levels and Deployment templates.

UNIT II IOT PHYSICAL DEVICES AND ENDPOINTS 9

IoT device - Basic Building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, other IoT devices. Raspberry Pi implementation of smart traffic control system.

UNIT III IOT AND M2M 9

Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER. SDN implementation of network traffic analysis and bandwidth allocation.

UNIT IV IOT PLATFORMS DESIGN METHODOLOGY 9

IoT Design and Methodology- Purpose and requirements specification, Process specification, Domain model specification, Information model specification, service specification, IoT level specification, functional view specification, Operational view specification, Device and component integration, application development.

UNIT V DOMAIN SPECIFIC IOT 9

Home Automation – IoT in Cities, Environment – IoT in smart grids, retails, logistics – IoT in agriculture, Industry, health & lifestyle, Smart Lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring, Reporting System & Bot, Air Pollution Monitoring, Forest Fire Detection, IoT Printer.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Students will be able to understand the vision of IoT.	**2**
CO2	Students will be able to experiment with various IoT physical devices.	**3**
CO3	Students will be able to identify the uses of SDN and NFV for IoT Technology.	**3**
CO4	Students will be able to analyze the different IoT platforms design methodology.	**4**
CO5	Students will be able to explain the applications of IoT in various domains.	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Internet of Things – A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.

REFERCENCES

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.
3. Honbo Zhou,―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.
4. Jan Ho ̈ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand.
5. David Boyle, "From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence", Elsevier, 2014.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	3	2	2	2	2	2	3	3	2	2	2	2
2	3	3	3	2	3	2	2	2	2	3	3	3	3	3
3	3	3	3	3	3	2	2	2	2	3	3	3	3	3
4	3	3	3	3	3	2	2	2	3	3	3	3	3	3
5	2	3	3	3	2	2	2	2	3	3	3	2	2	2

3-High, 2-Medium, 1-Low

CS22603 **CLOUD COMPUTING**

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the fundamentals of cloud computing.
- Illustrate the cloud computing architectures concepts.
- Recognize the significance of virtualization.
- Learn the programming and software environments related to cloud computing.
- Understand the security issues in cloud computing.

UNIT I INTRODUCTION TO CLOUD COMPUTING **9**

Technologies for Network-Based System – System Models for Distributed and Cloud Computing – Software Environments for Distributed Systems and Clouds - Performance, Security, and Energy Efficiency – Cloud Computing and Service Models - Cloud ecosystem and enabling technologies - NIST Cloud Computing Reference Architecture.

UNIT II CLOUD INFRASTRUCTURE **9**

Architectural Design of Compute and Storage Clouds – A Generic Cloud Architecture Design - Layered Cloud Architecture Development-Virtualization Support and Disaster Recovery – Architectural Design Challenges - Inter Cloud Resource Management – Extended Cloud Computing Services - Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

UNIT III VIRTUALIZATION **9**

Introduction – Implementation Levels of Virtualization – Virtualization Structures/Tools and Mechanisms – Virtualization of CPU, Memory, and I/O Devices – Virtual Machine Creation and Management - Virtual Cluster and Resource Management – Virtualization for Data Center Automation.

UNIT IV PROGRAMMING MODEL **9**

Parallel and distributed Programming Paradigms – Parallel computing and programming paradigms – MapReduce, Twister and Iterative MapReduce- Hadoop Library from Apache – Dryad and DryadLINQ from Microsoft. Programming Support of Google App Engine – GoogleFile System(GFS)- Programming on Amazon AWS and Microsoft Azure - Emerging cloud Software Environments – Open source Eucalyptus and Nimbus, Open Nebula, Open Stack, Manjrasoft Aneka Cloud and Appliances – Open source applications.

UNIT V CLOUD SECURITY **9**

Trust, Reputation and Security Management – Peer trust and Reputation Systems – Trust overlay and DHT implementation – Power Trust – Securing Overlays to Prevent DDoS Attacks. Cloud Security and Trust

Management – Defense Strategies – Distributed Intrusion Detection – Data and Software Protection Techniques - Reputation Guided Protection of Data Centers.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Describe the fundamentals of cloud computing.	**2**
CO2	Illustrate the cloud infrastructures concepts.	**2**
CO3	Recognize the significance of virtualization.	**3**
CO4	Explain the emerging cloud software's.	**2**
CO5	Identify the security issues in cloud computing.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.

REFERCENCES

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing Principles and Paradigms, Wiley, 2010.
2. Toby Velte, Anthony Velte, Robert Elsenpeter , Cloud Computing, A Practical Approach, McGrawHill, 2010.
3. Thomas Erl , Ricardo Puttini, Zaigham Mahmood," Cloud Computing: Concepts, Technology & Architecture", First Edition, Prentice Hall,2013.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	-	-	-	-	-	2	-	2	3	2
2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
3	3	3	2	2	3	-	-	-	-	-	-	3	3	3
4	3	2	3	3	3	-	-	-	-	2	-	3	3	3
5	3	3	2	2	2	2	2	3	-	2	-	3	3	3

3-High, 2-Medium, 1-Low

CS22604 **COMPILER DESIGN**

L	T	P	C
3	0	0	3

OBJECTIVES

- To learn the design principles of compiler.
- To learn the scanning and parsing techniques.
- To understand the different levels of translation.
- To apply the techniques to optimize the codes.
- To learn how effectively generate, machine codes.

UNIT I INTRODUCTION TO COMPILERS **9**

Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-, Interpretation, Bootstrapping, Data structures in compilation-Compiler Construction Tools, Applications of Compiler technology.

UNIT II LEXICAL ANALYSIS **9**

Need and Role of Lexical Analyzer - Lexical Errors - Expressing Tokens by Regular Expressions, Recognition of Tokens- Input Buffering-Language for Specifying Lexical Analyzers – LEX - Structure of LEX Specification – LEX library -Regular Expressions in LEX - Design of Lexical Analyzer for a sample Language.

UNIT III SYNTAX ANALYSIS **9**

Need and Role of the Parser-Context Free Grammars -Top Down Parsing -General Strategies-Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser - LR (0)Item-Construction of SLR Parsing Table -Introduction to LALR Parser – Error Handling and Recovery in Syntax Analyzer- YACC-Structure of YACC Grammar- Actions – Ambiguity and Conflicts- YACC library

UNIT IV SYNTAX DIRECTED TRANSLATION & RUN TIME ENVIRONMENT **9**

Syntax directed Definitions - Construction of Syntax Tree - Bottom-up Evaluation of S-Attribute Definitions- SDT for infix-to-postfix translation, SDT for Three address code Applications of SDT– Type Systems-Specification of a simple type checker.

RUN-TIME ENVIRONMENT: Source Language Issues - Storage Organization - Storage Allocation-Symbol Tables

UNIT V CODE OPTIMIZATION AND CODE GENERATION **9**

Principal Sources of Optimization-DAG- Optimization of Basic Blocks-Global Data Flow Analysis-Efficient Data Flow Algorithms-Issues in Design of a Code Generator – A Simple Code Generator Algorithm, Peephole Optimization.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	The students will be able to understand the major phases of compilation.	**2**
CO2	The students will be able to know the scanners experiments its design.	**2**
CO3	The students will be able to develop the parsers and experiments its design	**4**
CO4	The students will be able to apply the various optimization techniques.	**3**
CO5	The students will be able to use the effective techniques for generate the machine codes.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Alfred Aho, Ravi Sethi and Jeffrey D Ullman, "Compilers Principles, Techniques and Tools", Second Edition, Pearson Education, 2015.

REFERCENCES

1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation, "Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	1	3	1	3	-	-	-	3	2	2	2	3	1
2	2	1	3	2	1	-	-	-	2	1	1	3	3	3
3	3	3	1	2	2	-	-	-	3	2	1	2	3	1
4	3	1	2	2	2	-	-	-	1	2	1	3	3	1
5	1	1	2	3	2	-	-	-	3	2	1	2	3	3

3-High, 2-Medium, 1-Low

CS22611 **CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY**

(Common to CS and AD)

L	T	P	C
0	0	3	1.5

OBJECTIVES

- Learn to implement fundamental algorithms in Number Theory.
- Be exposed to the different cipher techniques.
- Learn to implement the algorithms DES, RSA,MD5,SHA-1.
- Learn to use network security tools like GnuPG, KF sensor, Net Strumbler.

LIST OF EXPERIMENTS

1. **Number Theory**
   a) Implementation of Euclidean Algorithm to find GCD between two numbers.
   b) Implementation of Extended Euclid Algorithm to find Inverse Modulo.
   c) Implementation of Euler Totient function.
   d) Implementation of Miller and Rabin's algorithm for primality check.

2. **Substitution Ciphers**
   a) Implementation of Caesar Cipher using C/C++/Java.
   b) Implementation of Playfair Cipher using C/C++/Java.
   c) Implementation of Hill Cipher using C/C++/Java.
   d) Implementation of Vigenere Cipher using C/C++/Java.
   e) Implementation of one time pad algorithm using C/C++/Java.

3. **Transpositional Ciphers**
   a) Implementation of Rail fence using C/C++/Java.
   b) Implementation of row & Column Transformation cipher using C/C++/Java.

4. Implementation of SDES Algorithm using C/C++/Java.
5. Implementation of RSA Algorithm using C/C++/Java.
6. Implementation of Diffiee-Hellman Exchange Algorithm using C/C++/Java.
7. Implementation of Digital signature algorithm (Elgamal Digital Signature Algorithm) using C/ C++/Java.
8. Setup a honey pot and monitor the honeypot on network (KF Sensor).
9. Verification of Integrity Check (MD5 Tool).
10. Demonstrate IDS using Snort.

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

- C / C++ / Java or equivalent compiler GnuPG, KF Sensor or Equivalent, Snort, Net Stumbler or Equivalent.

HARDWARE:

- Standalone desktops 30 Nos.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Implement the fundamental algorithms of Number theory and cipher techniques	3
CO2	Develop the various security algorithms	3
CO3	Use different open source tools for network security and analysis.	4

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	2	2	2	2	2	2	2	3	3	3	3
2	3	2	3	3	2	2	2	2	3	3	3	2	3	3
3	3	3	3	3	3	2	2	2	2	3	3	2	2	3

3-High, 2-Medium, 1-Low

CS22612 **CLOUD COMPUTING LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES

- To develop web applications in cloud computing.
- To learn the design and development process involved in creating a cloud based application.
- To develop the distributed programming environment.

LIST OF EXPERIMENTS

1. Develop a new Web Service for Calculator.
2. Develop a Cloud environment using CloudSim simulator.
3. Use Eucalyptus or Open Nebula or equivalent to set up the cloud computing environment.
4. Find procedure to run the virtual machine of different configuration.
5. Find procedure to attach virtual block to the created virtual machine .
6. Install a C compiler in the virtual machine and execute a sample program.
7. Find procedure to set up the one node Hadoop cluster.
8. Write a program to use the API's of Hadoop to interact with it and to display content of a file exist in hdfs.
9. Write a wordcount program to demonstrate the use of Map and Reduce tasks.
10. Write a grep program to demonstrate the use of Map and Reduce tasks.
11. Show the virtual machine migration based on the certain condition from one node to the other.
12. Procedure to install storage controller and interact with it.

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE:

Standalone desktops – 30 Nos.

SOFTWARE:

CloudSim simulator, Oracle VM VirtualBox, Eucalyptus or Open Nebula or equivalent.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Implement the web application in cloud environment.	**3**
CO2	Simulate the virtualization in cloud environment.	**3**
CO3	Implement the various cloud softwares.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	2	3	-	-	-	2	2	2	3	3	2
2	3	2	3	3	3	-	-	-	2	2	2	3	3	3
3	3	3	3	3	3	-	-	-	2	2	2	3	3	3

3-High, 2-Medium, 1-Low

CS22701 **ETHICS FOR COMPUTER PROFESSIONALS**

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To provide knowledge and understanding of Morals and Ethics.
- To provide a fundamental ethics basics in engineering.
- To acquire knowledge on AI ethics initiatives.
- To understand robotic ethics in technology.
- To understand Research, Publications and perform role based on ethics.

UNIT I HUMAN VALUES **9**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management

UNIT II ENGINEERING ETHICS **9**

Ethics and Excellence in Engineering, 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 - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III AI - ETHICAL SPIRIT **9**

International ethical initiatives-Ethical harms and concerns-Case study: Healthcare Robots, Autonomous Vehicles , Warfare and Weaponization.

UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS **9**

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility, Roboethics Taxonomy.

UNIT V PUBLISHING ETHICS & GLOBAL ISSUES **9**

Publication ethics: definition, introduction and importance - Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. - Conflicts of interest - Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types - Violation of publication ethics, authorship and contributor ship - Identification of publication misconduct, complaints and appeals - Predatory publisher and journals.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students can understand the importance moral, ethics and humanity.	**2**
CO2	Students can analyse and take decision based on situation.	**3**
CO3	Students can understand the AI actions in ethics.	**3**
CO4	Students analyze robot ethics in technology.	**4**
CO5	Students apply Publication ethics in their professional and research publications.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2015.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
3. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
4. Ethics in Science Education, Research and Governance Edited by Kambadur Muralidhar, Amit Ghosh Ashok Kumar Singhvi. Indian National Science Academy, 2019. ISBN : 978-81-939482-1-7.
5. Nicholas H. Steneck. Introduction to the Responsible Conduct of Research. Office of Research Integrity. 2007. Available at: https://ori.hhs.gov/sites/default/files/rcrintro.pdf

REFERCENCES

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2012.
2. https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65
3. https://nluassam.ac.in/docs/pub/Research%20and%20Publication%20Ethics.pdf
4. https://publicationethics.org/files/u7141/1999pdf13.pdf
5. The Student's Guide to Research Ethics By Paul Oliver Open University Press, 2003

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	-	-	-	-	3	3	3	-	-	-	2	-	-
2	2	3	-	-	-	3	3	3	2	2	-	2	-	-
3	2	3	-	-	3	3	3	3	-	2	-	2	2	3
4	2	3	2	3	3	3	3	3	2	2	-	2	-	-
5	2	3	-	3	2	3	-	3	2	3	-	3	3	3

3-High, 2-Medium, 1-Low

CS22021 **EXPLORATORY DATA ANALYSIS**

L	T	P	C
3	0	0	3

OBJECTIVES

- 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.

UNIT I EXPLORATORY DATA ANALYSIS **9**

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-Hypothesis testing.

UNIT II EDA USING PYTHON **9**

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.

UNIT III UNIVARIATE ANALYSIS **9**

Introduction to Single variable - Types of Univariate Analysis- Examples of Univariate Analysis - Univariate Descriptive Statistics - Univariate distributions -Discrete distributions and Continuous distributions - Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality.

UNIT IV BIVARIATE ANALYSIS **9**

Relationships between Two Variables - Types of Bivariate Analysis-Numerical and Categorical - Correlation - Regression - Percentage Tables - Analyzing Contingency Tables -Handling Several Batches - Scatterplots and Resistant Lines - Transformations - Chi-square test -T-test and ANOVA.

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS **9**

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Time based indexing – Visualizing – Grouping – Resampling.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to understand the fundamentals of exploratory data analysis.	**2**
CO2	Students will be able to implement the data visualization using python.	**3**
CO3	Students will be able to perform univariate data exploration and analysis.	**3**
CO4	Students will be able to apply bivariate data exploration and analysis.	**3**
CO5	Students will be able to do data exploration and visualization on multivariate and time series data.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017. (Unit 2)
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2009. (Unit 3,4,5)

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.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	2	2	-	2	-	-	1	2	2	3
2	3	2	2	2	3	2	-	2	-	-	-	2	2	2
3	3	3	3	3	3	3	-	-	-	-	-	-	3	3
4	3	3	3	3	3	2	-	-	-	-	-	-	2	2
5	3	3	3	3	3	3	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CS22022 DISTRIBUTED DATABASES AND ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the architecture of distributed databases and learn about query processing in distributed databases.
- To learn different distributed transaction processing and concurrency control algorithms for distributed databases.
- To gain knowledge about basics of Hadoop.
- To perform analytics using map-reduce.
- To learn about different Hadoop related tools for data analysis.

UNIT I DISTRIBUTED DATABASES INTRODUCTION AND DISTRIBUTED QUERY PROCESSING **9**

Introduction to Distributed Databases-Distributed DBMS Architecture-Design strategies (Top-down, Bottom-up) - Design Issues-Data Fragmentation (Horizontal, Vertical, Hybrid) - Allocation and Replication - Distributed Query Processing: Overview – Objectives – Layers - Query Decomposition - Data Localization - Distributed Query Optimization -Distributed Query Execution.

UNIT II TRANSACTION AND CONCURRENCY CONTROL IN DISTRIBUTED DATABASES **9**

Distributed Transaction Processing - Properties of Transactions - Types of Transactions -Distributed Concurrency Control-Serializability - Types of Concurrency Control Algorithms -Locking-Based - Timestamp-Based -Optimistic Concurrency Control Algorithms - Deadlock Management-Prevention-Avoidance-Detection and Resolution-Distributed DBMS Reliability-Failures in DDBMS - Types of Reliability Protocols -Dealing with site failures-Network Partitioning-Case study-NuoDB.

UNIT III BASICS OF HADOOP **9**

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.

UNIT IV MAPREDUCE APPLICATIONS **9**

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN –job scheduling– shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT V HADOOP RELATED TOOLS **9**

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Cassandra– Cassandra data model – Cassandra examples – Cassandra clients – Hadoop integration. Pig – Grunt– pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats

– HiveQL data definition – HiveQL data manipulation – HiveQL queries.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to understand distributed DBMS architecture and apply distributed query processing techniques.	**3**
CO2	Students will be able to analyze and evaluate distributed transaction processing and concurrency control.	**3**
CO3	Students will be able to learn the Hadoop fundamentals.	**3**
CO4	Students will be able to apply map-reduce for performing data analysis.	**3**
CO5	Students will be able to apply Hbase, Cassandra, Pig and Hive to do data analytics.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. M. Tamer Ozsu, Patrick Valduriez, “Principles of Distributed Database Systems”, Springer, Fourth Edition,2020.
2. Stefano Ceri, Giuseppe Pelagatti, “Distributed Databases: Principles and Systems”, Tata McGraw-Hill Education, Indian Edition,2018.

REFERENCES

1. Saeed K. Rahimi, Frank S. Haug,” Distributed Database Management Systems: A Practical Approach”, John Wiley & Sons 2010
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley,2013.
3. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.
4. Jeffrey Aven, “Hadoop in 24 Hours, Sams Teach Yourself “, Pearson Education, First Edition,2017.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O’Reilly, 2012.
6. Lars George, "HBase: The Definitive Guide", O’Reilly, 2011.
7. Eben Hewitt, "Cassandra: The Definitive Guide", O’Reilly, 2010.
8. Alan Gates, "Programming Pig", O’Reilly, 2011.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	2	2	-	2	-	-	1	2	2	3
2	3	3	2	2	3	2	-	2	-	-	-	2	2	2
3	3	2	2	3	3	2	-	-	-	-	-	-	2	2
4	2	3	3	2	3	2	-	-	-	-	-	-	2	2
5	2	2	3	3	2	2	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

CS22023 **MINING MASSIVE DATASETS**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the parallel processing of massive datasets using distributed file system.
- To learn the different ways of handling high dimensional data.
- To gain knowledge about data stream mining and advertising on web.
- To learn mining using frequent item sets and clustering.
- To understand the basics of graph data and mining in social network graphs.

UNIT I PARALLEL PROCESING IN DISTRIBUTED FILE SYSTEM 9

Introduction-Data Mining, Statistical Modeling, Machine Learning, Computational Approaches to Modeling-Feature Extraction, Statistical Limits on Data Mining-Distributed File Systems-Physical Organization of Compute Nodes, Large-Scale File-System Organization-MapReduce-Algorithms Using MapReduce-Extensions to MapReduce-Workflow Systems, Recursive Extensions to MapReduce-The Communication Cost Model-Complexity Theory for MapReduce.

UNIT II HANDLING HIGH DIMENSIONAL DATA 9

Finding Similar Items - Shingling of Documents – Similarity - Preserving Summaries of Sets -Locality Sensitive Hashing for Documents - The Theory of Locality - Sensitive Functions - LSH Families for different Distance Measures - Applications of Locality-Sensitive Hashing - Methods for High Degrees of Similarity - Dimensionality Reduction – Principal Component Analysis - Singular-Value Decomposition - CUR Decomposition.

UNIT III HANDLING INFINITE DATA 9

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing- Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Advertising on the Web-Issues in On-Line Advertising-On-Line Algorithms-The Matching Problem-The Adwords Problem.

UNIT IV FREQUENT ITEMSETS AND CLUSTERING 9

Introduction to Clustering Techniques-Hierarchical Clustering-K-means Algorithms-The CURE Algorithm-Clustering in Non-Euclidean Spaces-Clustering for Streams and Parallelism- Frequent Itemset-Market Baskets and the A-Priori Algorithm-Handling Larger Datasets in Main Memory-Limited-Pass Algorithms-Counting Frequent Items in a Stream-

UNIT V GRAPH DATA 9

Link Analysis-PageRank-Efficient Computation of PageRank-Topic-Sensitive PageRank-Link Spam-Hubs and Authorities- Mining Social-Network Graphs-Social Networks as Graphs-Clustering of Social-Network Graphs-Direct Discovery of Communities-Partitioning of Graphs-Finding Overlapping

Communities-Simrank-Counting Triangles-Neighborhood Properties of Graphs

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to apply parallel processing algorithms in distributed file system.	**3**
CO2	Students will be able to apply locality sensitive hashing for documents and principal component analysis for dimensionality reduction	**3**
CO3	Students will be able to do mining in data streams and learn the techniques for online advertising.	**3**
CO4	Students will be able to interpret various clustering algorithms and frequent item sets for handling big data.	**3**
CO5	Students will be able to apply algorithms for mining in social network graphs	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Third Edition, 2020.

REFERENCES

1. Tom White, "Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale", O'Reilly Media, 4th edition, 2015.
2. Tan, Steinbach, Karpatne and Kumar," Introduction to Data Mining", Pearson,2nd edition, 2019.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012.
4. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
5. Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann, Third Edition, 2011.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-		1	1	-	-	-	-	-	-	2	-
2	3	2	-	-	1	1	-	-	-	-	-	-	2	-
3	3	2	-	-	1	1	-	-	-	-	-	-	2	-
4	3	2	-	-	1	1	-	-	-	-	-	-	2	1
5	3	2	-	-	1	1	-	-	-	-	-	-	2	1

3-High, 2-Medium, 1-Low

CS22024 **TEXT AND SPEECH PROCESSING**

L	T	P	C
3	0	0	3

OBJECTIVES

- Learn the concepts and techniques of Natural language processing for analyzing word sense based on part of speech and Constituency parsing.
- Analyze speech signal in the time and frequency domain.
- Implement deep learning models covering a range of applications in speech recognition and text processing.

UNIT I LANGUAGE MODEL AND PART-OF-SPEECH **9**

Different Levels of NLP -Text Normalization - Minimum Edit Distance - N-gram Language Models – Evaluating Language Models - Smoothing - Huge Language Models - Perplexity's Relation to Entropy - Part-of-Speech Tagging – HMM for Part-of-Speech Tagging – Named Entities and Named Entity Tagging - HMM Part-of-Speech Tagging - - Conditional Random Fields (CRFs) - Evaluation of Named Entity Recognition.

UNIT II PARSING AND LEXICAL SEMANTICS **9**

Context-Free Grammars and Constituency Parsing - Constituency - Context-Free Grammars - CKY Parsing: A Dynamic Programming Approach - Span-Based Neural Constituency Parsing - Evaluating Parsers - Dependency Parsing - Word Senses and WordNet - Relations Between Senses - WordNet: A Database of Lexical Relations, Methods for Word Sense Disambiguation - Semantic Roles - Semantic Role Labeling.

UNIT III FEATURE REPRESENTATION FOR NATURAL LANGUAGE PROCESSING **9**

Vector Semantics - Words and Vectors - Cosine for measuring similarity -TF-IDF: Weighing terms in the vector - Pointwise Mutual Information (PMI) - Word Embedding's: Word2Vec, Glove and Fast text - Neural Language Models - The XOR problem - Feedforward Neural Networks - Feedforward Neural Language Modeling.

UNIT IV DEEP LEARNING ARCHITECTURE **9**

RNNs as Language Models - Stacked and Bidirectional RNN architectures- The LSTM – Self Attention Networks: Transformers, Transformers as Language Models – Applications of NLP: Sentiment analysis, Question and answering, Chat Bot.

UNIT V SPEECH RECOGNITION **9**

Introduction-Acoustic feature: Speech production, Raw Waveform, MFCC – Phones - Statistical Speech Recognition: Acoustic Models, Language Model, HMM Decoding – Error Metrics – DNN/HMM Hybrid – Text to Speech – WaveNet for Text to Speech.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Tag a given text with POS using HMM.	**3**
CO2	Parse the given text with various methods.	**4**
CO3	Represent the natural language in vector form.	**3**
CO4	Illustrate the working of deep neural networks for NLP.	**4**
CO5	Discuss statistical approach for automatic speech recognition.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Dan Jurafsky, James H. Martin “Speech and Language Processing”, Draft of 3rd Edition, Prentice Hall 2022.

REFERENCES

1. Uday Kamath, John Liu, James Whitaker "Deep Learning for NLP and Speech Recognition", 1st Edition, Springer 2019.
2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin Cummings publishing company, 1995.
3. Jacob Benesty, M. M. Sondhi,Yiteng Huang "Springer Handbook of Speech Processing" , 1st Edition, Springer, 2008

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	3	-	-	-	-	2	-	3	3	2
2	3	3	3	2	2	-	-	-	-	2	-	3	3	2
3	3	3	3	2	3	-	-	-	-	2	-	3	3	3
4	3	3	3	3	3	-	-	-	-	3	-	3	3	3
5	3	3	3	3	3	-	-	-	-	3	-	3	3	3

3-High, 2-Medium, 1-Low

CS22025 **IMAGE AND VIDEO ANALYTICS**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basic concepts and methodologies for digital image and video processing.
- To learn image compression and segmentation techniques
- To process color images with smoothing and sharpening methods
- To learn video compression and motion estimation technique
- To develop a foundation that can be used as the basis for further study and research in this field.

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Fundamental steps in Image processing system – Image Sampling and Quantization -Pixel relationship - Mathematical Tools Used in Digital Image Processing - Image Transformation Function - Histogram Processing - Spatial filtering - The Basics of Filtering in the Frequency Domain.

UNIT II IMAGE COMPRESSION AND SEGMENTATION 9

Image Compression – Fundamentals – Compression Methods - Huffman Coding, Arithmetic Coding, Bit Plane Coding, LZW Coding – Lossless Compression Methods - Image Segmentation – Line Detection – Edge Detection - Edge Linking and Boundary Detection. – Basic Global Thresholding. - Region-Based Segmentation.

UNIT III COLOR IMAGE PROCESSING AND OBJECT RECOGNITION 9

Color Image Processing – Color Models, Color Transformations Color Image Smoothing and Sharpening, Color Noise Reduction, Color-Based Image Segmentation - Object Recognition -Patterns and pattern class – Recognition based on Decision-Theoretic Methods – Structural Methods.

UNIT IV DIGITAL VIDEO COMPRESSION AND MOTION ESTIMATION 9

Overview of video analytics, Importance and applications of Video Analytics, Challenges and trends in video analytics, Digital Video, Sampling of video signal, Video preprocessing techniques - Video Enhancement and Noise Reduction, Video compression and encoding - Lossy compression and Lossless compression, Intra-frame and inter-frame compression, Spatial and temporal compression, Moving Picture Experts Group (MPEG), Fundamentals of Motion Estimation and Motion Compensation.

UNIT V VIDEO SEGMENTATION AND TRACKING 9

Change Detection - Background modeling - Motion Segmentation - Simultaneous Motion Estimation and Segmentation - Motion Tracking - Multi-target/Multi-camera tracking - Video Analysis Action Recognition - Video based rendering, Context and scene understanding. Case Study: Surveillance - Advanced Driver Assistance System.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply mathematical tools for a variety of basic image-processing tasks	**3**
CO2	Examine the image compression and segmentation recognition	**4**
CO3	Processing the color images with smoothing and sharpening methods	**3**
CO4	Inspect the image-plane (2D) motion and object-motion (3D) motion estimation	**4**
CO5	Demonstrate and analyze the motion tracking method	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Ed., Prentice-Hall, 2018.
2. A. Murat Tekalp, "Digital Video Processing", Second Edition, Prentice Hall, 2015.

REFERENCES

1. Oge Marques, "Practical Image and Video Processing Using MATLAB", Wiley-IEEE Press,2011
2. Yu Jin Zhang, "Image Engineering: Processing, Analysis and Understanding", Tsinghua University Press, 2009.
3. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012
4. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010
5. Boguslaw Cyganek,"Object Detection and Recognition in Digital Images: Theory and Practice", Wiley 2013

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	-	3	-	-	-	-	-	-	-	3	-
2	-	3	3	2	3	-	-	-	-	-	-	-	3	-
3	3	-	3	-	3	-	-	-	-	-	-	-	3	-
4	-	3	-	3	3	-	-	-	-	-	-	-	2	3
5	-	3	-	3	3	-	-	-	-	-	-	-	2	3

3-High, 2-Medium, 1-Low

CS22026 **SOCIAL NETWORK ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES

- To develop semantic web related simple applications.
- To explain Privacy and Security issues in Social Networking.
- To explain the data extraction and mining of social networks.
- To discuss the prediction of human behavior in social communities.
- To describe the Access Control, Privacy and Security management of social networks.

UNIT I INTRODUCTION **9**

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis.

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS **9**

Historical overview of privacy and security, Major paradigms, for understanding privacy and security The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world.

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA **9**

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES **9**

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks.

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT **9**

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Develop semantic web related simple applications.	**2**
CO2	Address Privacy and Security issues in Social Networking.	**3**
CO3	Explain the data extraction and mining of social networks.	**2**
CO4	Discuss the prediction of human behavior in social communities.	**4**
CO5	Describe the applications of social networks.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Peter Mika, "Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, "Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Learning Neo4j 3.x "Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing, 2017.
4. David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.

REFERENCES

1. Easley D. Kleinberg J., "Networks, Crowds, and Markets – Reasoning about a Highly Connected World", Cambridge University Press, 2010.
2. Jackson, Matthew O., "Social and Economic Networks", Princeton University Press, 2008.
3. GuandongXu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition, Springer, 2011.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	2	-	-	-	2	1	1	2	2	2
2	2	3	2	2	3	-	-	-	1	2	2	2	3	3
3	2	2	3	2	1	-	-	-	1	2	1	1	2	2
4	2	3	2	2	1	-	-	-	1	1	2	1	2	1
5	2	3	2	2	2	-	-	-	1	1	3	1	2	2

3-High, 2-Medium, 1-Low

CS22027 WEB INFORMATION SEARCH AND ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the principles and techniques of web information search.
- Learn analytics methods for extracting meaningful insights from web data.
- Explore tools and technologies used in web information retrieval.
- Develop skills in designing effective search algorithms.
- Apply analytics to improve decision-making based on web data.

UNIT I INTRODUCTION TO WEB INFORMATION RETRIEVAL 9

Definition and Importance of Web Information Retrieval - Basic Concepts of Search Engines - Types of Web Search Engines - Challenges in Web Information Retrieval.

UNIT II SEARCH ALGORITHMS 9

Ranking Algorithms in Web Search - PageRank Algorithm and its Variants - Evaluation Metrics for Search Algorithms - Designing Effective Search Algorithms.

UNIT III WEB ANALYTICS 9

Introduction to Web Analytics - Data Collection Methods in Web Analytics - Analyzing User Behavior on the Web - Using Analytics for Business Decision-Making.

UNIT IV NATURAL LANGUAGE PROCESSING IN WEB SEARCH 9

Text Mining and Information Extraction - Sentiment Analysis in Web Data - Query Expansion and Relevance Feedback - Semantic Web and Linked Data.

UNIT V EMERGING TRENDS IN WEB INFORMATION SEARCH AND ANALYTICS 9

Personalized Search and Recommender Systems - Mobile Search and Voice Search - Deep Learning in Web Information Retrieval - Case Studies and Future Directions.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	To Understand the principles and techniques of web information search.	**2**
CO2	To Learn analytics methods for extracting meaningful insights from web data.	**3**
CO3	To Explore tools and technologies used in web information retrieval.	**3**
CO4	To Develop skills in designing effective search algorithms.	**4**
CO5	To Apply analytics to improve decision-making based on web data.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. "Information Retrieval:Implementing and Evaluating Search Engines By Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack · 2016
2. Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity by Avinash Kaushik, 2009
3. "Web Search Engine: Searching Techniques and Algorithm" by Monika Jain.

REFERENCES

1. Introduction to Information Retrieval Hardcover – Illustrated, 7 July 2008 by Christopher D. Manning (Author), Prabhakar Raghavan (Author), Hinrich Schütze (Author)
2. Search Engines: Information Retrieval in Practice: United States Edition Hardcover – 6 February 2009 by Bruce Croft (Author), Donald Metzler (Author), Trevor Strohman (Author)

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	1	2	-	-	-	2	1	1	1	3	3
2	3	3	2	2	2	-	-	-	1	2	1	2	3	3
3	3	2	2	2	1	-	-	-	1	1	1	1	2	2
4	3	3	3	2	2	-	-	-	2	1	2	1	2	2
5	2	3	2	2	2	-	-	-	1	1	2	1	2	1

3-High, 2-Medium, 1-Low

CS22028 **MACHINE LEARNING OPERATIONS**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the operational aspects of deploying and managing machine learning models in real-world scenarios.
- To learn the techniques and tools for scalable and efficient machine learning operations.
- To explore the challenges and best practices in deploying machine learning models in production.
- To gain practical skills in automating and optimizing machine learning workflows.
- To evaluate and implement strategies for monitoring and maintaining machine learning models in production.

UNIT I INTRODUCTION TO MLOPS **9**

Introduction to Machine Learning Operations (MLOps) Definition and importance of MLOps - Key Components of MLOps – Practices - Challenges in Traditional ML Workflow Version control issues Reproducibility Challenges Deployment complexities - Overview of Tools and Technologies in MLOps.

UNIT II MODEL DEPLOYMENT AND SCALING **9**

Techniques for Model Deployment - On-demand prediction mode, Batch prediction, Deployment using a web service, Deploying on edge devices as embedded models - Scalability in Machine Learning Operations- Containerization and Orchestration- DevOps Principles in MLOps – Automation, Collaboration, Continuous Integration/Continuous Deployment, Version Control, Monitoring and Feedback.

UNIT III AUTOMATION IN MACHINE LEARNING WORKFLOWS **9**

Introduction to Feature Engineering, Automated Feature Engineering - Introduction to Featuretools - Hyperparameter Tuning - Continuous Integration and Continuous Deployment (CI/CD) in MLOp s- Model Versioning and Experiment Tracking.

UNIT IV MONITORING AND MAINTENANCE **9**

Importance of monitoring deployed models - Metrics to monitor (accuracy, drift, latency) - Tools for monitoring: Prometheus, Grafana, ELK stack - Model versioning and rollback strategies - Retraining and updating models - Handling model degradation and data drift.

UNIT V CASE STUDIES AND BEST PRACTICES **9**

Real-world Case Studies in MLOps - Best Practices for Deploying and Managing Machine Learning Models - Building an end-to-end MLOps pipeline - Regulatory Compliance and Security in MLOps -

Future Trends in Machine Learning Operations.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Demonstrate an understanding of MLOps principles.	**2**
CO2	Apply techniques for deploying and scaling models.	**3**
CO3	Implement automation in machine learning workflows.	**4**
CO4	Evaluate and implement monitoring and maintenance strategies.	**4**
CO5	Analyze case studies and apply best practices in MLOps.	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. "Building Machine Learning Powered Applications: Going from Idea to Product" by Emmanuel Ameisen Released January 2020. Publisher(s): O'Reilly Media, Inc.
2. "Machine Learning Engineering" by Andriy Burkov. True Positive Inc. 8 September 2020
3. "Introducing MLOps" by Mark Treveil, Nicolas Omont, Clément Stenac, Kenji Lefevre, Du Phan, Joachim Zentici, Adrien Lavoillotte, Makoto Miyazaki, Lynn Heidmann Released November 2020 Publisher(s): O'Reilly Media, Inc.

REFERENCES

1. Building Machine Learning Pipelines by Hannes Hapke, Catherine Nelson Released July 2020 Publisher(s): O'Reilly Media, Inc.
2. "Practical MLOps" by Noah Gift, Alfredo Deza Released September 2021 Publisher(s): O'Reilly Media, Inc

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	2	2	2	-	-	-	2	2	1	1	3	3
2	2	3	2	3	2	-	-	-	1	2	2	3	3	3
3	3	2	2	2	2	-	-	-	1	1	1	1	1	3
4	2	2	2	1	2	-	-	-	1	1	3	1	2	1
5	1	3	2	2	2	-	-	-	2	2	3	3	2	3

3-High, 2-Medium, 1-Low

CS22031 **KNOWLEDGE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basics of Knowledge Engineering.
- To learn the basics of knowledge based agents.
- To discuss methodologies for Agent Design and Development.
- To study about the modeling process and ontologies for problem solving.
- To introduce Generalization and Rule learning for knowledge agents.

UNIT I REASONING UNDER UNCERTAINITY **9**

Introduction - Abductive Reasoning - Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions — Baconian Probability – Fuzzy Probability - Evidence based reasoning.

UNIT II KNOWLEDGE ENGINEERING **9**

Artificial Intelligence – Knowledge Based Agents – Ontology of Problem solving task - Building Knowledge-based Agents – Intelligent Analysis - Cyber Insider Threat Discovery and Analysis - Analysis of Wide-Area Motion Imagery

UNIT III METHODOLOGIES FOR AGENT DESIGN **9**

Conventional Design and Development – Development tools for Agent Design - Learning Agent Shells - Rapid Prototyping - Ontology Refinement – Organization of Repository - Learning-based Design

UNIT IV MODELING THE PROBLEM-SOLVING PROCESS **9**

Inquiry-driven Analysis and Synthesis - Evidence-based Assessment - Believability Assessment Ontologies : Believability Assessment - Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values.

UNIT V GENERALIZATION AND RULE LEARNING **9**

Machine Learning – Concepts – Generalization and Specialization Rules – Types - Formal Definition of Generalization - Modeling, Learning, and Problem Solving – Rule refinement – The Rule Learning Problem – Rule Generation – Hypothesis Learning.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the basics of Knowledge Engineering.	**2**
CO2	Construct knowledge based agent to perform problem solving tasks.	**3**
CO3	Apply different methodologies for Agent Design and Development.	**3**
CO4	Model the ontologies for the knowledge agent.	**3**
CO5	Summarize the rules and generalized hierarchy for an knowledge agent.	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, "Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning", Cambridge University Press, First Edition, 2016.

REFERENCES

1. Ela Kumar, "Knowledge Engineering", I K International Publisher House, 2018.
2. King, "Knowledge Management and Organizational Learning", Springer, 2009.
3. Jay Liebowitz,"Knowledge Management Learning from Knowledge Engineering", 1st Edition, 2001.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	1	1	1	1	-	-	1	2	1	2	1	1
2	3	2	3	2	2	-	-	-	2	1	2	1	3	3
3	2	2	3	2	2	-	-	-	3	2	2	2	3	2
4	2	2	3	1	1	-	-	-	2	2	2	2	2	1
5	2	2	2	1	1	-	-	-	2	1	1	1	2	1

3-High, 2-Medium, 1-Low

AD22601 REINFORCEMENT LEARNING TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES

- Learn the basic concepts of probability theory and random variables.
- Learn Reinforcement Learning basics and Markov decision process.
- Understand Monte-Carlo methods and Temporal Difference learning.
- Understand policy gradient methods.
- Learn the applications and case studies of reinforcement learning.

UNIT I INTRODUCTION TO REINFORCEMENT LEARNING 9

Reinforcement Learning – Examples, Elements of Reinforcement Learning, Limitations and Scope, An extended example: Tic-Tac-Toe, Early history of Reinforcement Learning; Multi-armed Bandits: A k-armed Bandit problem, Action-value Methods, Gradient Bandit algorithms - Associative Search.

UNIT II FINITE MARKOV DECISION PROCESS 9

The Agent-Environment Interface, Goals and Rewards, Policies and Value functions, Optimal Policies and Optimal Value functions; Dynamic Programming – Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration.

UNIT III MONTE CARLO METHODS AND TEMPORAL-DIFFERENCE LEARNING 9

Monte Carlo Methods - Monte Carlo Prediction, Monte Carlo Estimation of Action-values, Monte Carlo control, Off-Policy Monte Carlo control; Temporal-Difference Learning – TD prediction, Advantages of TD Prediction Methods, Optimality of TD(0), SARSA, Q-Learning, Expected SARSA.

UNIT IV FUNCTION APPROXIMATION AND POLICY GRADIENTS 9

Getting started with the function approximation methods, Revisiting risk minimization, gradient descent from Machine Learning, Gradient MC and Semi-gradient TD(0) algorithms, Eligibility trace for function approximation, After states, Control with function approximation, Least squares, Experience replay in deep Q-Networks; Policy Gradient Methods – Policy approximation and its advantages, Policy Gradient Theorem, REINFORCE, Actor-critic methods, Policy gradient for Continuing Problems, Policy Parameterization for Continuous actions.

UNIT V APPLICATIONS AND CASE STUDIES 9

Deep Reinforcement Learning - Deep Q-Learning, Value-based Deep RL: Deep Q-network, Policy-based Deep RL: REINFORCE, Blackjack Game, Frozen Lake Environment, Recycling Robot, TD-Gammon, Samuel's Checkers Player, Watson's Daily-Double Wagering, Human Level Video Game Play, AlphaGo, AlphaGo Zero, Personalized Web Services, Thermal Soaring.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Apply the basic concepts of probability theory and random variables.	**3**
CO2	Apply Reinforcement Learning basics and Markov decision process.	**3**
CO3	Estimate Monte-Carlo methods and various Temporal Difference learning algorithms.	**4**
CO4	Analyze function approximation and policy gradient methods.	**4**
CO5	Apply reinforcement learning algorithms for various applications.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019.
2. Alberto Leon-Garcia, Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Edition, 2008.

REFERCENCES

1. Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).
2. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012).

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	3	2	-	1	-	-	2	-	-	3	2
2	3	3	2	3	2	1	-	-	1	3	-	-	3	3
3	3	3	3	2	3	2	1	-	2	3	-	-	3	3
4	3	3	3	2	3	3	2	1	3	3	1	-	3	3
5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3-High, 2-Medium, 1-Low

CS22032 **DEEP NEURAL NETWORKS**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basis of linear and softmax regression.
- To learn the architectures of Artificial Neural Network.
- To apply CNN architectures of deep neural networks.
- To develop expertise in modern neural networks for solving real world problems.
- To model recurrent neural network for handling sequential data.

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Linear Regression – logistic regression –- Loss function – Cost function – Softmax Regression - Model Evaluation.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Multilayer Perceptron –Activation Function - Back Propagation Algorithm – Model Selection – Regularization – Weight Decay – Dropout

UNIT III CONVOLUTIONAL NEURAL NETWORK 9

Constraints in MLP – Convolution for image – Padding – Stride – Multiple Input and Multiple output – Pooling – Convolution Neural Networks

UNIT IV MODERN NEURAL NETOWRKS 9

Deep Convolutional Neural Network – Networks using Blocks – Network in Network – Networks with Parallel concatenations – Batch Normalization

UNIT V RECURRENT NEURAL NETOWRK 9

Sequence Models – Recurrent Neural Networks – Gated Recurrent Unit – Long Short-Term Memory – Bi-Directional Recurrent Neural Network – Encoder and Decoder architecture.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Construct linear neural network for multi classification problem.	**3**
CO2	Train deep learning models and ensure the gradients are well controlled	**3**
CO3	Apply CNN and its variants for suitable applications.	**3**
CO4	Analyse and implement different neural network architecture to solve real world problems.	**4**
CO5	Construct a sequential model which can capture the dependencies for time series data	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Aston Zhang, Zachary C. Lipton, Mu Li, Alexander J. Smola, "Dive into Deep Learning", Cambridge University Press, First Edition, 2021.
2. Bengio Y, Goodfellow I, Courville A, "Deep learning", MIT press, 2017.

REFERENCES

1. Charniak E, "Introduction to deep learning", The MIT Press, 2019.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	2	3	3	-	-	2	1	3	3	3	3
2	3	1	2	1	3	3	-	-	1	1	3	3	3	3
3	3	3	3	3	3	3	-	-	2	1	3	3	3	3
4	3	3	3	3	3	3	-	-	2	1	3	3	3	3
5	1	1	3	2	3	3	-	-	2	1	3	3	3	3

3-High, 2-Medium, 1-Lows

CS22033 **RECOMMENDATION SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the foundations of the recommender system.
- To learn the significance of Content based recommendation systems.
- To apply mathematical optimization in collaborative filtering.
- To make students understand Attack resistant methods.
- To apply evaluating paradigms and its goals.

UNIT I INTRODUCTION TO RECOMMENDER SYSTEMS 9

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- classification, Bayes classifiers, Ensembles of classifiers, Clustering, SVMs Dimensionality reduction – Singular Value Decomposition (SVD)

UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS 9

Domain-specific challenges in recommender systems -High-level architecture of content-based systems - Content-based recommender systems. Advantages and drawbacks- Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT III COLLABORATIVE FILTERING METHODS 9

Mathematical optimization in CF RSs-Optimization objective -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 - Regularization and overfitting-Temporal models

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS 9

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

UNIT V EVALUATING RECOMMENDER SYSTEMS 9

Evaluating Paradigms – General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics- User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the basic concepts of recommender systems.	**2**
CO2	Implement Content based and data-mining algorithms in recommender systems data sets.	**3**
CO3	Construct Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.	**3**
CO4	Analyze different types of Attack resistant methods	**4**
CO5	Evaluate and compare the performance of various models	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Francesco Ricci , Lior Rokach , Bracha Shapira, "Recommender Systems", Handbook-Springer, Third edition, 2022
2. Charu C. Aggarwal, "Recommender Systems" Springer, First edition, 2016.

REFERENCES

1. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, "Mining of massive datasets", Cambridge University Press, Third edition, 2020
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , "Recommender Systems: An Introduction", Cambridge University Press, First edition 2011.
3. F. Ricci, L Rokach, B. Shapira and P.B. Kantor, "Recommender systems handbook", Springer 2010
4. J. Leskovec, A. Rajaraman and J. Ullman, "Mining of massive datasets", Cambridge University, Second Edition, 2012.
5. M. Chiang, "Networking Life", Cambridge, 2010.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	2	-	-	-	-	1	-	2	2	3
2	3	3	2	-	3	-	-	-	-	2	-	3	3	3
3	2	3	3	3	3	-	-	-	-	3	2	3	3	3
4	2	3	3	3	2	3	2	-	-	2	2	3	-	3
5	2	3	3	3	3	-	2	-	2	3	3	3	3	3

3-High, 2-Medium, 1-Low

CS22034 **ROBOTIC PROCESS AUTOMATION**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basic concepts of Robotic Process Automation.
- To expose to the Automation Process Activities and methodologies.
- To learn the fundamentals of APP integration, Recording and Scrapping.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To apply and learn to deploy and Maintain the software bot.

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9

Emergence of Robotic Process Automation (RPA)-Evolution of RPA, RPA vs Automation - Processes & Flowcharts -Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files- Scope and techniques of automation

UNIT II AUTOMATION PROCESS ACTIVITIES 9

Process Automation vs Robotic Process Automation -Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making-Data Manipulation: Variables, Collection, Arguments- Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III APP INTEGRATION, RECORDING AND SCRAPING 9

Integration- Recording, Scraping, Selector, Workflow Activities-Recording mouse and keyboard actions to perform operation-Scraping data from website and writing to CSV. Process Mining.

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT 9

Exception handling, Common exceptions, Logging- Debugging techniques, Strategies for solving issues - Catching errors. Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine

UNIT V DEPLOYMENT AND MAINTENANCE 9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages-License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the key distinctions between RPA and existing automation techniques and platforms.	**2**
CO2	Implement the Automation Process Activities and methodologies	**3**
CO3	Construct the fundamentals of APP integration, Recording and Scrapping	**3**
CO4	Use UIPath Studio to detect, and handle exceptions in automation processes	**3**
CO5	Evaluate and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Alok Mani Tripathi "Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool" ,UiPath, Packt Publishing,First edition,2018.
2. Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, First edition, 2020.

REFERENCES

1. Frank Casale , Rebecca Dilla , Heidi Jaynes , Lauren Livingston ," Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation", Amazon Asia-Pacific Holdings Private Limited, 2018.
2. Richard Murdoch, "Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Amazon Asia-Pacific Holdings Private Limited, 2018.
3. A Gerardus Blokdyk, "Robotic Process Automation RPA- A Complete Guide", 2020.
4. Srikanth Merianda,"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
5. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes", Packt Publishing, 1st Edition 2018.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	3	2	-	-	-	2	-	3	3	2
2	3	3	3	-	3	-	-	-	-	3	-	3	3	3
3	3	3	3	2	3	-	-	-	-	3	2	3	3	3
4	2	3	3	3	3	2	2	-	-	2	2	3	-	3
5	2	3	3	3	3	-	2	-	2	3	3	3	3	3

3-High, 2-Medium, 1-Low

CS22035 INFORMATION RETRIEVAL METHODOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the basics of information retrieval with pertinence to modeling, query operations, and indexing
- Familiarize with boolean and vector space retrieval models;
- Build working systems that assist users in finding useful information on the Web.
- Familiarize with Link Analysis and search in mobile web and social networks.
- To get an understanding of machine learning techniques for text classification and clustering.

UNIT I INTRODUCTION TO INFORMATION RETRIEVAL 9

Introduction - History of IR- Components of IR - Issues – Open source Search engine Frameworks - The impact of the web on IR - IR Versus Web Search - Components of a Search engine - Crawls and Feeds – Crawling the Web - Crawling Documents and Email – Document Feeds-Practical Issues on the Web-Visualization in Search Interfaces.

UNIT II INFORMATION RETRIEVAL MODELLING 9

Boolean and vector-space retrieval models- Term weighting - TF-IDF weighting- cosine similarity – Preprocessing - Inverted indices - efficient processing with sparse vectors – Language Model-based IR - Probabilistic IR – Latent semantic indexing- Relevance feedback and query expansion.

UNIT III WEB RETRIEVAL – CRAWLING AND NAVIGATION 9

Web search overview and structure, Content Relevance – Evaluating search engines – Different types of search engines Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations — Search Engine Ranking– Search Engine Advertising – Metasearch – Personalization – Image search - Special Purpose Search Engines - Web Browsing and Navigation - Navigation Tools - Navigational Metrics.

UNIT IV SEARCH IN MOBILE WEB AND SOCIAL NETWORKS 9

The Mobile Web - The Paradigm of Mobile Computing - Mobile Web Services - Mobile Device Interfaces - The Navigation Problem in Mobile Portals - Mobile Search - Social Networks – Introduction - Social Network Analysis - Collaborative Filtering – Weblogs - Social Tagging and Bookmarking - Opinion Mining.

UNIT V DOCUMENT TEXT MINING 9

Text Mining -Text classification and clustering - Categorization algorithms: Naive Bayes; decision trees; and nearest neighbour - Clustering algorithms: agglomerative clustering; k-means; Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Identify and design the various components of an Information Retrieval system.	**2**
CO2	Understand information retrieval models and techniques.	**2**
CO3	Design a Web Search Engine and explore its navigation tools.	**3**
CO4	Use Link Analysis and Search in mobile web & social networks.	**3**
CO5	Apply relevant document text mining techniques.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

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. C. Manning, P. Raghavan, and H. Schütze, ―Introduction to Information Retrieval, Cambridge University Press, 2008.

REFERENCES

1. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, ―Recommender Systems Handbook, First Edition, 2011.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	3	-	-	-	2	2	2	2	3	2
2	3	3	2	3	3	-	-	-	2	2	2	3	3	3
3	3	3	3	3	3	2	2	-	3	3	3	3	3	3
4	3	3	3	3	3	3	3	-	3	3	3	3	3	3
5	3	3	3	3	3	3	3	-	3	3	3	3	3	3

3-High, 2-Medium, 1-Low

CS22036 **COMPUTER VISION**

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the fundamental concepts related to Image formation and processing.
- Learn Feature detection, matching, and segmentation techniques.
- Build 3D Reconstruction Skills.
- Understand the Motion Analysis Techniques in Computer Vision.
- Understand image-based rendering and recognition.

UNIT I IMAGE PROCESSING FUNDAMENTALS 9

Introduction to Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization-Image Enhancement and Restoration-Thresholding techniques.

UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION 9

Points and patches - Edges - Lines - Segmentation - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT III 3D RECONSTRUCTION AND DEPTH ESTIMATION 9

Shape from X - Active rangefinding - Surface representations - Point-based representations-Volumetric representations - Model-based reconstruction - Recovering texture maps and albedos-Depth Estimation: Epipolar Geometry-Sparse Correspondence and Dense Correspondence-RANSAC and Alignment.

UNIT IV MOTION ANALYSIS AND PATTERN ANALYSIS 9

Background Subtraction and Modeling-Optical Flow- KLT- Spatio-Temporal Analysis-Dynamic Stereo- Motion parameter estimation. Pattern Analysis: Clustering - K-Means - K-Medoids; Classification - Discriminant Function.

UNIT V IMAGE-BASED RENDERING AND RECOGNITION 9

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the image transformation and enhancement methods.	**2**
CO2	Apply suitable feature extraction and segmentation techniques.	**3**
CO3	Use suitable methods for 3D Reconstruction.	**3**
CO4	Select a suitable optical flow for the motion field.	**3**
CO5	Apply Image rendering techniques.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. R. Szeliski- "Computer Vision: Algorithms and Applications 2nd Edition "- Springer 2022.
2. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, Second Edition, 2015.

REFERENCES

1. Simon Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th Edition, Cengage Learning, USA, 2017.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	3	2	-	1	-	-	2	-	-	3	2
2	3	3	2	3	2	1	-	-	1	3	-	-	3	3
3	3	3	3	2	3	2	1	-	2	3	-	-	3	3
4	3	3	3	2	3	3	2	1	3	3	1	-	3	3
5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3-High, 2-Medium, 1-Low

CS22037 **EXPLAINABLE AI**

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the concepts within Explainable AI and interpretable machine learning.
- Familiarize comprehension of current techniques for generating explanations from black-box machine learning methods.
- Understand the ability to select and assess Explainable AI methods.
- Learn current ethical, social, and legal challenges related to Explainable AI.
- Understand the performance of a machine learning model and its ability to produce explainable and interpret able predictions.

UNIT I INTRODUCTION **9**

Black-Box problem, Goals, Brief History, Purpose, Societal Impact, Types of Explanations, Trade-offs, Taxonomy, Flowchart for Interpretable and Explainable Techniques. Pre-model Interpretability and Explainability- XAI techniques and limitations.

UNIT II XAI MODELS **9**

Ante-hoc Explainability (AHE) models - Post-hoc Explainability (PHE) models - Interactive Machine Learning (IML) - Black Box Explanation through Transparent Approximation (BETA) models - Hybrid Models-Model Validation, Evaluation, and Hyperparameters, Model Selection and Visualization.

UNIT III MODEL INTERPRETABILITY **9**

Advances in Interpretable Machine Learning: Interpretable vs. Explainable Algorithms, Tools and Libraries, Ensemble-Based, Decision Tree-Based, Rule-Based Techniques, Scoring System. Post-Hoc Interpretability and Explanations: Tools and Libraries, Visual Explanation, Feature Importance, Example-Based, Interpretability Problems: Optimizing sparse logical models such as decision trees, Complete supervised disentanglement of neural networks, Dimensionality reduction for data visualization.

UNIT IV EXPLAINABLE DEEP LEARNING **9**

Attention Mechanisms - Modular Networks - Feature Identification - Learn to Explain - Feature Visualization - Deep Visualization- gradcam and Activation maps - Sensitivity analysis.

UNIT V EXPLAINABILITY **9**

Time Series Forecasting, Natural Language Processing, and Computer Vision XAI: Challenges: Properties of Explanation, Categories of Explanation, Taxonomy of Explanation Evaluation. XAI: Future: Formalization of Explanation Techniques and Evaluations, Adoption of Interpretable

Techniques, Human-Machine Collaboration, Collective Intelligence from Multiple Disciplines, Responsible AI (RAI), XAI and Security, Causality and XAI.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the context of the machine learning application and why explainability would help, but also scrutinize which kind of explainability technique is necessary.	**2**
CO2	Understand the concepts that are important in model validation, evaluation, and performance visualization for both supervised and unsupervised learning.	**2**
CO3	Implement one or more post hoc explain ability techniques through a self-chosen set of programming platforms.	**3**
CO4	Critically reflect on the results from Explainable deep learning techniques and suggest how they help the problem context.	**3**
CO5	Demonstrate comprehension of challenges and future related to Explainable AI.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Uday Kamath and John Liu "Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning", Springer Cham, First Edition, 2021.
2. Molnar, Christoph. "Interpretable machine learning. A Guide for Making Black Box Models Explainable", 2019.

REFERENCES

1. Leonida Gianfagna and Antonio Di Cecco, "Explainable AI with Python", Springer International Publishing, First Edition, 2021.
2. Denis Rothman, "Hands-On Explainable AI (XAI) with Python", Packt Publishing, First Edition, 2020.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	-	3	2	-	2	-	-	2	-	-	3	2
2	3	3	2	3	3	1	-	-	1	3	-	-	3	3
3	3	3	3	2	3	2	1	-	2	3	-	-	3	3
4	3	3	3	2	3	3	2	1	3	3	1	-	3	3
5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3-High, 2-Medium, 1-Low

CS22041 **INFORMATION SECURITY SYSTEM**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basics of Information Security.
- To know the Legal - Ethical and Professional issues in Information Security and Risk Management.
- To analyze the Data Leakage and the various risks and threats.
- To become aware of various International security standards.
- To have a technical knowledge on Information security.

UNIT I INTRODUCTION **9**

Information Security Fundamentals - Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System- Computer Security Concerns- Securing the Components-Balancing Security and Access - SDLC - SDLC Security.

UNIT II SECURITY INVESTIGATION AND ANALYSIS **9**

Need for Security- Business Needs- Threat and Attack Vectors- Types of Attacks- Common Vulnerabilities and Exposure (CVE)- Security Attacks - Legal- Ethical and Professional Issues- Risk Management: Identifying and Assessing Risk – Assessing and Controlling Risk.

UNIT III FUNDAMENTALS AND DATA LEAKAGE **9**

Key Elements of Networks- Logical Elements of Networks- Critical Information Characteristics- Information States- Work Effectively with Colleagues (NOS 9002)- Data Leakage and Statistics- Data Leakage Threats- Reducing the Risk of Data Loss- Key Performance Indicators (KPI)- Database Security.

UNIT IV RISK ASSESSMENT AND MANAGEMENT **9**

Threats and its Categories - Vulnerabilities and its Categories - Risk - Calculation of Overall Risk - Risk Identification - Risk Analysis - Risk Evaluation - Risk Control- Risk Termination - Risk Reduction - Risk Transfer - Risk Tolerance - Overall Risk Assessment - Risk Management Framework and Process - Managing Risk - Risk Treatment- Alternative Risk Management Methodologies.

UNIT V SECURITY MANAGEMENT MODELS AND PERFORMANCE MEASUREMENT **9**

Blueprints - Frameworks and Security Models - Security Architecture Models - Various Access Control Models - Information Security Performance Measurement.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	The student will be able to interpret the basics of information security.	**3**
CO2	The student will be able to illustrate and demonstrate the legal- ethical and professional issues and risk management.	**4**
CO3	The student will be able to explore the data leakage from various threats and the risk management	**4**
CO4	The student will be aware of various standards in the Information Security System.	**2**
CO5	The student will be able to design and implement the concepts of various Security Techniques.	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Andy Taylor, David Alexander, Amanda Finch and David Sutton, "Information Security Principles", 2020, Third Edition, BCS, United Kingdom
2. Michael E.Whilman and Herbert J.Mattord, "Management of Information Security", 6th Edition, Cengage- USA- 2018

REFERENCES

1. Micki Krause- Harold F. Tipton- " Handbook of Information Security Management"- Vol 1-3 CRC Press LLC- 2004.
2. Michael T. Goodrich and Roberto Tamassia- "Introduction to Computer Security"- Addison Wesley- Boston- 2011.
3. Matt Bishop, " Computer Security Art and Science"- Pearson/PHI- 2002.
4. Harold F. Tipton and Micki Krause, "Information Security Management Handbook", 6th Edition,-CRC Press, USA- 2007.
5. Douglas Landoll "Information Security Policies- Procedures- and Standards - A Practitioner's Reference", CRC Press- USA- 2016

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	2	2	-	2	-	-	1	2	2	3
2	3	2	2	2	3	2	-	2	-	-	-	2	2	2
3	3	3	3	3	3	3	-	-	-	-	-	-	3	3
4	3	3	3	3	3	2	-	-	-	-	-	-	2	2
5	3	3	3	3	3	3	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CS22042 **ETHICAL HACKING**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basics of computer-based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.

UNIT I INTRODUCTION **9**

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security.

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS **9**

Foot printing Concepts - Foot printing through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Foot printing through Social Engineering - Foot printing Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall.

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS **9**

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss.

UNIT IV SYSTEM HACKING **9**

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade.

UNIT V HARDWARE SECURITY **9**

Side-channel attacks- Physical inclinable functions- Hardware Trojans - Types of attacks using Metasploit framework: Password cracking- Privilege escalation- Remote code execution-Attack on web servers: password attack - SQL injection- Cross site scripting.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	The student will be able to express knowledge on basics of computer based vulnerabilities.	**3**
CO2	The student will be able to gain understanding on different foot printing, reconnaissance and scanning methods.	**2**
CO3	The student will be able to demonstrate the enumeration and vulnerability analysis methods.	**4**
CO4	The student will be able to knowledge on hacking options available in Web and wireless applications.	**4**
CO5	The student will be able to acquire knowledge on the options for network protection.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2022.

REFERENCES

1. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
2. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.
3. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.
4. https://www.w3schools.com/

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	2	2	-	2	-	-	1	2	2	3
2	3	3	2	2	3	2	-	2	-	-	-	2	2	2
3	3	2	2	3	3	2	-	-	-	-	-	-	2	2
4	2	3	3	2	3	2	-	-	-	-	-	-	2	2
5	2	2	3	3	2	2	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

CS22043 **5G SECURITY AND CHALLENGES**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the fundamental principles of 5G technology.
- To identify and analyze security challenges in the context of 5G networks.
- To explore security solutions and protocols for mitigating 5G-related threats.
- To assess the impact of 5G security on various applications and industries.
- To develop critical thinking skills in evaluating and proposing security measures for 5G networks.

UNIT I INTRODUCTION TO 5G **9**

Evolution of Mobile Networks - Key Features: 4G & 5G Technology – Architecture: 4G & 5G and Components of 5G Networks - Overview of 5G Security Landscape.

UNIT II SECURITY ARCHITECTURE IN 5G **9**

Core Network Security in 5G - Radio Access Network (RAN) Security - Network Slicing Security - Security Functions in 5G Architecture.

UNIT III THREATS AND VULNERABILITIES IN 5G **9**

Overview of Threat Landscape - DDoS Attacks in 5G - Insider Threats and Unauthorized Access - Privacy Concerns in 5G Networks.

UNIT IV SECURITY PROTOCOLS AND SOLUTIONS **9**

Authentication and Key Management - Encryption Techniques in 5G - Security Protocols for User and Control Plane - Virtualization and Cloud Security in 5G.

UNIT V CASE STUDY **9**

Security Challenges in IoT and Smart Cities - 5G Security in Healthcare and Finance - Critical Infrastructure Protection - Case Studies on 5G Security Incidents.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the fundamental principles of 5G technology.	**2**
CO2	Identify and analyze security challenges in 5G networks.	**4**
CO3	Explore security solutions and protocols for 5G threats.	**3**
CO4	Assess the impact of 5G security on various applications.	**4**
CO5	Develop critical thinking skills in proposing security measures.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Madhusanka Liyanage, Ijaz Ahmad, "A Comprehensive Guide to 5G Security", Wiley; 1st edition, 2018
2. Jonathan Rodriguez, "Fundamentals 5G Mobile Networks", John Wiley & Sons, 1st Edition, 2015.
3. R. Vannithamby and S. Talwar, "Towards 5G: Applications, Requirements and Candidate Technologies", John Willey & Sons, 1st Edition, 2017

REFERCENCES

1. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies, CRC Press, 1st Edition, 2019.
2. Erik Dahlman, Stefan Parkvall, Johan Skold "5G NR: The Next Generation Wireless Access Technology", Academic Press, 1st Edition, 2018

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	1	1	-	-	-	-	-	-	2	-
2	3	2	-	-	1	1	-	-	-	-	-	-	2	-
3	3	2	-	-	1	1	-	-	-	-	-	-	2	-
4	3	2	-	-	1	1	-	-	-	-	-	-	2	1
5	3	2	-	-	1	1	-	-	-	-	-	-	2	1

3-High, 2-Medium, 1-Low

CS22044 **CYBER SECURITY**

L	T	P	C
3	0	0	3

OBJECTIVES

- To learn cybercrime and cyberlaw.
- To understand the cyber attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber attack.
- To learn how to prevent a cyber attack

UNIT I INTRODUCTION **9**

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-Common cyber crimes- cyber crime targeting computers and mobiles, financial frauds, Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II ATTACKS AND COUNTERMEASURES **9**

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack - malware and ransomware attacks - zero day and zero click attacks– Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT III RECONNAISSANCE **9**

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 IV INTRUSION DETECTION SYSTEM **9**

Host Based Intrusion Detection – Network Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT V INTRUSION PREVENTION SYSTEM **9**

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 (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	The student will be able to basics of cyber security, cyber crime and cyber law.	**3**
CO2	The student will be able to classify various types of attacks and malware and the tools to launch the attacks.	**3**
CO3	The student will be able to apply intrusion techniques to detect intrusion.	**4**
CO4	The student will be able to apply intrusion prevention techniques to prevent intrusion.	**4**
CO5	The student will be able to apply intrusion prevention techniques to prevent intrusion.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021.
2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011.

REFERENCES

1. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013.
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011.
3. Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007.
4. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015.
5. https://owasp.org/www-project-top-ten/

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	2	1	2	1	2	-	2	-	3	-	2
2	2	3	2	2	3	2	2	1	-	2	-	3	1	3
3	3	3	2	2	3	1	-	1	1	2	1	3	2	3
4	2	2	3	3	3	1	1	2	-	2	2	3	2	3
5	2	2	3	3	3	2	1	2	-	3	3	3	3	3

3-High, 2-Medium, 1-Low

CS22045 **MALWARE ANALYSIS**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand Malware Taxonomy and malware attack life cycle.
- To analyze the static and dynamic malwares.
- To understand typical malware behavior and delivery mechanisms.
- To build and debug the malwares and Obfuscation using emerging tools.
- To explore anti-malware analysis techniques.

UNIT I INRODUCTION **9**

Malware Taxonomy - Malware Attack Life Cycle - The Combat Teams - Anti-malware Products Reverse Engineering for Windows and Linux systems - Trojan Concepts.

UNIT II MALWARE ANALYSIS **9**

Static: Fingerprinting the Malware - PE: File types, and header analysis, Extracting Strings – Classifying Malware using YARA. Dynamic: Behavior Events Analysis using ProcMon and Autoruns - Detecting Code Injection – Automated dynamic analysis - Sandboxing: Tools and Techniques -Intrusion Detection.

UNIT III REVERSE ENGINEERING **9**

Reverse engineering as a process - Binary analysis tools, Disassemblers – Debuggers – Decompilers- Identification and Extraction of Hidden Components - Typical malware behavior – Malware delivery- Phishing Attack.

UNIT IV BUILD AND DEBUG THE MALWARE **9**

Low-Level Language: Registers, Memory addressing, Opcode bytes - Builder and debugger: IDA Pro, Ollydebug -Windows API libraries - Packing and Encryption. Obfuscation Techniques: File Obfuscation - Binary Obfuscation Techniques - identification - Decrypting with x86dbg.

UNIT V ANTI-MALWARE ANALYSIS **9**

Anti-debugging - Anti-VM - Anti-emulation - Anti-dumping - SysInternals Suite Tools –Deadlisting - Analysis of HTML scripts - MS Office macro analysis - PDF file analysis – SWFTools – FLASM – Flare.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the Malware Taxonomy and malware attack life cycle.	**2**
CO2	Analyse different types of static malwares and dynamic malwares.	**3**
CO3	Understand the malware behavior and delivery mechanisms in reverse engineering.	**2**
CO4	Make use of appropriate techniques to build and debug the malware and Obfuscation using emerging tools.	**4**
CO5	Explore the different anti-malware analysis techniques.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Abhijit Mohanta, Anoop Saldanha, Malware Analysis and Detection Engineering a Comprehensive Approach to Detect and Analyze Modern Malware, 2020, 1st edition, Apress (ISBN 978-1-4842-6192-7), United States.
2. Reginald Wong, Mastering Reverse Engineering, 2018, 1st edition, Packt Publishing Ltd, Birmingham, ISBN 978-1-78883-884-9, UK.

REFERCENCES

1. M. Sikorski and A. Honig, Practical Malware Analysis: The Hands-on Guide to Dissecting Malicious Software. 2012, 1st edition, No Starch Press San Francisco, CA. (ISBN No.: 9781593272906), United States

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	2	2	2	1	2	-	2	-	3	-	2
2	3	3	2	2	3	1	1	1	-	2	-	3	2	3
3	3	3	2	3	3	-	-	1	1	2	1	3	3	3
4	2	2	3	3	3	-	-	1	-	2	2	3	3	3
5	2	2	3	3	3	2	1	2	-	3	3	3	3	3

3-High, 2-Medium, 1-Low

CS22046 **BLOCKCHAIN TECHNOLOGIES**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand blockchain technology and distributed systems.
- To learn how decentralization of trust is achieved.
- To study the technologies behind cryptocurrencies.
- To impart knowledge of distributed ledgers in business.
- To acquire knowledge in emerging concepts using blockchain.

UNIT I **9**

The growth of Blockchain technology – Distributed Systems – Distributed Ledger –Peer to Peer- Types of Blockchain - Cryptographically Secure - Generic Element of Blockchain – Benefits and limitation of Blockchain– Consensus – CAP Theorem and Blockchain.

UNIT II **9**

Methods of Decentralization – Routes to Decentralization – Smart Contract – Decentralized Organization – Platforms for Decentralization – Consensus Algorithms.

UNIT III **9**

Basic Crypto primitives - Hash functions, Puzzle friendly Hash, Collision resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems - Introduction Bitcoin – Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use - Bitcoin Network and Payments – Bitcoin clients and APIs – Alternative Coins.

UNIT IV **9**

Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts ; Hyperledger: Introduction – Reference Architecture – Fabric – Sawtooth Lake – Corda.

UNIT V **9**

Zero Knowledge proofs and protocols in Blockchain - Applications:Internet of Things, Medical Record Management System and distributed supply chain management-IBM Blockchain Platform Hyperledger.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the importance of distributed ledgers and need of Blockchain	**2**
CO2	Describe decentralization concepts and apply consensus algorithms	**3**
CO3	Explain the basics of cryptography and its applications in cryptocurrencies	**2**
CO4	Apply various distributed ledgers for business	**4**
CO5	Make use of appropriate techniques for designing trust-based business networks	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Van Haren Publishing (Editor), "Introduction to Blockchain Technology: The Many Faces of Blockchain Technology in the 21st Century", Paperback Import, 2019.
2. Imran Bashir, "Mastering Blockchain" Packt 2nd Edition, 2018.
3. Adrian Mcnulty, "Blockchain: The Complete and Comprehensive Guide to Understanding Blockchain Technologies", Createspace Independent Pub, 2018.

REFERENCES

1. Don, Alex Tapscott, "Blockchain Revolution". Portfolio Penguin 2016
2. William Mougayar, "Business Blockchain Promise, Practice and Application of the Next Internet Technology", John Wiley & Sons 2016
3. Tiana Laurence, "Blockchain for Dummies" John Wiley & Sons, 2017.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
2	3	2	-	-	-	-	-	-	-	-	-	-	2	-
3	3	2	-	-	-	-	-	-	-	-	-	-	2	-
4	3	2	-	-	1	-	-	-	-	-	-	-	2	2
5	3	2	-	-	1	-	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

CS22047 IDENTITY MANAGEMENT AND ACCESS MODELS

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the importance of IAM and its regulation.
- To understand the industry standards for Identity management.
- To create the capability to assess the risks, techniques of Identity and authentication.
- To study and devise various access control technique.
- To learn and gain knowledge on access control systems and do typical case studies of online applications

UNIT I INTRODUCTION **9**

Benefits of IAM Security-Identity and its theft: Eliminating vulnerabilities in identification and authentication processes - Compromising multiple identities -Exploiting Object ID OID identities. Ensuring strong authentication: Enforcing authentication with biometrics -Requiring multifactor authentication with smart cards - Migrating to virtual smart cards and Trusted Platform Module TPM-Health Insurance Portability and Accountability Act (HIPAA), Federal Security Information Security Act (FISMA).Sarbanes-Oxley Act.

UNIT II INDUSTRY STANDARDS FOR IDENTITY MANAGEMENT **9**

Industry standard protocols to enable cost-effective identity management - Service Provisioning Markup Language (SPML), Security Assertions Markup Language (SAML), extensible Access Control Markup Language (XACML), Lightweight Directory Access Protocol (LDAP) and X.500, Directory Services Markup Language (DSML), Universal Description Discovery Integration (UDDI), Web Services Security(WS-S).

UNIT III IDENTITY MANAGEMENT **9**

Identity and Access Management- key Concepts , Adoption risks, components, Administration of Access Rights and Entitlements, provisioning process and enforcement process, use of technology in IAM, auditing IAM. Managing identity including Internet of Things. Identification and Authentication Techniques -Passwords, Biometrics, Tokens, Tickets, Implementing Single Sign-On (SSO):- Interoperating via open industry standards, federated logon and claims -Applying Kerberos identities in a domain, Multiple Authentication Factors.

UNIT IV ACCESS MANGEMENT **9**

Types of access control, Layered access controls and ―defense in depth‖, The Process of Accountability. Access Control Techniques- Discretionary Access Controls (DAC), Nondiscretionary Access Controls (NAC), Mandatory Access Controls (MAC), Role-Based Access Controls (RBAC), Task Based Access Controls (TBAC),Lattice-Based Access Controls. Access Control Methodologies and Implementations - Access Control Administration - Account Administration - Account, Log, and Journal Monitoring/Audits- Access Rights and Permissions.

UNIT V ACCESS CONTROL SYSTEMS 9

Identity Management and Trust Models Current access management technologies. Authentication technologies-overview, authentication by third parties, choosing an authentication system. Authorization based on physical location-IP address-based licensing, Authorization based on user identity or affiliation. Open source IAM – Open sources Services: Google IAM, Azure IAM and AWS IAM. Case Studies: Technology, Architecture and Controlling Access to Online/Mobile Applications-Library, Banking and Shopping.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Able to understand the role of IAM with emerging mobile information society, compliance and regulations.	**2**
CO2	Able to understand the industry standards for Identity management.	**2**
CO3	Able to learn techniques of Identity and authentication with risks assessment.	**2**
CO4	Build capability to compare various access control techniques.	**3**
CO5	Gain knowledge on access control systems and Ability to carry out analysis and report strength and weakness in IAM.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Mike Chapple,"Access Control and Identity Management (Information Systems Security & Assurance) 3rd Edition" ,2020,ISBN: 9781284198355.
2. Messaoud Benantar,"Access Control Systems: Security, Identity Management And Trust Models" Springer,2006,ISBN-13:978-0-387-00445-7.

REFERENCES

1. Access Control Systems: Security, Identity Management and Trust Models Messaoud Benantar, IBM Corp, Austin, TX, USA. Library of Congress, ISBN-13: 978-0-387-00445-7 eISBN-13: 978-0-387-27716-5.
2. Access and Identity Management for Libraries: Controlling access to online information, Masha Garibyan, Simon McLeish and John Paschoud, Facet Publishing 2014 www.facetpublishing.co.uk.
3. Identity and Access Management GTAG , Frank Bresz, Ernst & Young LLP etal The Institute of Internal Auditors, Altamonte Springs, FL32701-4201. 2007.

4. Identity and Access Management - Digital 2020, Ray Wagner, ISSA Journal , June 2014 , www.issa.org.
5. The Definitive Guide to Security Management, Dan Sullivan, Realtimepublishers.com chapter5:Identity and Access Management http://www3.ca.com/ebook/.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3	2	3	2	3	-	3	-	2	2	2	2	3
2	1	2	2	1	2	-	2	3	2	2	1	2	2	2
3	2	3	3	3	3	2	2	3	3	2	3	2	3	3
4	2	2	3	2	3	2	3	3	3	2	3	3	3	2
5	3	3	3	3	3	3	3	3	3	2	3	3	3	3

3-High, 2-Medium, 1-Low

CS22048 **DIGITAL FORENSICS**

L	T	P	C
3	0	0	3

OBJECTIVES

- To emphasize the fundamentals and importance of digital forensics
- To Analyze the physical storage media and its importance.
- To understand the basic digital forensics and techniques for conducting the forensic examination on digital devices.
- To learn to analyze and validate forensics data.
- To analyze the various tools and techniques for investigation cases.

UNIT I FUNDAMENTALS OF DIGITAL FORENSICS 9

Introduction to Forensics - Procedure for forensics – Forensics duplication and investigation - Basics of Digital Forensics - Digital Evidence-Types & Sources of Digital Evidence - The digital forensic process- Challenges of Digital Evidence- the legal process of forensics- Data Acquisition- Types of Data Acquisition- Acquisition Methods.

UNIT II STORAGE MANAGEMENT 9

Types of Storage: The Primitive Storage media types- Magnetic Tape Drives and their usage- DVD and their usage types in forensics field- Blu-ray and it's features- Flash Storage Media - USB Flash drives -flash cards-hard disk and solid-state drivers.

UNIT III DIGITAL FORENSICS ARCHETYPE 9

Introduction to CyberCrime – Documenting and evidence of the crime scene-forensic cloning of evidence- hashing concepts to maintain the integrity of evidence- storing digital evidence- Creating a Kali Live (Forensic Mode) Bootable USB- Simulate Creating a Disk Image for a Forensic Analysis-Examining a forensic Disk Image Using Autopsy

UNIT IV COMPUTER FORENSICS 9

Using an external USB Device in Kali – Acquiring a forensic copy of the windows registry-Analyzing the windows registry for evidence-Dumping Wi-Fi Credentials using netsh-Email Header Analysis-Extracting Thumbnail images from a Suspects machine-Memory Forensics Using the Volatility Framework-Gathering Windows System Information using Live-Forensicate.

UNIT V COMPUTER FORENSICS TOOLS 9

Evaluating Computer Forensics Tool Needs, Types of Computer Forensics Tools, Tasks Performed by Computer Forensics Tools, Tool Comparisons, Other Considerations for Tools, Computer Forensics Software Tools, Command-Line Forensics Tools, UNIX/Linux Forensics Tools, Other GUI Forensics Tools, Computer Forensics Hardware Tools, Forensic Workstations, Using a Write-Blocker.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe Digital Forensic concepts and its process and law aspects.	**2**
CO2	Students will understand the inner workings of file systems.	**2**
CO3	Interpret the cyber pieces of evidence, Digital forensic process model and their legal perspective.	**3**
CO4	Students will be able to analyze disk images, recover deleted files and extract hidden information.	**4**
CO5	Demonstrate various forensic tools to investigate the cybercrime and to identify the digital pieces of evidence.	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

REFERENCES

1. Angus M.Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, 2008.
2. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", Fourth Edition, Course Technology.
3. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, Syngress imprint of Elsevier.
4. MarjieT.Britz, ―Computer Forensics and Cyber Crime‖: An Introduction‖, 3rd Edition, Prentice Hall, 2013
5. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3	2	3	2	3	-	3	-	2	2	2	2	3
2	1	2	2	1	2	-	2	3	2	2	1	2	2	2
3	2	3	3	3	3	2	2	3	3	2	3	2	3	3
4	2	2	3	2	3	2	3	3	3	2	3	3	3	2
5	3	3	3	3	3	3	3	3	3	2	3	3	3	3

3-High, 2-Medium, 1-Low

CS22051 **VIRTUALIZATION TECHNIQUES**

L	T	P	C
3	0	0	3

OBJECTIVES

- To Learn the basics and types of Virtualization.
- To Understand the Hypervisors and its types.
- To Explore the Virtualization Solutions.
- To Experiment the virtualization platforms.
- To Explore the various virtualization tools in real world.

UNIT I INTRODUCTION TO VIRTUALIZATION **9**

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 II SERVER AND DESKTOP VIRTUALIZATION **9**

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization.

UNIT III NETWORK VIRTUALIZATION **9**

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLAN-WAN Architecture-WAN Virtualization.

UNIT IV STORAGE VIRTUALIZATION **9**

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID.

UNIT V VIRTUALIZATION TOOLS **9**

VMWare-Amazon AWS-Microsoft Hyper-V- Oracle VM Virtual Box – IBM PowerVM- Google Virtualization- Case study.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the virtualization concepts.	**2**
CO2	Understand the types of hypervisors.	**2**
CO3	Experiment with the VM with various software.	**3**
CO4	Install & configure the different VM platforms.	**4**
CO5	Apply the Virtualization for real-world applications.	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Matthew Portnoy, "Virtualization Essentials", Wiley Publications,3rd Edition Mar 2023.
2. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, " Cloud Computing: Principles and Paradigms", John Wiley & Sons, 2011.
3. Anthony T. Velte, Toby J. Velte Robert Elsenpeter "Cloud computing a practical approach", TATA McGraw- Hill, New Delhi – 2010.

REFERENCES

1. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.
2. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	3	-	-	-	-	-	-	-	3	-
2	3	2	-	-	2	-	-	-	-	-	-	-	2	-
3	-	-	3	3	3	-	-	-	-	-	-	-	3	-
4	-	-	3	-	3	-	-	-	2	-	-	-	3	-
5	3	-	3	-	3	-	2	-	-	-	-	-	3	-

3-High, 2-Medium, 1-Low

CS22052 **DEVOPS AND CONTAINERIZATION**

L	T	P	C
3	0	0	3

OBJECTIVES

- To explore and deploy the microservice in a container
- To understand the Essentials of DevOps
- To build and automate the test cases using Maven & Gradle
- To perform continuous testing and deployment using Jenkins
- To Understand to leverage Cloud-based DevOps tools using Azure DevOps

UNIT I CONTAINERS **9**

Docker Containers: Virtual Machines – Containers – Docker Architecture and Components – The Power of Docker: A Simple Example; Docker Interface: Key Docker Commands – Docker- file – Docker Compose; Case Study: Containerizing a Helpdesk Application: Containerizing Microservices – Deploying the Catalog Microservice.

UNIT II INTRODUCTION TO DEVOPS **9**

DevOps Essentials – Introduction To AWS, GCP, Azure – Version control systems: Git and Github.

UNIT III COMPILE AND BUILD USING MAVEN & GRADLE **9**

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 IV CONTINUOUS INTEGRATION USING JENKINS **9**

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 V BUILDING DEVOPS PIPELINES USING AZURE **9**

Create Github Account, Create Repository, Create Azure Organization, create a new pipeline, Build a sample code, Modify azure- pipelines.yaml file, Case Study- Real-Time Chat Application: Node.js, Express, and Socket.io (Containerize a real-time chat application, set up a CI/CD pipeline with GitHub Actions, deploy using Kubernetes, and manage infrastructure with Terraform on AWS.)

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Build a container and deploy a microservice.	**2**
CO2	Understand different actions performed through Version control tools like Git.	**2**
CO3	Apply Maven & Gradle for continuous test and build the testcases.	**3**
CO4	Apply continuous testing and deployment using Jenkins.	**3**
CO5	Apply the DevOps tools using Azure DevOps.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Parminder Singh Kocher Boston, "Microservices and Containers", Addison-Wesley, 2018.
2. Mitesh Soni, " 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 January 2020.
3. 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.

REFERENCES

1. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014.
2. Scott Coulton, "Puppet for Containerization", PACKT Publishing, 2016.
3. https://www.jenkins.io/user-handbook.pdf.
4. https://maven.apache.org/guides/getting-started.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	2	3	-	2	-	2	2	3	2	3	-
2	3	2	2	2	3	-	-	-	2	2	3	2	3	-
3	3	2	3	2	3	-	-	-	2	2	3	2	3	-
4	3	2	3	2	3	-	2	-	2	2	3	2	3	-
5	3	2	3	2	3	-	2	-	2	2	3	2	3	-

3-High, 2-Medium, 1-Low

CS22053 **CLOUD SERVICES MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVES

- Introduce Cloud Service Management terminology, definition & concepts.
- Compare and contrast cloud service management with traditional IT service management.
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services.
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment.
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems.

UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

UNIT II CLOUD SERVICES STRATEGY 9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

UNIT III CLOUD SERVICE MANAGEMENT 9

Cloud Service Reference Model, Cloud Service Life Cycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

UNIT IV CLOUD SERVICE ECONOMICS 9

Pricing models for Cloud Services, Freemium, Pay Per Reservation, pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

UNIT V CLOUD SERVICE GOVERNANCE & VALUE 9

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. Case study: Real-Time Application for Cloud Service Management: IoT

Sensor Data Dashboard

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Exhibit cloud-design skills to build and automate business solutions using cloud technologies.	**2**
CO2	Analyze cloud service management with traditional IT service management.	**4**
CO3	Exhibit the strategies to reduce and eliminate risk issues associated with cloud services.	**2**
CO4	Design and deploy the cloud-based services in a business environment.	**4**
CO5	Work with real world problems with adoption of cloud-based services.	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Enamul Haque, “Cloud Service Management and Governance: Smart Service Management in Cloud Era”, Enel Publications, Jul 2020.
2. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, " Cloud Computing: Concepts, Technology & Architecture", The Prentice Hall Service Technology Series, 1st Edition, 2013.
3. Thomas Erl, Robert Cope, Amin Naserpour, “Cloud Computing Design Patterns”, Prentice Hall, 2015.

REFERENCES

1. Praveen Ayyappa,” Economics of Cloud Computing: Helping organizations make a decision about whether to adopt cloud computing in one or more of its forms”, LAP Lambert Academic Publishing, Apr 2020.
2. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, “Mastering Cloud Computing: Foundations and Applications Programming” , Elsevier Science, May 2013.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	3	-	3	-	-	-	2	2	-	-	3	-
2	-	3	-	3	2	2	-	-	-	-	-	-	-	3
3	-	3	2	-	2	3	3	3	-	-	-	-	-	3
4	3	-	3	-	3	-	-	-	-	2	3	-	3	-
5	3	3	3	3	3	-	-	-	3	-	3	3	-	3

3-High, 2-Medium, 1-Low

CS22054 **CLOUD APPLICATION DEVELOPMENT AND MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVES

- To enable student to develop and launch applications in the cloud Environment.
- To understand the frameworks that can be used for developing cloud based applications.
- To describe the cloud storage services and security.
- To understand the cloud applications in development and management.

UNIT I CLOUD COMPUTING BASICS **9**

Cloud Computing Overview-Cloud Components- Infrastructure-Services-Applications- Storage-Database Services- Intranets and the Cloud- Components- Hypervisor Applications- Amazon, Google, Microsoft - Open challenges in Cloud Computing - Building cloud computing environment- Cloud Computing Architecture.

UNIT II CLOUD APPLICATION PROGRAMMING **9**

Aneka Overview - Anatomy of the Aneka container-Building Aneka clouds - Cloud programming and management - Multithreading with Aneka- Programming applications with Aneka threads- Aneka task-based programming -Aneka MapReduce programming.

UNIT III NEW DEVELOPMENTS IN CLOUD **9**

Cloud Platforms in industry: AWS, Google App Engine, Microsoft Azure, Cloud Applications: Scientific applications: Healthcare, Biology, Geoscience, Business and Consumer applications Energy efficiency in clouds - Market-based management of clouds- Federated clouds/InterCloud - Third-party cloud services.

UNIT IV CLOUD STORAGE AND SECURITY **9**

)lications in the cloud – Working with cloud based storage - Using Webmail services - Using Media and Streaming – Using Smartphones with the cloud – Working with Mobile Web Services – Cloud Storage Providers –Understanding Cloud Security: Securing the Cloud--Establishing Identity and Presence -Security in an Automated Cloud Environment -Cloud Security Best Practices.

UNIT V CLOUD MANAGEMENT **9**

Understanding the Cloud Management System Architecture - Orchestrating Automated Actions - Creating Reports and Dashboards - Managing Systems and Services- Providing Self-Service Control Panels- Software Applications and Packaging - Cloud Management Platforms: The Build Versus Buy Decision -Open Source Cloud Platforms and Industry Standards -Cloud Management Best Practices.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the basics of Cloud Computing.	**2**
CO2	Demonstrate the ability to access the Aneka cloud platform.	**3**
CO3	Describe the new development methods in cloud and demonstrate the concepts of based on real-world applications.	**2**
CO4	Describe the applications of cloud storage services and security.	**2**
CO5	Design dashboards for management across cloud based service.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Rajkumarbuyya, Christian vecchiola, S ThamaraiSelvi , "Mastering cloud computing", McGraw Hill Education, First Edition, 2013.
2. Barrie sosinsky, "Cloud computing bible", Wiley publishers, 2011.

REFERENCES

1. James Bond, "The Enterprise Cloud", O'Reilly Media, Inc.2015.
2. Anthony T .Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing a PracticalApproach", Tata McGraw-HILL, 2010 Edition.
3. Jim Webber, SavasParastatidis, Ian Robinson, "REST in Practice" O'Reilly, Media; First edition.
4. Eugenio Pace, Dominic Betts, Scott Densmore, Ryan Dunn, MasashiNarumoto, MatiasWoloski, "Developing Applications for the Cloud on theMicrosoft Windows Azure Platform" Microsoft Press; First edition.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	2	2	-	-	-	-	-	-	1	2	2
2	2	3	3	2	3	-	-	-	-	-	-	2	3	2
3	2	3	3	2	3	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	2	-	-	-	-	-	2	3	3
5	2	2	3	2	3	-	-	-	2	2	3	2	3	2

3-High, 2-Medium, 1-Low

CS22055 **EDGE AND FOG COMPUTING**

L	T	P	C
3	0	0	3

OBJECTIVES

- Explore the need for new computing paradigms.
- To implement the concepts of fog and edge computing with IoT.
- To understand the real-time applications of edge and fog computing.
- To address the challenges in middleware and 5G networks.

UNIT I EDGE COMPUTING **9**

Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog, and M2M.

UNIT II IOT AND EDGE COMPUTING **9**

IoT Architecture and Core IoT Modules-A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples: Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

UNIT III FOG COMPUTING **9**

Introduction to Fog Computing: Fog Computing, Characteristics, Application Scenarios, Issues and Challenges. Fog Computing Architecture: Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare, and vehicles. Fog Computing Communication Technologies: Introduction, IEEE 802.11, 4G, 5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.

UNIT IV FOG COMPUTING TECHNIQUES & APPLICATIONS **9**

Distributed Machine Learning for IoT Applications in the Fog: Challenges in Data Processing for IoT-Computational Intelligence and Fog Computing - Challenges for Running Machine Learning on Fog Devices - Fog Computing: Based Communication Systems for Modern Smart Grids - Insights into Software-Defined Networking and Applications -Bioinformatics Applications.

UNIT V FOUNDATIONS & MIDDLEWARES IN FOG & EDGE **9**

Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds: Introduction, Background, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog, Middleware for Fog and Edge Computing, Need for Fog and Edge Computing Middleware, Clusters for Lightweight Edge Clouds, IoT Integration, Security Management for Edge Cloud Architectures. Fog Computing Realization for Big Data Analytics: Introduction to Big

Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the concepts of Edge computing.	**2**
CO2	Able to know the applications of IoT with Edge.	**3**
CO3	Understand the Fog computing architecture with its communications.	**2**
CO4	Knowledge about techniques and applications of Fog.	**4**
CO5	Explore the Fog & Edge on security, multimedia, and smart data.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Rajkumar Buyya, Satish Narayana Srirama, "Fog and Edge Computing: Principles and Paradigms", Wiley publication, 2019.
2. Assad Abbas, Samee U. Khan, Albert Y. Zomaya, "Fog Computing: Theory and Practice", Wiley Publications, 2020.
3. Perry Lea, "IoT and Edge Computing for Architects" - Second Edition, Packt Publishing, 2020.

REFERENCES

1. Taheri J. & Deng S. (eds.): "Edge Computing: Models, technologies and applications", IET, 2020.
2. Sabella D., Reznik A., Frazao R., "Multi-access Edge Computing in Action", 1st edition, Kindle, 2019.
3. Al-Turjman F. (ed.): "Edge Computing: from hype to reality", Springer, 2019.
4. David Jensen, "Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	1	3	-	-	-	2	1	-	2	2	1
2	3	3	2	2	3	-	-	-	2	2	-	2	3	2
3	2	2	3	2	3	-	-	2	2	1	2	2	3	2
4	3	3	3	3	3	2	2	-	3	3	3	3	3	3
5	3	3	3	3	3	3	2	2	2	2	2	3	3	3

3-High, 2-Medium, 1-Low

CS22056 **SOFTWARE DEFINED NETWORKS**

L	T	P	C
3	0	0	3

OBJECTIVES

- To learn about what software defined networks are.
- To understand the separation of the data plane and the control plane.
- To learn the various SDN controllers.
- To learn about the use of SDN in data centers.
- To learn about different applications of SDN.

UNIT I INTRODUCTION **9**

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Active Networks – Network Virtualization – Why SDN – Evolution of SDN- How SDN Works - Centralized and Distributed Control and Date Planes.

UNIT II CONTROL PLANE AND DATA PLANE SEPERATION **9**

Mininet Topologies and Mininet Python API- Virtualization - Applications of Virtual Networking - Network Virtualization with mininet – Control and Data plane Separation – Routing Control Platform.

UNIT III OPEN FLOW & SDN CONTROLLERS **9**

Introducing Open Flow- Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device- Open Flow in Cloud Computing – SDN Controllers – Customizing SDN Controllers – Commercial Controllers – ODL and RYU.

UNIT IV DATA CENTERS AND NETWORK VIRTUALIZATION **9**

Virtualization – Applications of Virtual Networking - Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE, SDN applied to Mobile Networks- SDN applied to Optical Networks- SDN applied to Firewalls.

UNIT V SDN PROGRAMMING **9**

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications, Open Stack- Applying SDN Open Source, A simple reactive Java Application-SDN futures.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand and appreciate the evolution of software defined networks.	**2**
CO2	Understand the various components of SDN and their uses.	**2**
CO3	Understand the concepts of Open Flow and SDN Controllers.	**2**
CO4	Understand the use of SDN in the current networking scenario.	**2**
CO5	Design and develop various applications of SDN.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Thomas D. Nadeau, Ken Gray, ―SDN: Software Defined Networks, O'Reilly Media, August 2013.
2. Paul Goransson and Chuck Black, ―Software Defined Networks: A Comprehensive Approach‖, First Edition, Morgan Kaufmann, June 2016.

REFERENCES

1. SiamakAzodolmolky, ―Software Defined Networking with OpenFlow‖, Packet Publishing, 2013.
2. Vivek Tiwari, ―SDN and OpenFlow for Beginners‖, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, ―Network Innovation through OpenFlow and SDN: Principles and Design, CRC Press, 2014.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	2	-	-	-	-	1	-	2	2	-
2	3	2	-	2	2	-	-	-	-	-	-	2	3	-
3	3	3	2	2	3	-	-	-	-	1	-	3	3	2
4	3	3	2	2	3	2	2	-	2	2	2	3	3	2
5	3	3	3	3	3	2	2	-	3	3	3	3	3	3

3-High, 2-Medium, 1-Low

CS22057 **SECURITY AND PRIVACY IN CLOUD**

L	T	P	C
3	0	0	3

OBJECTIVES

- To Introduce Cloud Computing terminology, definition & concepts.
- To understand the security design and architectural considerations for Cloud.
- To understand the Identity, Access control in Cloud.
- To follow best practices for Cloud security using various design patterns.
- To be able to monitor and audit cloud applications for security.

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key.

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT IV CLOUD SECURITY DESIGN PATTERNS 9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.

UNIT V MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the cloud concepts and fundamentals.	**2**
CO2	Explain the security challenges in the cloud.	**3**
CO3	Define cloud policy and Identity and Access Management.	**2**
CO4	Understand various risks and audit and monitoring mechanisms in the cloud.	**2**
CO5	Define the various architectural and design considerations for security in the cloud.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Raj Kumar Buyya, James Broberg, rzejGoscinski, "Cloud Computing", Wiley, First Edition, 2011.
2. Dave shackleford, "Virtualization Security: Protecting Virtualized Environments", SYBEX, WILEY,First Edition,2012.

REFERENCES

1. Mather, Kumaraswamy and Latif, "Cloud Security and Privacy, OREILLY, First Edition, 2011
2. Mark C. Chu-Carroll "Code in the Cloud,CRC Press, First Edition, 2011.
3. RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi, Mastering Cloud Computing Foundations and Applications Programming, First Edition, 2017.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
2	-	3	-	3	-	3	-	3	-	-	-	-	-	3
3	3	-	-	-	-	3	-	3	-	-	-	-	3	-
4	-	3	-	3	3	-	-	-	-	-	-	-	-	3
5	3	-	3	-	3	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CS22058 **IOT AUTOMATION**

L	T	P	C
3	0	0	3

OBJECTIVES

- To introduce IoT fundamentals, definition & concepts.
- To describe various IoT components.
- To identify communication technologies of IIOT.
- To discuss the about virtualization and data types of IIOT.
- To acquire the upcoming Industrial IoT.

UNIT I INTRODUCTION & ARCHITECTURE 9

IIoT and the connected world, difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT. Fundamentals of Control System, introductions, components, closed loop & open loop system.

UNIT II IIOT COMPONENTS 9

Introduction to Sensors (Description and Working principle): sensors, Types of sensors, working principle of basic Sensors - Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11). Digital switch, Electro Mechanical switches.

UNIT III COMMUNICATION TECHNOLOGIES OF IIOT 9

Communication Protocols: IEEE 802.15.4, ZigBee, Z Wave, Bluetooth, BLE, NFC, RFID Industry standards communication technology (LoRAWAN, OPC UA, MQTT), connecting into existing Modbus and Profibus technology, wireless network communication.

UNIT IV VISUALIZATION AND DATA TYPES OF IIOT 9

Front-end EDGE devices, Enterprise data for IIoT, Emerging descriptive data standards for IIoT, Cloud database, Cloud computing, Fog or Edge computing. Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.

UNIT V RETRIEVING DATA 9

Extraction from Web: Grabbing the content from a web page, Sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M). Control & Supervisory Level of Automation: Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA). HMI in an automation process, ERP & MES.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Discover key IIoT concepts including identification, sensors, localization, wireless protocols, data storage and security.	**4**
CO2	Explore IoT technologies, architectures, standards, and regulation.	**4**
CO3	Realize the value created by collecting, communicating, coordinating, and leveraging the data from connected devices.	**5**
CO4	Examine technological developments that will likely shape the industrial landscape in the future.	**4**
CO5	Understand how to develop and implement own IoT technologies, solutions, and applications.	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

REFERENCES

1. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, Industrial Internet of Things: Cyber manufacturing System, (Springer Publication), First Edition, 2017.
2. Ismail Butun, Industrial IoT Challenges, Design Principles, Applications, and Security, (Springer Publication), 2020.

REFERENCES

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication), 2019.
2. Jerker Delsing, IoT Automation: Arrowhead Framework, CRC Press, 2020.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	–	2	3	–	–	2	–	–	–	2	3	3
2	3	3	–	2	3	2	–	2	–	–	–	2	3	3
3	3	3	3	2	3	2	–	2	2	2	2	3	3	3
4	2	2	3	2	3	2	2	2	–	–	–	2	2	2
5	3	3	3	2	3	–	–	2	2	2	2	3	3	3

3-High, 2-Medium, 1-Low

CS22061 **PRINCIPLES OF MULTIMEDIA SYSTEMS**

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To get familiarity with scope of multimedia and its significance.
- To acquire knowledge in multimedia components.
- To gain understanding on audio format in multimedia.
- To acquire knowledge about multimedia tools and authoring.
- To acquire knowledge in the development of multimedia applications.

UNIT I INTRODUCTION TO MULTIMEDIA **9**

Multimedia - Components of Multimedia - Multimedia and Hypermedia - World Wide Web - Synchronized Multimedia Integration Language (SMIL) - Overview ofMu1timedia Software Tools - Image formats – JPEG - Basic JPEG Compression Framework - Major Coding Algorithms – Quantization - Zig-zag Scan - Differential Pulse Code Modulation - Run Length Encode - Huffman Coding - Artefacts and Gibb's phenomenon.

UNIT II GRAPHICS, IMAGES AND VIDEOS **9**

Graphic/Image File Formats: 24-bit and 8-bit colors - Bit-Maps, Gray Scale and Dithering - Graphic Formats: GIF, JPEG, TIFF, PNG, EPS - RGB and CMY Color Models - Chrominance, Luma, Luminance and Gamma Correction - Color Vision: Photoreceptors, Cone Sensitivity and Color Properties - Color Video Signals: NTSC and PAL - Chroma Subsampling, Aliasing - Temporal Aliasing.

UNIT III DIGITAL AUDIO **9**

Digitization of Sound: Nyquist Theorem - Signal-to-Noise Ratio (SNR) - Linear and Nonlinear Quantization - Audio Filtering - MIDI: Musical Instrument Digital Interface - Structure of MIDI Messages - MIDI-to-WAV Conversion - Quantization and Transmission of Audio.

UNIT IV MULTIMEDIA DATA COMPRESSION **9**

Lossless Compression Algorithms - Basics of Information Theory - Run-Length Coding - Variable-Length Coding (VLC) - Shannon-Fano Algorithm - Huffman Coding - Adaptive Huffman Coding - Dictionary-Based Coding - Arithmetic Coding - Lossy Compression Algorithms – Quantization - Wavelet-Based Coding - Embedded Zerotree of Wavelet Coefficients.

UNIT V MULTIMEDIA NETWORK COMMUNICATIONS AND APPLICATIONS **9**

Quality of Multimedia Data Transmission - QoS for IP Protocols - Multimedia over IP – IP Multicast - Real-time Transport Protocol (RTP) - Real Time Control Protocol (RTCP) - Multimedia over ATM Networks - ATM Adaptation Layer (AAL) – Media on demand (MoD) - Broadcast Schemes for Video-on-Demand.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Handle the multimedia elements effectively.	**3**
CO2	Articulate the concepts and techniques used in multimedia applications.	**2**
CO3	Design objectives to provide multimedia applications with a high-quality user experience.	**3**
CO4	Design and implement algorithms and techniques applied to multimedia objects.	**4**
CO5	Design and develop multimedia applications following software engineering models.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Ze-Nian Li, Mark S. Drew, Jianchuan Liu, "Fundamentals of Multimedia", Third edition, Springer, 2021, ISBN : 978-3-030-62123-0.
2. Khalid Sayood: Introduction to Data Compression", Morgan Kauffman Harcourt India, Fifth Edition, 2019.
3. Yun Q.Shi, Huifang Sun, "Image and Video Compression for Multimedia Engineering: Fundamentals, Algorithms, and Standards, Third Edition", CRC Press, 2019.

REFERENCES

1. Tay Vaughan – Multimedia : Making it work – TMH – Ninth Edition – 2014.
2. James F. Kurose and Keith W. Ross, "Computer Networking-A Top-Down Approach Featuringthe Internet", Pearson, 2012.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	-	3	-	-	-	-	1	-	2	3	2
2	3	3	2	2	2	-	-	-	-	3	-	2	2	3
3	2	2	3	3	3	-	2	-	-	2	-	3	3	2
4	3	3	3	3	3	-	-	-	-	2	2	3	3	3
5	3	2	3	3	3	-	-	-	2	3	2	3	3	3

3-High, 2-Medium, 1-Low

CS22062 **MULTIMEDIA DATA COMPRESSION AND STORAGE**
(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basic ideas of compression algorithms related to multimedia components.
- To escalate the use of compression in multimedia processing applications and the storage mechanisms.
- To understand the principles and standards and their applications with an emphasis on underlying technologies, algorithms, and performance.
- To understand and implement compression standards in speech and audio technologies.
- To understand and implement compression standards in video technologies.

UNIT I PRINCIPLES OF COMPRESSION **9**

Introduction To multimedia – Graphics, Image and Video representations – Fundamental concepts of video, digital audio — Need for compression – Taxonomy of compression Algorithms - Elements of Information Theory – Error Free Compression – Lossy Compression.

UNIT II TEXT COMPRESSION AND MULTIMEDIA STORAGE **9**

Huffman coding – Adaptive Huffman coding – Arithmetic coding – Shannon- Fano coding – Dictionary techniques – LZW family algorithms - Storage requirements of multimedia applications – Storage networks– Storage medium: Optical storage, Magnetic storage – RAID.

UNIT III IMAGE COMPRESSION TECHNIQUES **9**

Image Compression: Fundamentals — Compression Standards – JPEG Standard – Sub-band coding – Wavelet Based compression – Implementation using Filters – EZW, SPIHT coders – JPEG 2000 standards – JBIG and JBIG2 standards.

UNIT IV AUDIO COMPRESSION TECHNIQUES **9**

Audio compression Techniques – law, A-Law companding – Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – MPEG audio – progressive encoding – Silence compression, Speech compression – Formant and CELP vocoders.

UNIT V VIDEO COMPRESSION TECHNIQUES **9**

Video compression techniques and Standards – MPEG video coding: MPEG-1 and MPEG2 video coding: MPEG-3 and MPEG-4 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – DVI real time compression – Current Trends in Compression standards.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Implement basic compression algorithms familiar with the use of open source environments	**3**
CO2	Design and implement basic compression standards and their storage mechanisms	**4**
CO3	Critically analyze different approaches of compression algorithms in multimedia.	**4**
CO4	Understand the various audio, speech compression techniques	**2**
CO5	Understand and implement MPEG video coding techniques	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Khalid Sayood: Introduction to Data Compression", Morgan Kauffman Harcourt India, Fifth Edition, 2019.
2. David Solomon, "Data Compression – The Complete Reference", Fourth Edition, Springer Verlog, New York, 2007.
3. Mark S. Drew, Ze-Nian Li, "Fundamentals of Multimedia", PHI, 2009.

REFERENCES

1. Yun Q.Shi, Huifang Sun, "Image and Video Compression for Multimedia Engineering: Fundamentals, Algorithms, and Standards, Third Edition", CRC Press, 2019.
2. Darrel Hankerson, Greg A Harris, Peter D Johnson, "Introduction to Information Theory and Data Compression" Second Edition, Chapman and Hall ,CRC press, 2019.
3. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	3	3	-	-	-	-	1	-	2	3	2
2	3	3	3	3	3	-	-	-	-	2	-	2	3	3
3	3	3	3	3	3	-	2	-	-	2	-	3	3	3
4	3	3	2	3	2	-	-	-	-	2	-	3	3	3
5	3	2	3	3	3	-	-	-	2	3	2	3	3	3

3-High, 2-Medium, 1-Low

CS22063 **MULTIMEDIA NETWORK TECHNOLOGIES**
(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- Define the Multimedia Communication Models.
- Explain Multimedia Transport in Wireless Networks.
- Solve the Security issues in multimedia networks.
- Illustrate real-time multimedia network applications.
- Explain different network layer based application.

UNIT I MULTIMEDIA COMMUNICATION 9

Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles,. Text, images, audio and video.

UNIT II TEXT AND IMAGE COMPRESSION 9

Text and image compression,, compression principles, text compression- Runlength, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression- GIF, TIFF and JPEG.

UNIT III AUDIO AND VIDEO COMPRESSION 9

Audio and video compression, audio compression – principles, DPCM, ADPCM, Adaptive and Linear predictive coding, Code-Excited LPC, Perceptual coding, MPEG and Dolby coders video compression, video compression principles.

UNIT IV STANDARD FOR MULTIMEDIA COMMUNICATIONS & ENTERPRISE NETWORK 9

Reference Models, Standards relating to interpersonal communication- Standards relating to interactive applications over the internet - Standards for entertainment applications, Enterprise Network – LANs, Ethernet/IEEE 802.5,Token Ring, Bridges, FDDI, High Speed LANs, LAN Protocols, Multisite LAN interconnection technologies.

UNIT V INTERNET & INTERNET APPLICATIONS 9

Introduction –IP Datagram – Fragmentation and reassembly – IP addresses – ARP and RARP – Routing algorithms – ICMP – DNS – Electronic mail – FTP – TFTP - SNMP.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand basics of different multimedia networks and applications.	**2**
CO2	Compress different types of text and images using different compression techniques.	**3**
CO3	Understand and apply different compression techniques to compress audio and Video.	**3**
CO4	Understand and apply the standard of multimedia communications.	**3**
CO5	Apply QoS to multimedia network applications with efficient routing techniques and Develop the real-time multimedia network applications.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Fred Halsall, "Multimedia Communications", Pearson education, 2015.

REFERENCES

1. Raif Steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson education, 2012.
2. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004.
3. John Billamil, Louis Molina, "Multimedia : An Introduction", PHI, 2002.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-		1	1	-	-	-	-	-	-	2	-
2	3	2	-	-	1	1	-	-	-	-	-	-	2	-
3	3	2	-	-	1	1	-	-	-	-	-	-	2	-
4	3	2	-	-	1	1	-	-	-	-	-	-	2	1
5	3	2	-	-	1	1	-	-	-	-	-	-	2	1

3-High, 2-Medium, 1-Low

CS22064

MULTIMEDIA DATABASES

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand about the database storage, retrieval of multimedia elements.
- To familiarize about the database indexing methods and different multidimensional data Structures.
- To learn about text database and image database storage and retrieval.
- To understand design and architecture of a Multimedia Database.
- To understand about Audio and Video Storage.

UNIT I DATABASE INDEXING METHODS 9

Hashing – B-trees – Secondary Key Access Methods – Inverted Files – Point Access Methods (PAMs) –Spatial Access Methods (SAMs) – Space Filling Curves – Transformation to Higher–D Points – Multidimensional Data Structures – K-D Trees – Point Quadtrees– The MX–Quadtree– RTrees.

UNIT II TEXT DATABASES 9

Precision and Recall – Stop Lists – Word Stems and Frequency Tables – Latent Semantic Indexing – TV-Trees – Indexing Text and DNA Strings – Access Methods for Text – Full Text Scanning – Inversion – Signature Files – Vector Space Model and Clustering.

UNIT III IMAGE RETRIEVAL MECHANISMS 9

Image Databases – Raw Images – Compressed Image Representations – Similarity Based Retrieval – Alternative Image DB Paradigms – Representing Image DBs with Relations – Representing Image DBs with R-Trees – Retrieving Images by Spatial Layout – Implementations.

UNIT IV AUDIO/VIDEO DATABASES 9

Audio Databases – A General Model of Audio Data – Capturing Audio Content through Discrete Transformation – Indexing Audio Data–Video Databases – Organizing Content of a Single Video – Querying Content of Video Libraries – Video Segmentation.

UNIT V MULTIMEDIA DATABASE DESIGN 9

Design and Architecture of a Multimedia Database – Organizing Multimedia Data based on the Principle of Uniformity – Media Abstractions – Query Languages for Retrieving Multimedia Data.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Demonstrate the multidimensional data structures for multimedia applications.	**2**
CO2	Apply database indexing methods for efficient storage and retrieval of multimedia content.	**3**
CO3	Work with Text databases, its storage and retrieval.	**3**
CO4	Formulate and generalize the use of audio and video databases for real time multimedia applications.	**3**
CO5	Demonstrate about the Image database, its storage and retrieval. Apply multimedia database design for multimedia architecture.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. V. S. Subramanian, "Principles of Multimedia Database Systems", Harcourt India Pvt Ltd., 2014.
2. Christos Faloutsos, "Searching Multimedia databases by Content", Kluwer Academic Publishers, 2012.

REFERENCES

1. R. Elmasri, S. B. Navathe, "Fundamentals of Database Systems", Seventh edition, Pearson Education,2017.
2. S. Khoshafian, A. B. Baker, "Multimedia and Imaging Databases", Elsevier, 1996.
3. C. Kingsley Nwosu, "Multimedia Database Systems: Design and Implementation Strategies", Kluwer Academic Publishers,1996.
4. Lynne Dunckley, "Multimedia Databases: An Object Relational Approach", Pearson Education, 2003.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	2	2	-	2	-	-	1	2	2	3
2	3	3	2	2	3	2	-	2	-	-	-	2	2	2
3	3	2	3	3	3	2	-	-	-	-	-	-	2	2
4	3	3	3	3	3	2	-	-	-	-	-	-	2	2
5	3	2	3	3	3	2	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

CS22065 **DIGITAL IMAGE PROCESSING TECHNIQUES**
(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To get exposed to different image enhancement techniques.
- To learn about image transformation and color image analysis.
- To learn about image classification.
- To study various applications of image processing.

UNIT I INTRODUCTION **9**

Introduction-Origins, Examples of Fields, fundamental steps, Components, Fundamentals- Elements of Visual Perception, Image Sensing & Acquisition, Sampling and Quantization, Relationship between Pixels, Mathematical Tools – Spatial, Vector and Matrix operations.

UNIT II IMAGE ENHANCEMENT **9**

Histogram Processing, Fundamentals of Spatial Filtering- Smoothing, Sharpening, Frequency domain-Smoothing and Sharpening, Filters – Homo-morphic Filtering, Noise Models, Inverse filtering, Wiener filtering, Geometric Mean Filter.

UNIT III IMAGE TRANSFORMATION AND RESTORATION **9**

Transforms: Matrix-based - correlation, Fourier related, Walsh- Hadamard, Slant, Haar, Wavelet, Color: Models, Transformations, Image smoothing and sharpening, Noise in color images-color image compression-A model of the image degradation/Restoration process-Noise models-Restoration in the presence of noise only spatial filtering-periodic noise reduction using frequency domain filtering-Linear, position invariant degradation-estimating the degradation function-inverse filtering-minimum mean square error(wiener) filtering-constrained least squares filtering-geometric mean filter.

UNIT IV MIDDLE & HIGH LEVEL IMAGE PROCESSING **9**

Basic Morphological algorithms: Hole filling, Convex hull, Pruning, Edge Detection-Basic, Thresholding-Foundation and Segmentation - Region Growing and Region Splitting & Merging, Active contours- image segmentation using Snakes, Feature Extraction- Preprocessing, Feature descriptors - Boundary, Region and Principal components, Patternclassification: Statistical classifiers – Bayes classifier, Neural Networks and Deep learning:Multilayer Feedforward Neural Networks , Deep Convolutional Neural Networks.

UNIT V APPLICATIONS **9**

Face Recognition, Finger print Recognition, Gait Recognition, Location of dark contaminants incereals, recent developments in In-Vehicle Vision systems.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Interpret missing data and infer knowledge on advanced graphics.	**4**
CO2	Implement the various image enhancement techniques.	**3**
CO3	Interpret image transformation and its algorithms.	**4**
CO4	Identify the image classification techniques.	**2**
CO5	Relate the various applications of image processing.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Rafael C. Gonzalez and Richard E. Woods, ―Digital Image Processing, Fourth Edition, Pearson Education, 2017.
2. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.

REFERENCES

1. S. Sridhar, "Digital Image Processing", Oxford University Press, 2011.
2. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2011.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	-	1	-	-	-	-	-	-	2	-
2	3	2	3	2	-	2	-	-	-	-	-	-	2	-
3	3	2	2	2	-	1	-	-	-	-	-	-	2	-
4	3	2	2	2	1	2	-	-	-	-	-	-	2	2
5	3	2	3	2	1	1	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

CS22066	INTRODUCTION TO 3D PRINTING AND DESIGN: THEORY AND PRACTICES (Common to CS and AD)	L	T	P	C
		2	0	2	3

OBJECTIVES

- Acquire the knowledge on fundaments of manufacturing processes and digital manufacturing.
- Understand the various software tools, process and techniques for digital manufacturing.
- Gain knowledge and skills related to 3D printing technologies.

UNIT I INTRODUCTION OF DIGITAL MANUFACTURING AND CAD/CAM TOOLS **8**

Classification of Manufacturing- principles of subtractive, Additive and Rapid prototyping - Role of CAD and CAM in manufacturing industry – Drafting software for drawings and model creation - Auto CAD - simple Commands – simple Model - CAD Data exchange format -export and import file systems. CAM- CNC machine tools- Simple turning, milling and drilling programs-Software for modeling: Tinkercad, Blender, Fusion 360.

UNIT II DATA PREPARATION AND MATERIAL FOR 3D PRINTING PROCESS **12**

3D Printing interfaces, STL interface Specification, Creating STL file, Repair of STL files, STL data Manipulation-Advantages and limitations of STL file format. 3D printing software: STL, OBJ, Slicing Software -Cura, PrusaSlicer, Simplify3D.

Part orientation and support generation-Model Slicing and Contour Data organization, Direct and adaptive slicing: Identification of peak features-Types of tool paths for simple profiles.

Introduction of raw material: Polymers, metals, non-metals, ceramics support material – properties – selection criteria.

UNIT III 3D PRINTING TECHNOLOGIES **10**

Introduction of 3d Printing processes- preprocessing- processing- post processes- Technologies: working principles of Stereo lithography apparatus (SLA)-advantages and disadvantages – Solid ground curing (SGC) – Laminated object manufacturing (LOM)- Fused Deposition Modeling (FDM)- Electron Beam Melting – Binder Jet 3D Printing- Applications – Post Processing- Cleaning, Curing and Finishing- Comparison of Additively manufactured product with conventional manufactured Counterpart.

PRACTICALS: **30**

LIST OF EXPERIMENTS

1. Using Auto CAD /Creo - 3D Modeling of a single component.
2. Assembly of simple CAD modeled Components (prismatic)
3. Exercise on CAD Data Exchange.

4. Generation of STL files.
5. Identification of a product for Additive Manufacturing and its process plan.
6. Printing of own name on part available AM machine.
7. Post processing of additively manufactured product.
8. Inspection and defect analysis of the additively manufactured product.
9. Comparison of Additively manufactured product with conventional manufactured counterpart.

TOTAL (L:30 + P:30): 60 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	**Understand** the principles of Additive Manufacturing (AM), file conversion, and STL file structure.	3
CO2	**Identify** various AM processes and their respective process parameters. Calculate build time for AM processes.	3
CO3	**Demonstrate** about the material properties and types suitable for 3D printing	3
CO4	**Select** suitable 3D Printing technology for the given scenario.	3
CO5	**Explain** the applications of AM in various fields**.**	3

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid prototyping, Rapid Tooling, Rapid Manufacturing”, anser Publisher, 2011, ISBN: 156990507X, 9781569905074.
2. SabrieSoloman,"3D Printing and Design", Khanna Publishing House, Delhi ISBN: 9789386173768.

REFERENCES

1. Gibson, David W. Rosen and Brent Stucker, “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
2. Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid
3. Tooling, Rapid Manufacturing”, Hanser Publisher, 2011.
4. Khanna Editorial, “3D Printing and Design”, Khanna Publishing House, Delhi.
5. CK Chua, Kah Fai Leong, “3D Printing and Rapid Prototyping- Principles and Applications”, World Scientific, 2017.
6. J.D. Majumdar and I. Manna, “Laser-Assisted Fabrication of Materials”, Springer Series in Material Science, 2013.

7. L. Lu, J. Fuh and Y.S. Wong, "Laser-Induced Materials and Processes for Rapid Prototyping", Kulwer Academic Press, 2001.
8. Zhiqiang Fan and Frank Liou, "Numerical Modelling of the Additive Manufacturing (AM) Processes of Titanium Alloy", InTech, 2012
9. Chua C.K., Leong K.F. and LIM C.S Rapid prototyping: Principles an Applications, World Scientific publications, 3rdEd., 2010
10. D.T. Pham and S.S. Dimov, "Rapid Manufacturing", Springer, 2001 3. Terry Wohlers, " Wholers Report 2000", Wohlers Associates, 2000
11. Paul F. Jacobs, "Rapid Prototyping and Manufacturing"–, ASME Press, 1996
12. Ian Gibson, Davin Rosen, Brent Stucker "Additive Manufacturing Technologies, Springer, 2nd Ed, 2014

E-RESOURCES:

1. https://nptel.ac.in/courses/107/101/107101088/
2. https://drive.google.com/file/d/1-zsHtxKWkIaddBdxJWJgYUGpIrguHyNF/view

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	1	-	-	-	-	-	-	-	1	2	2
2	3	2	1	1	-	-	-	-	-	-	-	1	1	2
3	3	2	1	1	1	-	-	-	-	-	-	1	2	1
4	3	2	1	1	-	-	-	-	-	-	-	1	2	1
5	3	2	1	1	-	-	-	-	-	-	-	1	2	2

3-High, 2-Medium, 1-Low

CS22067

PATTERN RECOGNITION
(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the fundamentals of Pattern Recognition techniques.
- Learn and Understand the Statistical models of Pattern Recognition.
- Understand the principles of Parameter approaches to Pattern Recognition.
- Understand the Syntactic Pattern Recognition techniques.
- Understand the Neural Network approach to Pattern Recognition.

UNIT I INTRODUCTION TO PATTERN RECOGNITION 9

Introduction: Machine perception – Pattern recognition systems – Design cycle – Learning and adaptation – Bayesian decision theory – Minimum error rate classification – Discriminant functions – Decision surfaces – Normal density based discriminant functions – Maximum likelihood estimation – Bayesian estimation.

UNIT II STATISTICAL PATTERN RECOGNITION 9

Bayesian Decision Theory, Classifiers, Normal density and discriminant functions, Gaussian model – supervised learning-Parametric estimation-Maximum likelihood estimation-Bayesian parameter estimation-Perceptron algorithm-LMSE algorithm-Problems with Bayes approach-Pattern classification by distance functions- Maximum distance pattern classifier.

UNIT III PARAMETER ESTIMATION METHODS 9

Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), and Gaussian mixture models.

UNIT IV SYNTACTIC PATTERN RECOGNITION 9

Density Estimation, Parzen Windows, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification, Elements of formal grammar-String generation as pattern description-Recognition of syntactic description-Parsing-Stochastic grammar and applications-Graph based structural representation.

UNIT V FEATURES EXTRACTION AND RECENT ADVANCES 9

Entropy minimization-Karhunen-Loeve transformation-Neural network structures for pattern recognition-Unsupervised learning-Self organizing networks-Fuzzy pattern classifiers-Genetic algorithms-Application to pattern recognition.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the fundamentals of Pattern Recognition techniques.	**2**
CO2	Work on Statistical models of Pattern Recognition.	**3**
CO3	Acquire the knowledge on the principles of Parameter approaches to Pattern Recognition.	**2**
CO4	Gain the insights of Syntactic Pattern Recognition techniques.	**4**
CO5	Understand the Neural Network approach to Pattern Recognition.	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Abraham Kandel Menahem Friedman, "Introduction to Pattern recognition: Statistical, Structural, Neural and Fuzzy logic approaches", 2020.

REFERENCES

1. Trevor H, Robert T,Jerome Friedman, "The Elements of Statistical Learning",SpringerSeries,2017.
2. Christopher M Bishop, "Pattern Recognition and Machine Learning". Springer,2011.
3. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Edition, Academic Press, 2009.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	2	-	-	-	-	-	-	-	2	-
2	3	3	2	-	3	-	-	-	-	-	-	-	3	3
3	3	3	2	-	-	-	-	-	-	-	-	-	3	2
4	-	-	3	3	3	-	-	-	-	2	-	-	3	3
5	-	2	-	-	3	-	-	-	-	2	-	-	3	3

3-High, 2-Medium, 1-Low

CS22068 **AUGMENTED AND VIRTUAL REALITY PROGRAMMING: THEORY AND PRACTICES**
(Common to CS and AD)

L	T	P	C
2	0	2	3

OBJECTIVES

- Learn core skills needed for developing AR and VR applications such as basics of 3D graphics, design considerations and programming toolkits.
- Explore industry standard development platforms such as Unity3D, Vuforia, ARCore and ARKit.
- Publish Augmented Reality (AR) applications to both Android and IOS.
- Develop Virtual Reality applications and publish to a variety of headsets.
- Learn the fundamentals of C# programming to create AR/VR experiences in Unity3D.

UNIT I INTRODUCTION TO 3D GRAPHICS AND AR VR FUNDAMENTALS 6+6

Introduction to 3D graphics concepts – modelling, file formats – texturing – lighting and rendering – animation –AR / VR and MR (Mixed Reality) concepts – mobile phones and headset applications – basic introduction to ARCore and ARKit

UNIT II EXPLORING THE UNITY 3D PROGRAMMING TOOLKIT 6+6

Introduction to Unity 3D Interface – Using Unity 3D to create AR and VR applications –Importing and creating assets – User Interfaces for AR and VR –Combining assets into complex models –Adding physics to the interactions - Creating an AR Application and publishing to a mobile device.

UNIT III C# PROGRAMMING AND SCRIPTING FOR AR AND VR 6+6

C# programming introduction – data types and classes – programming logic –using C# to write scripts for Unity 3D – Using C# to animate and add advanced interactions to AR and VR models.

UNIT IV VIRTUAL REALITY APPLICATION ESSENTIALS 6+6

Virtual Reality fundamentals – VR design considerations – Using Unity 3D and C# programming to create VR applications – Oculus Quest VR headset fundamentals – User interface considerations - Creating a VR application and publishing to the Oculus VR headsets.

UNIT V INDUSTRY APPLICATIONS OF AR AND VR 6+6

Industry domains where AR and VR are applied – healthcare, manufacturing, field service, retail and branding – Design considerations while creating domain specific applications – Example industry applications – Writing an industry application from a domain of your choice.

TOTAL (L:30 + P:30): 60 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to understand the design considerations of AR and VR applications	**2**
CO2	Students will be able to write AR and VR applications using the industry standard tool Unity 3D	**3**
CO3	Students will be able to use C# along with Unity 3D to add advanced interaction and physics to their simulations	**3**
CO4	Students will be able to publish AR and VR applications to mobile phones (IOS and Android) and to headsets (Oculus Quest)	**3**
CO5	Students will be able to understand where AR and VR is used in industry and how to design applications for the same	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Bernhard Jung, Paul Grimm, Ralf Doerner, Wolfgang Broll, "Virtual and Augmented Reality (Vr/Ar): Foundations and Methods of Extended Realities (Xr)", Springer, January 2022.
2. Preston So, "Immersive Content and Usability", Book Apart, April 2023.

REFERENCES

1. Samuel Greengard, "VIRTUAL REALITY (The MIT Press Essential Knowledge series)", The MIT Press, September 2019.
2. Jonathan Linowes, "Unity Virtual Reality Projects: Explore the World of Virtual Reality by Building Immersive and Fun Vr Projects Using Unity 3d", Packt Publishing Ltd, August 2015.
3. Simon Jackson, "Unity 3D UI Essentials", Packt Publishing Ltd , January 2015.
4. Terry Norton, "Learning C# by Developing Games with Unity 3D Beginner's Guide", Packt Publishing Ltd , September 2013.
5. Jesse Glover, Jonathan Linowes, "Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications", Packt Publishing Ltd, April 2019.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	2	2	2	-	-	-	2	2	1	1	3	3
2	2	3	2	3	2	-	-	-	1	2	2	3	3	3
3	3	2	2	2	2	-	-	-	1	1	1	1	1	3
4	2	2	2	1	2	-	-	-	1	1	3	1	2	1
5	1	3	2	2	2	-	-	-	2	2	3	3	2	3

3-High, 2-Medium, 1-Low

CS22071

AGILE METHODLOGY

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To provide knowledge and understanding of agile software development approaches.
- To provide a good knowledge on Agile based software design.
- To do thorough analysis on agile development knowledge.
- To understand the agility and requirement management.
- To understand agile quality. Metrics and testing.

UNIT I AGILE METHODOLOGY 9

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

UNIT II AGILE PROCESSES 9

Lean Production – SCRUM, Crystal, Feature Driven Development- Adaptive Software Development – Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices – Feedback Loops - Code Smells and Anti patterns - Avoid Monolithic Design, Incremental Design and the Holistic XP Practices.

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT 9

Agile Information Systems – Agile Decision Making – Earl S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story Cards – Story-Card Maturity Model (SMM).

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING 9

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE- Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V AGILITY AND QUALITY ASSURANCE 9

Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance –Test Automation – Agile Approach in Global Software Development – Risk Analysis - Agility in Design, Testing – Agile Documentations – Agile Drivers,

Capabilities and Values.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students can understand the importance of interaction with stakeholders in gathering the requirements for a software.	**3**
CO2	Students can perform planning of agile iterative software development processes.	**2**
CO3	Students can develop techniques and tools for improving agile process.	**3**
CO4	Students can practice agile knowledge management processes.	**3**
CO5	Students can understand about agile approaches, Metrics and quality.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. David J. Anderson and Eli Schragenheim―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2004.

REFERENCES

1. Hazza and Dubinsky, ―Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.
2. Craig Larman, ―Agile and Iterative Development: A Managers Guide, AddisonWesley, 2004.
3. Kevin C. Desouza, ―Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	1	-	1	1	-	-	-	1	2	2
2	2	2	1	2	2	-	3	1	-	-	-	1	2	2
3	2	2	3	2	2	1	1	2	-	-	-	1	2	3
4	1	1	3	2	2	-	1	1	-	-	1	1	2	2
5	3	3	1	2	2	-	1	1	-	-	-	1	2	2

3-High, 2-Medium, 1-Low

CS22072 **WEB APPLICATION DEVELOPMENT AND DEPLOYMENT**
(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To explain the standards and protocols of internet.
- To design web pages using HTML and CSS.
- To apply client scripts for designing responsive web pages.
- To understand the XML usage in Web Applications.
- To implement web application using server-side programming script.
- To use Model View Controller (MVC) architecture in the implementation of web applications.

UNIT I WEB DESIGN STANDARDS AND FUNDAMENTALS **9**

Introduction web Technology –Web Standards and Accessibility – Client Server Model – Internet Protocols – FTP – Email Protocols – HTTP – HTTPS – TCP/IP – IP – URL - Domain Name System – Web; Application Server Markup Languages – HTML – HTML Elements – List – Forms –HTTP Methods - Structural Elements – Hyperlinks – CSS Basics – Web Fonts – Responsive Web Pages - Position - Opacity - Masking – Pagination – Box Models – Display Block – Float - Layers –Media Types – Web Page Deployment.

UNIT II CLIENT SCRIPT **9**

Javascript – Variables – Literals – Operators – Control Structures – Arrays - functions - Objects – Forms Validation – Form Object and Elements – Data Entry and Validation - Event Handling - Regular expression – JQuery – AJAX– Asynchronous communication – Processing steps – URL methods.

UNIT III EXTENSIBLE MARKUP LANGUAGE **9**

Introduction to eXtensible Markup Language (XML) – Elements – Attributes – Validation – Namespace – DTD – Element Type Declarations – Compound Elements – Attribute Declarations – Entity Declaration – Schema – Element Definitions – Simple and Complex elements – Parsing XML – XML DOM – DOM Nodes – XPath – XML Transformation – Xquery.

UNIT IV SERVER-SIDE SCRIPTING **9**

Introduction to PHP – Operators and Flow Controls – Strings and Arrays – Creating functions – Reading data in web pages – PHP browser handling – Advanced Object Oriented Programming – File handling – File Uploading & Downloading - Working with Databases – State Management – Session – Cookies and FTP - String Manipulation and Regular Expression - PDF Generation - Excel or CSV Generation - Implementing Pagination - Exception Handling – PHP with AJAX.

UNIT V WEB APPLICATION DEVELOPMENT WITH MVC ARCHITECTURE 9

Introduction to MVC framework – MVC Pattern – Installing MVC Framework – Directory Structure – Controller - Calling a Controller - Creating & Calling Constructor Method - Controller function - Interacting with views – MVC Routing - Views- Introduction - Loading the View -- Working with configuration layout - Creating custom layout - Controller variables and parameters - Passing argument through url - Redirection - Form and Getting post data - Model Introduction - Creating Model Class – Migrate Model to work with Databases - User defined function in model - Connecting to a Database - Automatic Connecting - Manual Connecting - Inserting Data To Database - Fetching data – Deleting data - Updating data.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	To design web pages using HTML and CSS.	**2**
CO2	To apply client scripts for designing responsive web pages.	**3**
CO3	To use XML elements in the Web Applications.	**3**
CO4	To implement web application using server-side programming script.	**3**
CO5	To use Model View Controller (MVC) architecture in the implementation of web applications.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Mikael Olsson, PHP 8 Quick Scripting Reference: A Pocket Guide to PHP Web Scripting, A press, 3rd Edition, 2020.
2. Robin Nixon, Learning PHP, MySQL & JavaScript With JQuery, CSS & HTML5, O'Reilly Media, 2015.
3. Frank M. Kromann, W Jason Gilmore, Beginning PHP and MySQL From Novice to Professional, A press, 2008.

REFERENCES

1. Matt Stauffer, Laravel: Up and Running A Framework for Building Modern PHP Apps, O'Reilly Media, Incorporated, 2019.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	2	2	-	-	-	-	-	-	-	3	2
2	3	3	2	2	3	-	-	-	-	1	-	-	3	3
3	3	3	3	2	3	1	-	-	2	2	-	-	2	2
4	3	3	3	3	3	2	-	-	-	3	-	-	3	2
5	3	3	3	2	3	-	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

CS22073

C# AND .NET FRAMEWORK

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- Design and Develop professional console and window based .NET applications.
- Construct classes, methods and assessors and instantiate objects.
- Create and manipulate GUI components in C#.
- Design and Implement database connectivity using ADO.NET in window based applications.
- Identify industry defined problem and suggesting solution(s) using .NET applications.

UNIT I INRODUCTION TO .NET FRAMEWORK 9

.NET Overview, Behind Microsoft .NET, The .NET Platform, .NET Framework Design Goals, Common Language Runtime, CLR Environments and Executables , Metadata-JIT Compilation, Automatic Memory Management, Assemblies and Manifests, Intermediate Language(IL), CTS and CLS.

UNIT II INTRODUCTION TO C# .NET PROGRAMMING 9

Introduction to C#, Common Elements in Visual C, C# Core Language Features, Types, Classes, Structures, Enumeration, Inheritance, Interfaces, Polymorphism, Arrays and Collections, Generics, Operator Overloading, Delegates and Events, Introduction to LINQ Programming, Exception Handling, MSIL Programming.

UNIT III APPLICATION DEVELOPMENT USING ADO .NET 9

Features of ADO .NET- Architecture of ADO .NET,ADO .NET Providers, Accessing Database using ADO .NET, Connection Opening and Closing- Command Object, Data Adapter, Dataset, Data Tables, Controlling table views with Data Views , Data-binding in Windows Forms and Web Forms.

UNIT IV INTRODUCTION TO ASP.NET 9

Introduction, Working in ASP.NET Controls, Session and Cookies, Caching, Authentication and Authorization, Web User Controls, Working with Web Configure file, Implementing Security, Crystal Reports, Creating Setup and Deployment.

UNIT V WEB SERVICES 9

Introduction to Web Services, Web Services Protocol and Standards, WSDL, Overview of UDDI, Calling a Web Service from a Browser, Calling a Web Service by using a proxy, Creating a Simple Web Service-AJAX.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand, analyze and explain C# and .NET Framework.	**2**
CO2	Understand, analyze and use basic C# constructs, delegates and events and use language interfaces and inheritance.	**4**
CO3	Understand, analyze and exposed to the Common Language Runtime (CLR), garbage collection, and assemblies.	**2**
CO4	Understand, analyze and use exceptions, Windows Forms, .NET Remoting and Serialization.	**4**
CO5	Build interactive web applications using ASP.NET and C#.	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Thuan L. Thai. .NET Framework Essentials. O'Reilly, 2013, 3rd Ed.
2. Donis Marshall. Programming Microsoft Visual C# . Microsoft Press 2018.

REFERENCES

1. Francesco Balena. Programming Microsoft Visual Basic .NET. Microsoft Press 2016.
2. Rebecca M. Riordan. Microsoft ADO.NET Step by Step. Microsoft Press 2012.
3. Kogent, ASP.NET 3.5 Black Book, Dream Tech Publications, 2010.
4. Andy Wigley, Peter Roxburgh. Building Microsoft ASP.NET Applications for Mobile devices. Microsoft Press 2013,2nd edition.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	1	1	1	-	-	-	-	-	3	2
2	3	2	2	2	3	2	2	-	-	-	-	-	3	2
3	3	2	2	2	3	2	2	-	-	-	-	-	3	2
4	3	1	2	2	3	1	1	-	-	-	-	-	3	2
5	3	1	2	2	3	2	2	-	-	-	-	-	3	2

3-High, 2-Medium, 1-Low

CS22074

FRONTEND AND MIDDLEWARE TECHNOLOGIES

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- Introduce Frontend technologies terminology, definition & concepts.
- Compare and contrast Web APIs and Asynchronous Applications in JavaScript.
- Identify strategies to design and implement Distributed Systems.
- Understand existing Distributed Technologies.
- Illustrate the benefits of Middleware Technologies to build Distributed Applications.

UNIT I INTRODUCTION TO FRONTEND TECHNOLOGIES 9

Overview- Top Frontend Technologies - HTML5 Boilerplate- React JS- Angular-Vue JS- Next JS-Gatsby JS- React Native-Flutter-Monorepo-Micro Frontends-Three JS-Remix- Headless CMS-GraphQL-PWA- Design System- Lonic – NPM.

UNIT II WEB APIS AND ASYNCHRONOUS APPLICATIONS 9

Node & Express Environment, HTTP Requests & Routes-Handle requests to an Express with routes - Asynchronous JavaScript- Manage asynchronous JavaScript control flow with Promise- Single Threaded Processing-Going Asynchronous With Callbacks.

UNIT III OVERVIEW OF MIDDLEWARE TECHNOLOGIES 9

Conceptual framework, features, development history and development tendency of middleware technology. Basic framework of middleware, operating principle of middleware technology and key technology.

UNIT IV TECHNICAL SUMMARY OF MIDDLEWARE 9

Middleware elements - Vendor architectures, Vendor platform architectures, Vendor distributed architectures, Using vendor architectures, Positioning, Strawman for user target architecture, Marketing, Implicit architectures, - Vendor platform architecture -Middleware interoperability

UNIT V DISTRIBUTED APPLICATIONS DEVELOPMENT USING MIDDLEWARE 9

Middleware-Support for business processes, Information retrieval, Collaboration, Tiers, The presentation tier, The processing tier, The data tier, Services versus tiers, Architectural choices, Middleware bus architectures, Hub architectures, Web services architectures, Loosely coupled versus tightly coupled.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Exhibit to understand the Frontend Technologies.	**2**
CO2	Analyze Web APIs and Asynchronous Applications	**4**
CO3	Demonstrate the methods for creating distributed applications using middleware.	**2**
CO4	Create and implement middleware systems for business processes.	**4**
CO5	Work with real world problems with adoption of middleware systems	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Larry Ullman, "Visual Quick Start Guide – PHP for the Web", Peach pit Press, Fifth Edition, 2016.
2. Chris Britton, Peter Bye, "IT Architectures and Middleware Strategies for Building Large, Integrated Systems ", Addison-Wesley, Second Edition, 2007.
3. Qusay H. Mahmoud, "Middleware for Communications", John Wiley and Sons, 1st Edition , 2004.

REFERENCES

1. Michah Lerner, "Middleware Networks: Concept, Design and Deployment of Internet Infrastructure", Kluwer Academic Publishers, 1st Edition, 2000.
2. https://www.knowledgehut.com/blog/web-development/front-end-technologies-list.
3. https://blog.hubspot.com/website/asynchronous-api.
4. Fortino and Giancarlo, Internet of Things Based on Smart Objects Technology. Middleware and Applications, 2014.
5. Ok-Hwan Byeon, Future Application and Middleware Technology on e-Science. 2009.
6. Elias N. Houstis, Enabling Technologies for Computational Science: Frameworks. Middleware and Environments, 2000.
7. Tammy Noergaard, Demystifying Embedded Systems Middleware. 2010.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	2	2	-	2	-	-	1	2	2	3
2	3	3	2	2	3	2	-	2	-	-	-	2	2	2
3	3	2	3	3	3	2	-	-	-	-	-	-	2	2
4	3	3	3	3	3	2	-	-	-	-	-	-	2	2
5	3	2	3	3	3	2	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

CS22075 **SOFTWARE TESTING AND QUALITY ASSURANCE**
(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the overview of software engineering testing process.
- To comprehend the phases of software testing.
- To Demonstrate a variety of testing techniques, methods, and tools.
- To Describe the quality assurance process and its role in software development.
- To learn software quality metrics, assurance and various software standards.

UNIT I INTRODUCTION TO SOFTWARE TESTING 9

Software development life cycle versus software testing life cycle, Software specifications, Program correctness and verification, Failures, errors and faults, Testing approaches: Black Box, White Box and Regression Testing, Levels of Testing: Unit Testing, Integration Testing, System Testing, Acceptance Testing.

UNIT II TEST DATA GENERATION 9

Test generation concepts, Functional and structural criteria, Test Oracle design, Test Driver design, Test outcome analysis.

UNIT III MANAGEMENT OF SOFTWARE TESTING 9

Metrics for software testing, tools – Scripting tools, record-and-replay tools, performance testing tools, oracle design tools, exception discovery, collaborative tools, Quality assurance tools – CASE tools for software quality.

UNIT IV SOFTWARE QUALITY ASSURANCE 9

Defining Software Quality, Software Quality factors, Components of software quality assurance system, pre-project software quality components- Contract Review - Development and Quality Plans, integrating quality activities in project life cycle, Quality Assurance Techniques, QA Monitoring and Measurement.

UNIT V SOFTWARE QUALITY STANDARDS 9

People's Quality Expectations, McCall's Quality Factors and Criteria – Relationship, SQA Standards – Basic software quality parameters and its metrics, Quality management models: ISO, SPICE, IEEE, CMM, Organizing for Quality Assurance -Management and its Role in Quality Assurance - SQA Unit & other actors, introduction to Six Sigma.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Examine the overall process of Software Testing.	**4**
CO2	Understand how to develop & implement Test Generation & Test Oracles.	**1**
CO3	Acquire hands-on experience with Software Testing Tools; especially in Code Coverage, Performance Testing, & General Testing.	**4**
CO4	Understand & appreciate complexities in Software Testing and Quality Assurance.	**1**
CO5	Develop a software quality assurance plan for software projects.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Ali Mili, Fairouz Tchier , "Software Testing: Concepts and Operations", John wiley & sons, 2015.
2. Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson Addison-Wesley, Second Edition, 2012.

REFERCENCES

1. Jeff Tian, "Software Quality Engineering: Testing, Quality Assurance, and Quantifiable", Wiley, 2006.
2. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.
3. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	2	1	1	2	-	-	-	-	2	2	3	2
2	3	1	2	2	1	2	-	-	-	1	1	1	3	2
3	3	1	2	2	2	2	-	-	-	-	2	2	3	3
4	2	1	2	2	2	2	-	-	1	2	2	3	3	2
5	2	1	2	2	2	2	-	-	-	-	2	2	3	3

3-High, 2-Medium, 1-Low

CS22076

SERVER-SIDE PROGRAMMING

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- Introduce the basics of PHP programming terminology, definition & concepts.
- Compare and contrast PHP Functions, Arrays, RegEx and Forms in PHP.
- Introduce the basics of Java Server Page terminology, definition & concepts and its environment setup.
- Introduce various Objects and Tag libraries in JSP.
- Illustrate the benefits and drive the adoption of how to connect database with PHP and JSP for various applications to solve real world problems.

UNIT I INTRODUCTION TO PHP 9

Introduction - Syntax – Comments – Variables – Datatypes – String – Numbers – Casting – Math – Constants – Operators – Conditional Statements - Loops.

UNIT II FUNCTIONS, ARRAYS, SUPERGLOBALS, REG EX AND FORMS 9

Functions and its Types – Arrays – Variables in Super global – Regular Expressions – Forms Handling – Validation – Required Fields – URL/E-mail – Complete Form Example

UNIT III JSP OVERVIEW 9

JSP Introduction – Environment Setup – Architecture – Life Cycle – Basics – Scripting Elements – Directives – Actions – Expressions

UNIT IV JSP IMPLICIT OBJECTS, JSTL AND CORE TAGS 9

Objects in JSP – Types - Implicit, Request, Response, Session and Exceptions – JSTL introduction and its Tag Categories: Core, Function, Formatting, XML and SQL tags– List of JSTL Core Tags

UNIT V CONNECTING DATABASE WITH PHP AND JSP 9

Introduction to Database – Database operations in PHP application and JSP application – Difference between JSP and PHP

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Exhibit the basics of PHP to build and automate business solutions using server-side technologies.	**2**
CO2	Analyze how to write a PHP code with functions, arrays and regular expressions.	**4**
CO3	Exhibit the strategies to know about the basics of JSP to reduce and eliminate risk issues associated with server side.	**2**
CO4	Design and deploy the various JSP programs in a business environment.	**4**
CO5	Work with the adoption of database connection with PHP and JSP applications.	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Larry Ullman, "Visual Quick Start Guide – PHP for the Web", Peach pit Press, Fifth Edition, 2016.
2. Phil Hanna, "The Complete Reference JSP ", The McGraw – Hill Companies, Inc, Fourth Edition, 2013.

REFERENCES

1. Loel Murach and Andrea Steelman, Mike Murach and Associates," Murach's Java Servlets and JSP", Hill Companies, Inc, 2nd Edition ,2017.
2. https://dotnettutorials.net/lesson/jsp-database/
3. https://books.goalkicker.com/PHPBook/
4. PHPNotesForProfessionals.pdf

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	-	1	-	-	-	-	-	-	2	-
2	3	2	3	2	-	2	-	-	-	-	-	-	2	-
3	3	2	2	2	-	1	-	-	-	-	-	-	2	-
4	3	2	2	2	1	2	-	-	-	-	-	-	2	2
5	3	2	3	2	1	1	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

CS22077	ADVANCED USER INTERFACE TECHNOLOGIES (Common to CS and AD)	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concepts and need of TypeScript.
- To understand and practice Client-side JS Framework, Basics of ANGULAR 8.0.
- To understand on Front-end application development and the React library.
- To understand various React features including components and forms.

UNIT I INTRODUCTION TO TYPESCRIPT **9**

TypeScript : Introduction to TypeScript – Features of TypeScript – Installation setup – Variables – Datatypes – Enum – Array – Tuples – Functions – OOP concepts – Interfaces – Generics – Modules – Namespaces – Decorators – Compiler options – Project Configuration.

UNIT II INTRODUCTION TO CLIENT-SIDE JS FRAMEWORK – BASICS OF ANGULAR 8.0 **9**

Introduction to Angular 8.0 - Needs & Evolution – Features – Setup and Configuration – Components and Modules – Templates – Change Detection – Directives – Data Binding - Pipes – Nested Components.

UNIT III INTRODUCTION TO ANGULARJS – FORMS AND ROUTING **9**

Template Driven Forms - Model Driven Forms or Reactive Forms - Custom Validators - Dependency Injection - Services- HTTP - Routing.

UNIT IV INTRODUCTION TO REACT AND ITS ROUTER **9**

Introduction to React: Platforms and Frameworks tools – Hybrid frameworks versus Native – React Environment Setup – React internals – React JSX – React Components and its styling– React Router: Parameters – Designing single page applications using React Router.

UNIT V INTRODUCTION TO REDUX AND CLIENT-SERVER COMMUNICATION **9**

Introduced to uncontrolled and controlled forms – Form validation in React applications – Overview of the Flux architecture - Introduction to Redux **–** React Redux Forms and its validation – Redux Actions and Combining Reducers – Client-Server Communication and Fetch , Building and Deploying the React Application.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to review the various concepts and need of Typescript.	**2**
CO2	Students will be able to excel expertly about the various Client-side JS Framework, Basics of ANGULAR 8.	**3**
CO3	Students will be able to know the Front end application development using ANGULARJS.	**3**
CO4	Students will be able to develop React features including components and forms .	**3**
CO5	Students will be able to accomplish the functional front end web application using React.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Nate Murray, Felipe Coury, Ari Lerner and Carlos Taborda, "ng-book, The Complete Book on Angular 4", First Edition, CREATESPACE Publishers, 2017.
2. Michele Bertoli, "React Design Patterns and Best Practices: Build easy to scale modular applications using the most powerful components and design patterns" , First Edition, Packt Publishing, 2017.

REFERENCES

1. Nathan Rozentals, "Mastering TypeScript", Second Edition, Packt Publishing, 2017.
2. Matt Frisbie, "Angular 2 Cookbook", First Edition, Packt Publishing, 2017.
3. Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", Second Edition, Pearson Education, 2018.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	2	-	-	-	-	1	-	2	3	-
2	3	3	2	2	3	-	2	-	2	2	1	2	3	2
3	3	3	3	2	3	-	2	-	2	2	1	2	3	2
4	3	3	3	3	3	-	2	-	3	3	2	2	3	3
5	3	3	3	3	3	-	3	2	3	3	3	3	3	3

3-High, 2-Medium, 1-Low

CS22078

WEB 3.0 AND METAVERSE

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- Introduce the basics of Web 3.0 terminology, definition & concepts.
- Learn the role of Metaverse and its technologies to connect the real world and blockchain.
- Work with advanced development of blockchain in the future.
- Explore the open ecosystem of smart properties and assets.
- Integrate gaming and social interactions using futuristic technologies such as blockchain, cryptocurrency, DAO, AR/VR.

UNIT I INTRODUCTION TO WEB 3.0 9

Introduction to Web 3.0 and Metaverse and immersive experience- History of Metaverse- Metaverse value chain with 7 layer

UNIT II TECHNOLOGIES INVOLVED IN THE METAVERSE 9

Metaverse as a product of Extended Reality- Augmented Reality (AR)- Virtual Reality (VR)-Benefits of AR/VR-Difference between AR/ VR - Mixed Reality (MR)-Artificial Intelligence (AI) ,Introduction in Metaverse-Financial and Economics of Metaverse-Benefits of Metaverse

UNIT III BLOCKCHAIN ADOPTION IN METAVERSE 9

Blockchain Overview-History of Blockchain- Need of Decentralization in MV-Smart Contract , Capabilities in Blockchain - Blockchain in Metaverse -Understanding Tokens-Understanding the NFT-NFT Token Standards-NFTs in MV-Cryptocurrency in MV

UNIT IV AR, VR, AND MR IN METAVERSE 9

Everything about VR (Virtual Reality)-Everything about AR (Augmented Reality)-Everything about MR (Mixed Reality)-Block chain Identity Management in Metaverse -NFT (non-fungible token) for Metaverse-Introduction to NFTs-History of NFTs-Benefits of NFTs

UNIT V USE-CASES 9

Gaming in Metaverse-Meetings in Metaverse-Virtual Learning in Metaverse-Social Interactions in Metaverse-Virtual Real-estate in Metaverse-e-commerce in Metaverse-Travel in Metaverse-Personalized Avatars-Digital Identity in Metaverse

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the History of Web 3.0 and Metaverse**.**	**2**
CO2	Learn the role of Metaverse to connect the real world and blockchain.	**4**
CO3	Work with advanced development of blockchain in the future.	**2**
CO4	Explore the open ecosystem of smart properties and assets.	**4**
CO5	Integrate futuristic technologies such as blockchain, cryptocurrency, DAO, AR/VR.	**5**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. The Metaverse: And How It Will Revolutionize Everything Kindle Edition by Matthew Ball , Publisher : Liveright ,2022.
2. The Metaverse Handbook: Innovating for the Internet;s Next Tectonic Shift Kindle Edition by QuHarrison Terry (Author), Scott Keeney (Author), Paris Hilton (Foreword), Publisher: Wiley; 1st edition ,2022.

REFERENCES

1. The Wearable Technology Handbook, Haider Raad ,scholar publications, 2017.
2. Metaverse Made Easy: A Beginner's Guide to the Metaverse, Dr. Liew Voon Kiong, Publisher, Liew Voon Kiong, 2022.
3. Metaverse For Beginners and Advanced: A Complete Journey Into the Metaverse Virtual World (Web 3.0), Darell Freeman, Publisher Darell Freeman,2022.
4. Metaverse Glossary - Your Gateway to the Future , Ravindra Dastikop, Evincepub Publishing, 2022.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	-	2	-	-	-	-	2	-	3	2	1
2	2	3	2	2	3	1	1	-	-	2	-	3	3	2
3	3	2	3	3	3	2	-	-	2	3	2	3	3	3
4	2	2	3	2	3	-	1	-	1	2	1	3	3	3
5	3	2	2	3	3	-	2	1	2	3	2	3	3	3

3-High, 2-Medium, 1-Low

CS22081

UNIX INTERNALS

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To get thorough understanding of the kernel.
- To understand the file organization and management.
- To know the various system calls.
- To understand the Inter Process Communication.
- To have a knowledge of process architecture, process control & scheduling and memory management.

UNIT I GENERAL OVERVIEW OF THE SYSTEM AND THE KERNEL 9

History – System structure – User perspective – Operating system services –Assumptions about hardware. Introduction to the Kernel: Architecture of the UNIX operating system – Introduction to system concepts – Kernel data structures – System administration – Kernel Resource Management – Scheduling – Signals.

UNIT II BUFFER CACHE AND FILES 9

Buffer headers – Structure of the buffer pool – Advantages and disadvantages of the buffer cache. Internal representation of files: Inodes – Structure of a regular file – Directories – Conversion of a path name to an Inode – Super block – Other file types.

UNIT III SYSTEM CALLS FOR THE FILE SYSTEM 9

Open – Read – Write – File and record locking – Adjusting the position of file I/O –LSEEK – Close – File creation – Creation of special files – Pipes – Dup – Mounting and unmounting file systems – File system implementation - Support for multiple file systems - Network File System.

UNIT IV PROCESS – STRUCTURE, CONTROL AND SCHEDULING 9

Process states and transitions – Layout of system memory – The context of a process – Saving the context of a process. Process Control: Process creation – Signals – Process termination – Awaiting process termination – Invoking other programs – The shell – System boot and the INIT process. Process Scheduling and Time.

UNIT V MEMORY MANAGEMENT POLICIES AND IPC 9

Memory Management Policies: Swapping – A hybrid system with swapping and demand paging. The I/O Subsystem: Driver Interfaces– Disk Drivers-Terminal Drivers. Interprocess Communication: Process Tracing– Network Communications – Sockets. Multiprocessor Systems. Distributed Systems: Satellite Processors – The Newcastle Connection – Transparent Distributed File Systems - Interprocess Communication - Basic IPC services - Example use of IPC and network facilities.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	The student will be able to interpret the basics of Unix Operating system and the kernel.	**2**
CO2	The student will be able to illustrate the operational concepts of buffer cache and files.	**2**
CO3	The student will be able to summarize the system calls to operate on the file system.	**2**
CO4	The student will be able to examine the various aspects of processes like process structure, process control and scheduling.	**4**
CO5	The student will be able to apply concepts of the memory management and inter process communication to solve problems.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Maurice J. Bach, "The Design of the Unix Operating System", Prentice Hall of India, 2004.

REFERENCES

1. UreshVahalia, "UNIX Internals: The New Frontiers", Prentice Hall, 2000.
2. John Lion, "Lion's Commentary on UNIX", 6th edition, Peer-to-Peer Communications, 2004.
3. Daniel P. Bovet & Marco Cesati, "Understanding the Linux Kernel", O'REILLY, Shroff Publishers &Distributors Pvt. Ltd, 2000.
4. M. Beck et al, "Linux Kernel Programming", Pearson Education Asia, 2002.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	-	-	-	-	1	-	1	1	2	-
2	3	2	2	-	-	-	-	-	1	-	1	1	2	-
3	3	3	2	-	-	-	-	-	1	-	1	1	2	2
4	3	3	3	2	2	-	-	-	1	2	1	1	3	2
5	3	3	3	3	2	2	2	2	2	2	2	2	3	3

3-High, 2-Medium, 1-Low

CS22082

DISTRIBUTED COMPUTING

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- Summarize various computation and communication models of distributed systems.
- Illustrate election algorithm, global snapshot algorithm and termination detection algorithm.
- Compare token based, non-token based and quorum based mutual exclusion algorithms.
- Recognize the significance of deadlock detection and shared memory in distributed systems.
- Illustrate distributed file system architectures concepts of failure recovery and consensus.

UNIT I DISTRIBUTED SYSTEMS BASICS AND COMPUTATION MODEL 9

Distributed System – Definition, Relation to computer system components, Motivation, Primitives for distributed communication, Design issues and Challenges. A model of distributed computations – Distributed program, Model of distributed executions, Models of communication networks, Global state of a distributed system, Cuts of a distributed computation, Past and future cones of an event, Models of process communications.

UNIT II ELECTION ALGORITHM, GLOBAL STATE AND TERMINATION DETECTION 9

Logical time – A framework for a system of logical clocks, Scalar time, Vector time. Leader election algorithm – Bully algorithm, Ring algorithm. Global state and snapshot recording algorithms –System model and definitions, Snapshot algorithm for FIFO channels – Chandy Lamport algorithm. Termination detection – System model of a distributed computation, Termination detection using distributed snapshots, Termination detection by weight throwing, Spanning-tree-based algorithm.

UNIT III MUTUAL EXCLUSION AND DEADLOCK DETECTION 9

Distributed mutual exclusion algorithms – System model, Requirements of mutual exclusion algorithm. Lamport's algorithm, Ricart–Agrawala algorithm, Quorum-based mutual exclusion algorithms – Maekawa's algorithm - Token-based algorithm – Suzuki–Kasami's broadcast algorithm. Deadlock detection in distributed systems – System model, Deadlock handling strategies, Issues in deadlock detection, Models of deadlocks.

UNIT IV DISTRIBUTED SHARED MEMORY AND FAILURE RECOVERY 9

Distributed shared memory – Abstraction and advantages. Shared memory mutual exclusion – Lamport's bakery algorithm. Check pointing and rollback recovery – System model, consistent and inconsistent states, different types of messages, Issues in failure recovery, checkpoint based recovery, log based roll back recovery.

UNIT V CONSENSUS AND DISTRIBUTED FILE SYSTEM 9

Consensus and agreement algorithms – Assumptions, The Byzantine agreement and other problems, Agreement in (message-passing) synchronous systems with failures – Consensus algorithm for crash failures. Distributed file system – File service architecture, Case studies: Sun Network File System, Andrew File System, Google File System.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	To understand the foundations of distributed systems.	**2**
CO2	To solve synchronization and state consistency problems.	**4**
CO3	To use resource sharing techniques in distributed systems.	**3**
CO4	To apply working model of consensus and reliability of distributed systems.	**4**
CO5	To understand the concept of various distributed file systems.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms, and Systems, Cambridge University Press, 2011.

REFERENCES

1. George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair. Distributed Systems: Concepts and Design, Addison Wesley, Fifth edition, 2012.
2. Kai Hwang, Geoffrey C Fox, Jack J Dongarra, Distributed and Cloud Computing – From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers, 2012.
3. Sukumar Ghosh, Distributed Systems: An Algorithmic Approach, CRC Press, Second edition, 2015.
4. Maarten Van Steen, Andrew S. Tanenbaum, Distributed Systems, Prentice Hall of India,Third edition, 2017.
5. Randy Chow and Theodore Johnson, Distributed Operating Systems and Algorithm Analysis, Pearson Education India, First edition, 2009.
6. Valmir C. Barbosa, An Introduction to Distributed Algorithms, MIT Press, 2003.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	2	-	-	-	-	-	-	2	3	2
2	3	3	3	3	3	2	-	-	-	-	-	2	3	2
3	3	3	3	3	3	2	-	-	-	-	-	2	3	2
4	3	3	3	3	3	2	-	-	-	-	-	2	3	3
5	3	2	2	2	3	-	-	-	-	-	-	2	3	3

3-High, 2-Medium, 1-Low

CS22083

QUANTUM COMPUTING

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

UNIT I QUANTUM COMPUTING BASIC CONCEPTS **9**

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Superpositions.

UNIT II QUANTUM GATES AND CIRCUITS **9**

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction.

UNIT III QUANTUM ALGORITHMS **9**

Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm.

UNIT IV QUANTUM INFORMATION THEORY **9**

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels.

UNIT V QUANTUM CRYPTOGRAPHY **9**

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the basics of quantum computing.	**2**
CO2	Understand the background of Quantum Mechanics.	**2**
CO3	Analyze the computation models.	**4**
CO4	Model the circuits using quantum computation, environments and frameworks.	**4**
CO5	Understand the quantum operations such as noise and error–correction.	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".

REFERENCES

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	–	–	–	–	–	–	–	–	–	3	3	2
2	3	3	–	–	–	–	–	–	–	–	–	3	3	2
3	3	3	3	3	3	–	–	–	–	–	–	3	3	3
4	3	3	3	3	3	–	–	–	2	2	2	3	3	3
5	3	3	3	3	3	–	–	–	–	–	–	3	3	3

3-High, 2-Medium, 1-Low

CS22084

HIGH PERFORMANCE COMPUTING

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand multiprocessors and multicomputer architectures in parallel computing.
- To understand High Performance Computing (HPC) system architectures and various computational models.
- To be familiar with cluster architecture and cluster models.
- To understand high speed networks and balancing of load over networks.
- To learn basics of CUDA programming.

UNIT I INTRODUCTION TO PARALLEL PROGRAMMING & COMPUTING 9

Era of Computing- Parallel Computing- Multiprocessors and Multicomputer Architectures- Scalar Vs Vector Processing- Multivector and Superscalar Machines- Pipelined Processors- SIMD Computers- Conditions of parallelism- Program flow mechanisms- Types of Parallelism – ILP, PLP, LLP- Program Partitioning and scheduling.

UNIT II INTRODUCTION TO HIGH PERFORMANCE COMPUTING 9

Scalable Parallel Computer Architectures- low-cost computing- Network of Workstations project by Berkeley- Cluster Computing Architecture- Components- Cluster Middleware and SSI- Need of Resource Management and Scheduling- Programming Environments.

UNIT III CLUSTER COMPUTING 9

Clustering Models- Clustering Architectures- key factors- types of clusters- Mission critical Vs Business Critical Applications- Fault Detection and Masking Algorithms- Check pointing, Heartbeats, Watchdog Timers- Fault recovery through Failover and Failback Concepts.

UNIT IV HIGH SPEED NETWORKS & MESSAGE PASSING 9

Introduction to High-Speed Networks- Lightweight Messaging Systems- Xpress Transport Protocol- Software RAID and Parallel File systems- Load Balancing Over Networks– Algorithms and Applications- Job Scheduling approaches- Resource Management in Cluster.

UNIT V CUDA PROGRAMMING 9

Introduction to CUDA architecture for parallel processing- CUDA Parallelism Model- Foundations of Shared Memory- Introduction to CUDA-C- Parallel programming in CUDA-C- Thread Cooperation and Execution Efficiency- Constants memory and events- memory management - CUDA-C on multiple GPUs- Hashing and Natural Parallelism- Scheduling and Work Distribution- Atomics, Barriers and Progress- Transactional Memory.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Infer parallel execution models and methodologies for parallel programming and parallel applications development.	**2**
CO2	Design and implement compute intensive applications on HPC platform.	**4**
CO3	Analyze the clustering models for business-critical applications.	**4**
CO4	Understand the purpose of Xpress transport protocol.	**2**
CO5	Perform parallel programming using CUDA.	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Rajkumar, High Performance Cluster Computing: Architectures and Systems, Vol. 1 Pearson Education, First Edition, 2007.
2. Georg Hager and Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, CRC Press, First Edition, 2019.

REFERENCES

1. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw Hill, Eighteenth Edition, 2008.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	–	–	–	2	2	2	3	3	3
2	3	3	3	3	3	–	–	–	2	2	2	3	3	3
3	3	3	3	3	3	–	–	–	–	–	–	3	3	3
4	3	2	–	–	2	–	–	–	–	–	–	3	2	2
5	3	3	3	3	3	–	–	–	2	2	2	3	3	3

3-High, 2-Medium, 1-Low

CS22085

GRAPH THEORY

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the fundamental concepts of Graph Theory.
- To understand trees, fundamental circuits, cut-sets and cut-vertices.
- To be familiar with planarity and vector spaces of graphs.
- To be familiar with familiar with matrices, coloring, covering and partitioning of graphs.
- To be familiar with directed graphs and enumeration of graphs.

UNIT I INTRODUCTION 9

Graphs - Applications of Graphs - Types of graph and directed graph - Finite and Infinite graphs - Incidence and Degree - Isolated Vertex - Pendant Vertex and Null graph - History of Graph Theory. Paths and Circuits: Isomorphism - Subgraphs - Walks, Paths and Circuits - Connectedness - Components - Euler graphs - Hamiltonian Paths and Circuits - The Travelling Salesman Problem.

UNIT II TREES, FUNDAMENTAL CIRCUITS, CUT-SETS & CUT-VERTICES 9

Trees and Fundamental Circuits: Trees - Properties of Trees - Pendant Vertices in a Tree - Distance and Centers in a Tree – Rooted and Binary Trees - On Counting Trees - Spanning trees - Fundamental circuits - Finding All Spanning Trees of a Graph - Spanning trees in a weighted graph - Cut sets - Properties of a Cut-set - All cut sets ina graph - Fundamental Circuits and Cut-Sets - Connectivity and Separability - Network flows - 1-Isomorphism - 2-Isomorphism.

UNIT III PLANAR & DUAL GRAPHS, VECTOR SPACES OF A GRAPH 9

Combinational Vs. Geometric Graphs - Planar graphs - Kuratowski's Two Graphs - Different Representation of a Planar Graph - Detection of Planarity - Geometric Dual - Combinatorial dual - Criteria of Planarity - Thickness and Crossings. Vector Spaces of a Graph: Sets with One Operation - Sets with Two Operations - Modular Arithmetic and Galois Fields - Vectors and Vector Spaces - Vector Space Associated with a Graph - Basics Vectors of a Graph - Circuit and Cut-Set Subspaces - Orthogonal Vectors and Spaces - Intersection and Join of W and Ws.

UNIT IV MATRICES, COLORING , COVERING AND PARTITIONING 9

Incidence Matrix - Submatrices of A(G) - Circuit Matrix - Fundamental Circuit Matrix and Rank of B - Application to a Switching Network - Cut-Set Matrix - Relationships among Af, Bf and Cf. Path Matrix, Adjacency Matrix. Chromatic number - Chromatic partitioning - Chromatic polynomial - Matchings - Coverings - The Four color problem.

UNIT V DIRECTED GRAPHS & ENUMERATION OF GRAPHS 9

Directed graphs: Directed Graphs - Types of Digraphs - Digraphs and Binary Relations - Directed paths and Connectedness - Euler graphs - Trees with Directed Edges - Fundamental Circuits in Digraphs -

Matrices A, B and C of digraphs, Adjacency Matrix of a Digraph, Paired Comparisons and Tournaments - Acyclic Digraphs and Decyclization. Enumeration of Graphs: Types of Enumeration - Counting Labelled and Unlabelled Trees - Polya's Counting Theorem - Graph Enumeration with Polya's Theorem.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to understand precise and accurate mathematical definitions of objects in graph theory.	**2**
CO2	Students will be able to use mathematical definitions to identify and construct examples and to distinguish examples from non-examples.	**3**
CO3	Students will gain the skill to validate and critically analyze a mathematical proof.	**4**
CO4	Students will be able to use a combination of theoretical knowledge and independent mathematical thinking in examination of questions in graph theory.	**3**
CO5	Students will be able to infer from definitions and examples to construct mathematical proofs.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Narsingh Deo, "Graph Theory: With Application to Engineering and Computer Science", Prentice Hall of India, 2017.

REFERENCES

1. Clark J. and Holton D.A, "A First Look at Graph Theory", Allied Publishers, 1995.
2. Gary Chartrand, Ortrud R. Oellermann, "Introduction to Graph Theory", Tata McGraw-hill, 2005.
3. Douglas B West, "Introduction to Graph Theory", Prentice-Hall of India, 2005.
4. Frank Harary, "Graph Theory", Prentice-Hall of India, 1988.
5. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata Mc Graw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
6. Bondy J A and Murthy U S R , Graph Theory with Applications, Elsevier Science Publishing Co. Inc. New York, 1982

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	-	-	-	-	-	-	-	2	2	-
2	3	3	-	-	-	-	-	-	-	-	-	2	2	2
3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
4	-	3	2	2	-	-	-	-	-	2	-	2	3	-
5	3	2	-	2	-	-	-	-	-	-	-	2	3	2

3-High, 2-Medium, 1-Low

CS22086

RESOURCE MANAGEMENT TECHNIQUES

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basics of resource management techniques and its applications.
- To understand the modeling of real-world decision-making problems.
- To solve problems in linear programming and Integer programming and be exposed to CPM and PERT.
- To apply optimization techniques on real problems and make decisions.

UNIT I LINEAR MODEL 9

Introduction to operation research – Different phases of an operational research study. Mathematical formulation of linear programming problems - Graphical LP solution – Simplex method – Two phase Method, Charnes-M Method – Special cases in the simplex method. Sensitivity analysis.

UNIT II INTEGER PROGRAMMING MODELS 9

Formulation – Gomory's IPP method – Gomory's mixed integer method – Branch and bound technique.

UNIT III TRANSPORTATION AND ASSIGNMENT MODELS 9

Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution – degeneracy. Mathematical formulation of assignment models – Hungarian Algorithm – Variants of the assignment problem.

UNIT IV NETWORK MODEL 9

Scope of network model. Minimal spanning tree algorithm. Network Construction – Critical Path Method – Time estimates – Crashing – Time charts - Project Evaluation and Review Technique – Project scheduling and Resource planning.

UNIT V DECISION MODEL 9

Decision model – Game theory – Two-person zero-sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to formulate linear programming (LP) models and solve the problems using appropriate methods.	**3**
CO2	Students will be able to solve a linear integer programming model.	**3**
CO3	Students will be able to produce optimized solutions for transportation and assignment models.	**4**
CO4	Students will be able to apply CPM and PERT techniques constructively to make effective business decisions and resource mapping.	**3**
CO5	Students will be able to find an optimal solution of the game and to solve dynamic programming.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Hamdy A. Taha, "Operations Research : An Introduction" 10th Edition, Pearson Education, 2017.

REFERENCES

1. A. Ravindran, D. T. Phillips and James J. Solberg, "Operations Research- Principles and Practice", John Wiley & Sons, 2005.
2. Prem Kumar Gupta, D.S. Hira, "Operations Research", S.Chand & Company Ltd, New Delhi, 3rd Edition , 2003.
3. F.S. Hillier. G.J. Lieberman, "Introduction to Operations Research- Concepts and Cases", 9th Edition, Tata Mc-Graw Hill, 2010.
4. R.Panneer Selvam, "Operations Research", Prentice Hall of India, 2002.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	1	1	1	-	-	-	2	1	3	2	2	1
2	3	3	3	2	3	-	1	-	2	1	2	2	3	1
3	3	3	2	2	3	-	-	-	1	1	2	2	3	2
4	2	3	3	2	3	-	-	-	2	1	2	3	2	2
5	2	3	3	2	2	2	-	-	3	1	2	3	3	3

3-High, 2-Medium, 1-Low

CS22087

RISK ANALYTICS

(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- To develop a basic understanding of risk assessment and its role within the risk management process.
- To understand risk assessment and its role within the risk management process.
- To differentiate between risk assessment and risk management.
- To develop a basic understanding of how to conduct and evaluate an uncertainty analysis for a risk assessment

UNIT I INTRODUCTION 9

Introduction, Fundamentals of Risk- Risk Planning, Assessment and Management Process and the Systems Approach-Types of Risk Assessment- Risk, Hazard, Performance and Engineering Risk Assessment.

UNIT II RISK IDENTIFICATION 9

Preliminary Hazard Analysis (PHA), Hazards and Operability Analysis (HAZOP) - Job Safety Analysis (JSA) - Failure Modes and Effects Analysis (FMEA)- Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Decision Trees- Cause-Consequence Analysis (CCA).

UNIT III RISK QUANTIFICATION 9

Introduction to Risk Quantification-Quantitative Risk Assessment (QRA)-Probability Distributions in Risk Analysis-Statistical Methods for Risk Assessment-Monte Carlo Simulation-Scenario Analysis-Sensitivity Analysis-Uncertainty Analysis-Bayesian Methods in Risk Assessment.

UNIT IV RISK PRIORITIZATION & TREATMENT 9

Risk Probability and Impact Assessment, Risk Index and Risk Ranking - − Risk Matrix, EV Analysis, Sensitivity and Tradeoff Analysis, Modeling and Simulation- Risk Attitude and Risk Tolerance, As Low As Reasonably Practicable (ALARP)- Avoidance, Separation, Reduction, Transfer, Acceptance-Detection, Control, Response and Recovery- Performance Monitoring.

UNIT V SPECIAL TOPICS AND APPLICATION 9

ISO3100, Quality and Reliability- Supply Chain Risk Management- Project Risk Management Positive Risk/ Opportunities Management- Risk and TOC.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Identify the core types of project risks.	**3**
CO2	Use qualitative and quantitative risk assessment methods.	**3**
CO3	Competently use risk simulation techniques	**3**
CO4	Use risk analysis tools/methods and work in a group to create a risk management plan based on the ISO 31000:2009.	**3**
CO5	Identify a range of risk management issues/challenges and the risks as complex systems cascade and be competent to initiate potential actions in response	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Marvin Rausand Stein Haugen , Risk Assessment: Theory, Methods, and Applications, Wiley, 2020.

REFERENCES

1. Mohammad Modarres , Risk Analysis in Engineering Techniques, Tools, and Trends, CRC Press, 2006.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**-**	**-**	**-**	**2**	**1**	**3**	**-**
2	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**-**	**-**	**-**	**2**	**1**	**3**	**-**
3	**3**	**3**	**2**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**2**	**1**	**3**	**-**
4	**3**	**2**	**1**	**1**	**3**	**1**	**2**	**-**	**-**	**-**	**2**	**2**	**3**	**-**
5	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**-**	**-**	**-**	**2**	**2**	**3**	**-**

3-High, 2-Medium, 1-Low

CS22088 **MOBILE APPLICATION DEVELOPMENT**
(Common to CS and AD)

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the system requirements for mobile applications.
- Generate suitable design using specific mobile development frameworks.
- Generate mobile application design.
- Understand the design using specific mobile development frameworks.
- Deploy the mobile applications in marketplace for distribution.

UNIT I INTRODUCTION **9**

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.

UNIT II BASIC DESIGN **9**

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – user interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III ADVANCED DESIGN **9**

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV ANDROID **9**

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V IOS **9**

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the requirements for mobile applications.	**2**
CO2	Design the Basic screen layout.	**4**
CO3	Develop design for mobile applications for specific requirements.	**3**
CO4	Implement the design using Android SDK.	**4**
CO5	Implement the design using iOS.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2016.
2. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2016.

REFERENCES

1. http://developer.android.com/develop/index.htm.
2. Mobile Application Development, Usability, and Security, IGI Global,2017.

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	1	2	1	-	-	-	2	1	3	3	2
2	3	3	3	2	3	-	2	-	-	2	2	3	3	3
3	2	3	3	3	3	2	3	1	1	3	2	3	3	3
4	3	2	3	3	3	3	2	2	2	3	3	2	3	2
5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3-High, 2-Medium, 1-Low

OE22501 **BASIC OPERATING SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the basic concepts and functions of operating systems.
- Understand Processes and Threads Analyze Scheduling algorithms.
- Understand the concept of Deadlocks.
- Analyze various memory management schemes.
- Understand I/O management and File systems.

UNIT I INTRODUCTION TO OS **9**

Computer System Organization - Computer System Architecture – Evolution of Operating System - Operating System Structures - Services and Operations - System Calls - System Programs - Operating System Generation and System Boot – Computing Environments.

UNIT II PROCESS SCHEDULING **9**

Process Concept - Process Scheduling - Operations on Processes – Inter Process Communication – Shared Memory - Message Passing - PIPES. CPU Scheduling - Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling – Real time scheduling – Algorithm Evaluation. Case study : Process scheduling in Linux.

UNIT III PROCESS SYNCHRONIZATION **9**

Process Synchronization: The critical-section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock.

UNIT IV STORAGE MANAGEMENT **9**

Main Memory- Memory Partitioning - Memory Allocation Algorithms – Segmentation – Paging - 32 and 64 bit architecture - Virtual Memory – Data structures – Management Policies – Demand Paging - Replacement Algorithms – Allocation – Thrashing - Allocating Kernel Memory - Case Study : Windows, Solaris OS.

UNIT V FILE & I/O SYSTEMS **9**

File-System Interface: File concept – Access methods – Directory structure –Directory implementation – Allocation methods, I/O Systems - Disk scheduling RAID structure

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to apply the functionality of Operating Systems	**3**
CO2	Students will be able to design various Scheduling algorithms..	**2**
CO3	Students will be able to apply the principles of concurrency and to design deadlock, prevention and avoidance algorithms..	**3**
CO4	Students will be able to compare and contrast various memory management schemes.	**3**
CO5	Students will be able to design and implement a prototype file systems.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Abhraham Silberschatz, Peter B Galvin, and Gerg Gagne, "Operating System Concepts", 10th Edition, Wiley India Pvt Ltd, 2018

REFERCENCES

1. Andrew S. Tanenbaum, "Modern Operating Systems", fourth Edition, Pearson Education/PHI, 2015

OE22502 **BASICS ON CYBER SECURITY AND ETHICAL HACKING**

L	T	P	C
3	0	0	3

OBJECTIVES

- To acquire fundamental knowledge on the concepts of Cyber Security and Ethical Hacking
- To understand cyber-attack, types of cybercrimes, cyber laws
- To demonstrate the techniques for system hacking
- To detect and prevent the security attacks in different environments

UNIT I INTRODUCTION TO CYBER SECURITY 9

Network and Security concepts: CIA Triad - Information Assurance Fundamentals, Basic Cryptography: Symmetric Encryption - Public Key Encryption, Firewalls, Microsoft Windows Security Principles.

UNIT II ATTACKERS TECHNIQUES AND MOTIVATION 9

Proxies: Types – Detecting the use of proxies, Tunneling Techniques- HTTP, DNS, ICMP, Steganography- Detection and prevention, Fraud Techniques- Phishing-Malicious code, Rogue Antivirus, Threat Infrastructure- Botnets, Exploitation: SQL Injection.

UNIT III MALICIOUS CODE 9

Self-Replicating Malicious Code- Virus, Worms, Evading Detection and Elevating Privileges, Rootkits, Spyware, Token Kidnapping, Man in the middle attack, Form Grabbing, DLL injection- Windows Registry DLL Injection- Injecting Applications - Reflective DLL Injections, Browser Helper Objects, Intrusion Detection System.

UNIT IV INTRODUCTION TO ETHICAL HACKING 9

Hacking: Evolution, Security Fundamentals, Security Testing, Hacker and Cracker Description, Ethical Hackers, Test Plans, Ethics and Legality, Attacker's Process, The ethical hacker's process, Security and the Stack.

UNIT V TECHNICAL FOUNDATIONS OF HACKING 9

Footprinting & Scanning- Overview of the Seven-Step Information-Gathering Process, Information Gathering, Documentation, Google Hacking, Usenet, Identifying Active machines, Finding Open Ports and Access Points, OS Fingerprinting, System Hacking, Malware threats – Trojans, Keystroke Logging and Spyware, Covert Communication, Malware Countermeasures, Sniffers, Session Hijacking, and Denial of Service.
Case Study: Web Application Hacking scenarios and remedies

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Understand cyber-attack, types of cybercrimes, cyber laws.	**2**
CO2	Protect them self and ultimately society from such attacks	**3**
CO3	Describe and understand the basics of the ethical hacking	**2**
CO4	Demonstrate the techniques for system hacking	**3**
CO5	Detect and prevent the security attacks in different environments	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Cyber Security Essentials by James Graham , Richard Howard, Ryan Olson, CRS Press, Taylor & Francis Group, New York, 2016.
2. CEH Certified Ethical Hacker Cert Guide, 4th Edition, Michael Gregg, Omar Santos, Pearson IT Certification, 2022.

REFERCENCES

1. Anti- Hacker Tool Kit (Indian edition) by Mike Sherma, 4 edition, Mc Graw Hill publication, 2014.
2. Hacking the Hacker, Roger Grimes, Wiley & sons, 2017.
3. The Unofficial Guide to Ethical Hacking, Ankit Fadia, Premier Press.

OE22503 INTRODUCTION TO INTERNET OF THINGS

L	T	P	C
3	0	0	3

OBJECTIVES

- To introduce the terminology, technology and its applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To apply the concept of Internet of Things in the real world scenario

UNIT I INTRODUCTION TO INTERNET OF THINGS 9

Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs

UNIT II IOT AND M2M 9

IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology- M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

UNIT III INTRODUCTION TO PYTHON 9

Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages – JSON, XML, HTTPLib, URLLib, SMTPLib

UNIT IV IOT PHYSICAL DEVICES AND ENDPOINTS 9

Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT V CASE STUDIES 9

Smart Lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring, Reporting System & Bot, Air Pollution Monitoring, Forest Fire Detection, Smart Irrigation, IoT Printer

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Students will be able to analyze various protocols for IoT	**4**
CO2	Students will be able to develop IoT application using scripting languages	**3**
CO3	Students will be able to design a portable IoT using Rasperry Pi	**3**
CO4	Students will be able to develop web services to access/control IoT devices.	**3**
CO5	Students will be able to analyze applications of IoT in real time scenario	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.

REFERCENCES

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011
3. Honbo Zhou,―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.
4. Jan Ho¨ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand.
5. David Boyle, "From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence", Elsevier, 2014

OE22504 MULTIMEDIA AND ANIMATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES

- To comprehend the building blocks of multimedia
- To learn multimedia authoring tools
- To understand data compression and applications of multimedia
- To know about the various multimedia tools
- To learn basic animations

UNIT I MULTIMEDIA –AN OVERVIEW 9

Introduction- Components of Multimedia-Software Tools-Multimedia Presentation and Production-Characteristics and Challenges for multimedia system -Multimedia Building blocks-Hardware and Software Requirements-Data Compression-Multimedia Sharing and Distribution-Uses of Multimedia Analog and Digital Representations–Digitization-Nyquist's Sampling Theorem-Quantization Error-Visual Display Systems.

UNIT II MULTIMEDIA BASICS 9

Text, Image, Audio, Video –types, representations, standards, file formats-Use of Image and Graphics-Working with image and graphics-Image synthesis, analysis and Transmission.

UNIT III MULTIMEDIA AUTHORING AND TOOLS 9

Multimedia Authoring-Requirements - Intramedia Processing-Intermedia processing Multimedia Authoring Paradigms and User Interfaces-Device-Independent Content Authoring-Distributed Authoring and Versioning-Multimedia Services and Content Management-Asset Management- Adobe DreamWeaver-Flash- Edge Animate CC, Camatasia Studio 8, Claro, E-Learning Authoring Tools – Articulate, Elucidate, Hot Lava.

UNIT IV MULTIMEDIA APPLICATIONS 9

Global structure of Multimedia-Multimedia scope-Multimedia Databases – Content Based Information Retrieval, Multimedia Communications - Multimedia Information Sharing and Retrieval – Applications – Online Social Networking - Virtual Reality - Multimedia for Portable Devices, Collaborative Multimedia Applications

UNIT V ANIMATION 9

Animation language -Timeline and frame based application-Timeline and Tween based application-Methods of controlling animation -Appeal - Solid Drawing-Squash and Stretch - Timing- Staging -

Secondary Action-Follow Through and Overlapping Action - Exaggeration-Arcs - Straight Ahead and Pose to Pose-Anticipation - Slow In and Slow Out-Character Design- Methods of Creation- Waveforms -Character Speech -Character Movement-The Walk Cycle.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to understand on basic elements of multimedia	**1**
CO2	Students will be able to use and apply authoring tools	**3**
CO3	Students will be able to understand data compression and applications of multimedia	**2**
CO4	Students will be able to use multimedia tools	**3**
CO5	Students will be able to create animations	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Ranjan Parekh, "Principles of Multimedia", 2nd Edition, Mcgraw Hill, 2012.
2. Parag Havaldar and Gerard Medioni, ―Multimedia Systems - Algorithms, Standards and Industry Practices‖, Course Technology, Cengage Learning, 2010.

REFERCENCES

1. Ralf Steinmetz and Klara Nahrstedt, ―Multimedia Computing, Communications and Applications‖, First Edition, Pearson, 2005.
2. Ze - Nian Li, Mark S Drew and Jiangchuan Liu ―Fundamentals of Multimedia‖, Second Edition, Springer, 2014.
3. Heather D.Freeman "The Moving Image Workshop: Introducing Animation, Motion Graphics and Visual Effects in 45 Practical Projects" Published by Fairchild Books,2015

OE22505 **PYTHON PROGRAMMING**

L	T	P	C
3	0	0	3

OBJECTIVES

- To know the basics of algorithmic problem solving.
- To read and write simple Python programs with conditionals, loops and functions.
- To use Python data structures –- lists, tuples, sets and dictionaries.
- To do input/output with files in Python and use modules & packages.
- To know the basics of databases, computation and visualization.

UNIT I INTRODUCTION TO PROBLEM SOLVING AND PYTHON 9

Introduction to Problem solving: Computer algorithms – Hardware – Software – Computational Problem solving – Python Programming Language – Introduction – Data and Expressions – Literals – Variables and Identifiers – Operators – Expressions – Control structures – Boolean expressions – Selection control - conditional (if), alternative (if-else), chained conditional (if-elif-else); – Iterative control - state, while, for, break, continue, pass.

UNIT II FUNCTIONS & STRINGS 9

Function calls – type conversion – math function – composition - definition and use - flow of execution - parameters and arguments. Fruitful functions: return values – parameters - scope: local and global - recursion. Strings: string slices – immutability - string functions and methods - string comparison. Illustrative programs: square root – GCD – exponentiation - sum the array of numbers - linear search - binary search.

UNIT III DATA STRUCTURES IN PYTHON 9

Lists - list operations - list slices - list methods - list loop – mutability – aliasing - cloning lists - list parameters. Tuples – immutable - tuple assignment - tuple as return value. Dictionaries: operations and methods – dictionaries and tuples – dictionaries and lists. Advanced list processing - list comprehension. Illustrative programs: Searching and Sorting. - Set data type in Python.

UNIT IV FILES, MODULES,PACKAGES 9

Files and exception: file operation - text files - reading and writing files - format operator- command line arguments - errors and exceptions - handling exceptions – writing modules – packages. Illustrative programs: word count - copy file.

UNIT V DATABASES AND VISUALIZATION 9

Database Programming: Connecting to a database, Creating Tables, INSERT, UPDATE, DELETE and READ operations, Transaction Control, Disconnecting from a database. Python packages: Simple programs using the built-in functions of packages Numpy, Matplotlib.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Develop algorithmic solutions to simple computational problems and Structure simple Python programs for solving problems.	**3**
CO2	Decompose a Python program into functions and handle the strings.	**3**
CO3	Represent compound data using Python lists, tuples, sets and dictionaries.	**3**
CO4	Read and write data from/to files in Python programs.	**3**
CO5	To develop projects using Database and visualization.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Third edition, O'Reilly Publishers, 2024
2. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017).

REFERCENCES

1. Charles Dierbach, "Introduction to Computer Science using Python", Wiley, 2015
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Interdisciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Wesley J. Chun, "Core Python Applications Programming", 3rd Edition , Pearson Education, 2016.
4. John Zelle, "Python Programming: An Introduction to Computer Science", Second edition, Course Technology Cengage Learning Publications, 2013.
5. Michel Dawson, "Python Programming for Absolute Beginers" , Third Edition, Course Technology Cengage Learning Publications, 2013.

OE22506 **ANALYTICS FOUNDATION**

L	T	P	C
3	0	0	3

OBJECTIVES

The main objectives of this course are to:

- Understand overview of data and analytics, different skill set required for analytics;learn basic
- Learn SQL programming for data science
- Learn basics of python and hands on implementation of python for ML
- Learn different EDA and Statistical techniques to explore and identify patterns in data
- Learn visualization tool: Tableau, and building of dashboard

UNIT I INTRODUCTION TO DATA, ANALYTICS AND EDA 9

Intro to data: Types of data - Data understanding -Learning to Interpret data- cleaning data- analytical dataset- basics of data engineering-Intro to Statistics: Need for Statistics and Exploratory Data Analysis- Basics of stats and types of statistical analysis - descriptive and inferential-Intro to toolkit for data analytics -EDA

UNIT II SQL PROGRAMMING 9

SQL programming - Introduction to DBMS-ER diagram- Schema design- Key constraints and basics of normalization- Joins- Subqueries involving joins and aggregations- Sorting- Independent subqueries-correlated subqueries- Analytic functions- Set operations- Grouping and filtering

UNIT III PYTHON FOUNDATION 9

Intro to Python:Syntax and Semantics of Python programming- conditional statements- loops-Iterators-User-defined functions-Python functions- packages and routines-Modular Programming: Basics of OOPs-Python for analytics: NumPy- Pandas-Understand how to use the various Python libraries to manipulate data- Numpy- Pandas- Seaborn- Matplotlib- Scikit Learn- Plotly

UNIT IV STATISTICAL TESTING AND EXPLORATORY DATA ANALYSIS 9

Statistical testing: Measures of central tendency- Probability distributions (Discrete and Continuous)-Correlation- Covariance- Multicollinearity- Hypothesis testing and types

UNIT V VISUALIZATION AND INTERPRETATION 9

Intro to Tableau- Organizing & Simplifying Data- Charts: Basic and Advanced- Advanced Tableau-Interpretation of tools

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Understand overview of data and analytics, different skill set required for analytics; learn basic	**2**
CO2	Learn SQL programming for data science	**3**
CO3	Learn basics of python and hands on implementation of python for ML	**3**
CO4	Learn different EDA and Statistical techniques to explore and identify patterns in data	**3**
CO5	Learn visualization tool: Tableau, and building of dashboard	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Statistics for Machine Learning, by Pratap Dangeti
2. Database System Concepts, By Abraham Silberschatz, Henry F. Korth, S. Sudarshan
3. Learning SQL, 3rd Edition, O'Reilly

REFERCENCES

1. https://www.linkedin.com/learning/learning-data-analytics-1-foundations
2. https://www.udemy.com/course/top-python-for-data-science-course/
3. https://in.coursera.org/projects/exploratory-data-analysis-python-pandas
4. https://www.udemy.com/course/tableau-2021-a-z-master-tableau-for-data-science-and-bi/

OE22507 **ARTIFICIAL INTELLIGENCE BASICS**

L	T	P	C
3	0	0	3

OBJECTIVES

The main objectives of this course are to:

- To understand basic principles of Artificial Intelligence
- To learn and design intelligent agents
- To understand the basic areas of artificial intelligence including problem solving, knowledge representation, reasoning
- To Understand on decision making, planning, perception and action
- To Identify the AI based problems

UNIT I FOUNDATIONS FOR AI **9**

AI- Application areas – AI Basic Strategy: Divide and conquer, Greedy, Branch and Bound, Gradient Descent-Neural Networks Basics: Backpropagation- Intelligent Agents - Characteristics of Intelligent Agents, Typical Intelligent Agents; Problem solving - Search Strategies, Uninformed, Informed, Heuristic Functions; Water Jug Problem.

UNIT II KNOWLEDGE REPRESENTATION AND REASONING **9**

Ontology - Commonsense Knowledge Representation of Commonsense knowledge – Graphical models – Belief networks - State space representation – Vector representation - Propositional logic and predicate logic - Propositional and predicate logic - Equivalence - De Morgan's laws - Decidable problems

UNIT III REASONING UNDER UNCERTAINTY **9**

Automated Reasoning– Formal program techniques: specification by pre- and post-conditions, derivation and verification of programs, invariants. Strategic Reasoning in AI - Agents, strategic behaviours of agents in multiagent systems (MAS) by using the language of alternating-time temporal logic (ATL).

UNIT IV PLANNING AND DECISION MAKING **9**

Decision Theory Decision-Making: basics of utility theory, decision theory, sequential decision problems, decision networks, elementary game theory, sample applications;. Intelligent agents - reactive, deliberative, goal-driven-Artificial Intelligence programming techniques; Planning: planning as search, partial order planning, construction and use of planning graph

UNIT V META HEURISTICS APPROACH FOR EXPERT SYSTEMS **9**

Problem-solving through Meta heuristic Search: Hill climbing, best-first, A, A*, AO*, minimax, constraint propagation, intelligent search, meta-heuristics. Expert system-based reasoning - Production system, semantic network, and frame - Soft computing based reasoning – Fuzzy logic.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Understand formal methods of knowledge representation	**2**
CO2	Understand foundation principles, mathematical tools and program paradigms of AI.	**3**
CO3	Apply intelligent agents for Artificial Intelligence programming techniques	**3**
CO4	Apply problem solving through search for AI applications	**3**
CO5	Apply logic and reasoning techniques to AI applications.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Peter Norvig and Stuart Russel, Artificial Intelligence: A Modern Approach, Pearson, 4th Edition, 2021
2. Elaine Rich, Kevin Knight and B.Nair, Artificial Intelligence 3rd Edition, McGraw Hill, 2010
3. Russell, Norvig, Artifificial Intelligence: A Modern Approach, Third edition, Prentice Hall,2010
4. Gendreau, Michel, and Jean-Yves Potvin, Handbook of metaheuristics, Springer, 2010.

REFERCENCES

1. Melanie Mitchell, Artificial Intelligence: A Guide for Thinking Humans. Series: Pelican Books, 2020
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems,1st Edition by Patterson, Pearson, India, 2015

OE22508 **DATABASE SYSTEMS AND APPLICATIONS**

L	T	P	C
3	0	0	3

OBJECTIVES

- The students will learn the fundamentals of data models and SQL and represent a database system using ER diagrams
- The students will write Query for real-life problems
- The students will obtain knowledge about Functional dependencies and Normalization and how to normalize the databases.
- The students will understand the physical storage and file organization techniques and obtain knowledge about the fundamental concepts of transaction processing, and concurrency control.
- The students will understand the various databases and process of storing data.

UNIT I FUNDAMENTALS OF DATABASE & RELATIONAL DATABASE 9

DBMS History and Architecture - Data models - Database Schemas, Data modeling: keys -Relational Query language - ER modeling - Specialization - Generalization and inheritance - Conversion of ER model to Relational schema ER Diagram Tool: smart draw.

UNIT II SQL 9

SQL schema definitions - Basic & queries in SQL - Views in SQL, Dynamic SQL, PL/SQL - Embedded Queries - Triggers - Database Connectivity.

UNIT III NORMALIZATION 9

Functional Dependencies -Non-loss Decomposition -First, Second, Third Normal Forms, Dependency Preservation -Boyce/Codd Normal Form -Multi-valued Dependencies and Fourth Normal Form -Join Dependencies and Fifth Normal Form

UNIT IV DATA STORAGE AND TRANSACTION PROCESSING 9

RAID - File Organization - Organization of Records in Files -Indexing and Hashing - Ordered Indices - Transaction Concepts - ACID Properties -Schedules - Serializability - Concurrency Control

UNIT V ADVANCED DATABASE 9

Unstructured or semi-structured databases - Scientific workflows - Object-Oriented databases - Multimedia databases - XML database – Temporal Database

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Identify an entity and discover its relationship using an ER diagram.	**2**
CO2	Develop an application with SQL and programming language using database connectivity	**3**
CO3	Normalize the databases to reduce costs due to data redundancy	**3**
CO4	Analyze the various indexing strategies and basic issues of transaction processing and maintain consistency of the databases.	**4**
CO5	Explore the Advanced Database Techniques in real world application	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", McGraw Hill, Seventh Edition, 2020.
2. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Pearson Education/Addison Wesley, Seventh Edition, 2021.

REFERCENCES

1. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Pearson Education, Fifth Edition, 2009.
2. C. J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", Pearson Education, Eighth Edition, 2006.
3. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition, 2004.
4. G.K. Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
5. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T. Snodgrass, V.S. Subrahmanian, Roberto Zicari, "Advanced Database Systems", Morgan Kaufmann publishers, 2006.

OE22509 **INTERNET PROGRAMMING**

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand various protocols.
- Study about various tags in html.
- Impart knowledge in designing form with style sheets.
- Acquire knowledge about validation at client side.
- Acquire knowledge about PHP at server side

UNIT I WEB ESSENTIALS: CLIENTS, SERVERS AND COMMUNICATION 9

The Internet-Basic Internet Protocols (TCP/IP, UDP, DNS and High-Level Protocols) - World Wide Web - HTTP-Request and Response Message -Web Clients and Web Servers.

UNIT II MARKUP LANGUAGES 9

HTML Introduction-Syntax - Fundamental HTML elements – URLs – Lists – Tables - Frames.

UNIT III FORMS AND STYLE SHEETS 9

Form Creation with basic html elements – Style Sheets -Introduction to CSS, Features, syntax and its types.

UNIT IV CLIENT-SIDE PROGRAMMING -JAVASCRIPT 9

CLIENT-SIDE PROGRAMMING- History and Versions of JavaScript-Basic syntax, Variables, Datatypes, Operators, Functions and Regular Expressions

UNIT V SERVER-SIDE PROGRAMMING – PHP 9

Introduction to PHP & Features: PHP Scripts - Data Types - Variables - Operators - Control Structures - Working with Arrays - Functions - Working with Files

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Able to be familiar with basics of the Internet Programming	**2**
CO2	Able to acquire knowledge and skills for creation of web page for client side with basic html elements.	**2**
CO3	Develop web applications with styling sheets	**4**
CO4	Create interactive web site for client side with JavaScript	**5**
CO5	Able to understand PHP basics	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Jeffrey C. Jackson, "Web Technologies-A Computer Science Perspective"-, Fourth Edition.
2. Larry Ullman, "Visual Quick Start Guide – PHP for the Web", Fourth Edition.

REFERCENCES

1. https://www.w3schools.com

OE22510 **INTRODUCTION TO CLOUD AND BIG DATA ANALYTICS**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand fundamentals of cloud computing.
- To understand the cloud infrastructure.
- To gain knowledge on the concept of virtualization that is fundamental to cloud computing .
- To learn the concept of big data.
- To understand the security issues in cloud computing.

UNIT I INTRODUCTION **9**

Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Computing and Service Models:- Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Cloud ecosystem and enabling technologies.

UNIT II CLOUD INFRASTRUCTURE **9**

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

UNIT III VIRTUALIZATION **9**

Introduction – Implementation Levels of Virtualization – Virtualization Structures / Tools and Mechanisms – Virtualization of CPU, Memory, and I/O Devices – Virtual Cluster and Resource Management – Virtualization for Data Center Automation.

UNIT IV CLOUD SECURITY **9**

Security management in Peer-to-Peer Networks – Peer trust and Reputation Systems – Trust overlay and DHT implementation – Power Trust – Securing Overlays – Cloud Security and Trust Management – Defense Strategies – Distributed Intrusion / Anomaly Detection – Data and Software Protection Techniques – Reputation – Guided Protection of Data Centers.

UNIT V BIG DATA **9**

Hadoop – Hadoop HDFS – Hadoop Map Reduce, Google - Google App Engine-GFS- BigTable.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to be learn the fundamentals of cloud computing.	**2**
CO2	Students will be able to understand the cloud infrastructure.	**2**
CO3	Students will be able to understand the concept of virtualization that is fundamental to cloud computing.	**2**
CO4	Students will be able to analyze the security issues in cloud computing.	**4**
CO5	Students will be able to understand the concepts of big data.	**2**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.

REFERCENCES

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing Principles and Paradigms, Wiley, 2010 2.
2. Toby Velte, Anthony Velte, Robert Elsenpeter , Cloud Computing, A Practical Approach, McGrawHill, 2010 3.
3. Thomas Erl , Ricardo Puttini, Zaigham Mahmood," Cloud Computing: Concepts, Technology & Architecture", First Edition, Prentice Hall,2013.

OE22511 **INTRODUCTION TO DATA STRUCTURES**

L	T	P	C
3	0	0	3

OBJECTIVES

This course will develop the student's ability

- To understand the concepts of Data structures, Lists.
- To learn the working principle of Stack and Queue.
- To understand the concepts of Trees and its operations.
- To familiarize with the concepts of Graphs and its operations.
- To learn and practice the various sorting and hashing concepts.

UNIT I INTRODUCTION TO DATA STRUCTURES 9

Data structures - Abstract Data Types (ADTs) – Types of Data structures – Linear and Non Linear Data Structures. List ADT – Array-based implementation – Linked list implementation – Singly linked lists- Doubly-linked lists - Circularly linked lists – Operations (Insertion, Deletion, Display) – List Applications.

UNIT II STACKS AND QUEUES 9

Stack ADT – Implementations – Operations. Applications - Infix to Postfix Conversion - Expression Evaluation – Function Call – Balancing the Symbol. Queue ADT – Implementations - Operations - Circular Queue – Applications of queues.

UNIT III TREES 9

Tree ADT – Tree traversals - Binary Tree ADT – Expression trees – Applications of trees – Binary search tree ADT – AVL Trees – Splay Tree – B Trees.

UNIT IV GRAPHS 9

Graphs – Definition – Types of Graphs - Representation of Graphs – Breadth First Search and Depth First Search, Topological Sort. Shortest Path Algorithms - Dijkstra's Algorithm - All Pairs Shortest Path; Minimum Spanning Tree - Prim's Algorithm - Kruskal's Algorithm.

UNIT V SORTING AND HASHING TECHNIQUES 9

Sorting – Insertion Sort - Bubble sort - Selection sort - Shell Sort - Merge Sort - Quick Sort – Bucket Sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Applying the basic data structures to understand the LIST and its operations.	**3**
CO2	Articulate linear data structures Stack and Queue and the operations permitted on them.	**3**
CO3	Articulate non-linear data structure - Tree and legal operations permitted on them.	**3**
CO4	Appraise the usage of graph algorithms for various applications.	**4**
CO5	Critically analyze the various sorting techniques with suitable examples and understand the hashing techniques.	**4**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2013.

REFERCENCES

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, University Press, 2008.
3. Narasimha Karumanchi, N. K. (2017). Data Structures And Algorithms Made Easy, Careermonk Publications; Fifth edition (1 January 2016)

OE22512 MACHINE LEARNING TOOLS AND TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES

The main objectives of this course are to:

- Understand the overview of different problems solved using machine learning, Learn on introduction to supervised learning techniques (Including python implementation)
- Learn on unsupervised learning techniques (Including python implementation)
- Understand various problems under NLP umbrella and learn on text mining (Including python implementation)
- Learn on time series analysis (Including python implementation)
- Learn on operationalization of machine learning models

UNIT I FUNDAMENTALS OF MACHINE LEARNING AND SUPERVISED MACHINE LEARNING 9

Intro to machine learning and operationalization- Modeling Process Overview - Modeling Nuances - Regression: Multiple linear regression - Classification: Tree based models-Decision Trees, Bagging and Boosting Techniques -Explainable AI

UNIT II UNSUPERVISED LEARNING 9

Algorithms and Assumptions: K-Means, Hierarchical Clustering, Gaussian Mixture Models- Understand the different distance metrics used in clustering (Example: Euclidean, Manhattan, Cosine, Mahala Nobis)-Features of a Cluster –Labels- Centroids- Inertia- Eigenvectors and Eigenvalues- Principal component analysis

UNIT III NATURAL LANGUAGE PROCESSING 9

Introduction to NLP and umbrella of problems- Text Mining Deep Dive: Text cleaning, regular expressions- Stemming- Lemmatization- Word cloud- Principal Component Analysis- Bigrams & Trigrams- Web scrapping- Text summarization- Lex Rank algorithm- Latent Dirichlet Allocation (LDA) Technique- Word2vec Architecture (Skip Grams vs CBOW)- Text classification- Document vectors- Text classification using Doc2vec- Sentiment Analysis- Topic Modelling

UNIT IV TIME SERIES 9

Modeling Process for time series:EDA - Decomposition- ACF- PACF Plots- Feature Engineering and Transformations (Moving Average, Exponential Smoothing)- Train-Test split- Models: Auto Regressive- Moving Average- ARIMA- SARIMA- Auto ARIMA- Holt Winters- Prophet- Model Evaluation: Metrics walk through (MAE, MAPE)

UNIT V INTRODUCTION TO CLOUD AND MLOPS 9

Cloud Technology - Fundamentals of Cloud, Commonly used Cloud Services- GIT - Git Basics- MLOps: CI/CD - Basics- CI/CD using Jenkins or equivalent.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Understand overview of different problems solved using machine learning, Learn on introduction to supervised learning techniques (Including python implementation)	**2**
CO2	Learn on unsupervised learning techniques (Including python implementation)	**3**
CO3	Understand various problems under NLP umbrella and learn on text mining (Including python implementation)	**2**
CO4	Learn on time series analysis (Including python implementation)	**3**
CO5	Learn on operationalization of machine learning models	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERCENCES

1. https://in.coursera.org/learn/machine-learning
2. https://www.udemy.com/course/machine-learning-advanced-decision-trees-in-python/
3. https://www.udemy.com/course/xai-explain-ml-models/
4. https://www.udemy.com/course/cluster-analysis-unsupervised-machine-learning-python/
5. https://christophm.github.io/interpretable-ml-book/
6. https://www.udemy.com/course/cluster-analysis-unsupervised-machine-learning-python/
7. https://www.coursera.org/learn/classification-vector-spaces-in-nlp
8. https://in.coursera.org/learn/python-text-mining
9. https://www.udemy.com/course/python-for-time-series-data-analysis/
10. https://www.udemy.com/course/mastering-git-for-beginners-and-experts/
11. https://www.udemy.com/course/devops-core-fundamentals/
12. https://www.udemy.com/course/mlops-course/

VD22001 **GO PROGRAMMING**

L	T	P	C
2	0	0	0

OBJECTIVES

- To know the basics of Go language.
- To write Go programs with conditional structures, array, and maps.
- To learn functions, different interfaces and error handling methods in Go.
- To code applications in Go for Cloud Native infrastructure and software development.
- To learn about multiple tasks simultaneously, using goroutines and tools.

UNIT I GO PROGRAMMING FUNDAMENTALS **6**

Introduction – Go Environment setup – Features - Variables, values, Data Types – Constants – Operators - String – packages, short declaration operator, var keyword, exploring type, zero values, fmt package, creating your own type, conversion, not casting. Control flow – Understanding control flow, loop, conditional.

UNIT II CONDITIONAL STATEMENTS AND GROUPING DATA **6**

Go Conditional Statements – Loops –Scope Rules – Slice - composite literal, for range, slicing a slice, append to a slice, delete from a slice, make, multi-dimensional slice. Map - introduction, add element & range, delete. Struct – introduction, embedded structs, anonymous structs.

UNIT III FUNCTIONS IN GO **6**

Functions - Introduction, variadic parameter, unfurling a slice, Defer- Panic, Methods, Interfaces & polymorphism, Anonymous function, function expression, returning a function, callback, closure, recursion. Error handling – introduction, checking errors, Printing and logging, Recover, Errors with info.

UNIT IV POINTERS AND APPLICATION **6**

Pointer – introduction, use, method sets, Passing and Returning Pointers from Functions, Passing by Value vs. Passing by Pointer. Application – JSON marshal and unmarshal, bycrypt. Testing and Benchmarking – introduction, table test, golint, benchmark, coverage.

UNIT V MULTITASKING USING CONCURRENCY **6**

Concurrency vs parallelism, Wait-group, race condition, mutex, atomic. Goroutines, and Channels – introduction, Directional channels, using channels, range, select.

TOTAL (L:30): 30 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	The students will be able to develop solutions to computational problems using Go language.	**3**
CO2	The students will be able to structure simple Go programs for solving problems.	**3**
CO3	The students will be able to develop task specific functions, interfaces and error handling routines.	**3**
CO4	The students will be able to develop applications for different environments like cloud, etc.	**3**
CO5	The students will be able to perform multitasking using goroutines and tools.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Sachchidanand Singh, Prithvipal Singh, "Hands-on Go Programming", BPB Publications,2021.
2. Wei-Meng Lee, “Go Programming Language for Dummies”, First Edition, John Wiley & Sons, Inc, 2021.

REFERCENCES

1. Mark Bates and Cory LaNou, “Go Fundamentals”, Third Edition, Addison-Wesley, 2022.
2. Mihalis Tsoukalos, "Mastering Go: Create Golang production applications using network libraries, concurrency, machine learning, and advanced data structures", Second Edition, Packt Publishing Limited,2019.
3. Nathan Youngman and Roger Peppé, “Get Programming with Go”, Manning Publications Co,2018.
4. Alan A. A. Donovan, Brian W. Kernighan, "The Go Programming Language", First Edition, Pearson Education,2016.
5. Caleb Doxsey, "An Introduction to Programming in Go", CreateSpace Independent Publishing Platform,2012.

VD22002 **SCALA PROGRAMMING**

L	T	P	C
2	0	0	0

OBJECTIVES

- To know the basics of Scala language.
- To write Scala programs with control statements and functions in Scala.
- To learn and use Scala collections, string, and regular expressions.
- To write Scala programs using functional objects and polymorphism
- To make use of traits, unit testing and annotations of Scala.

UNIT I INTROCUTION TO SCALA & BASICS 6

Introduction – Scala Environment Setup – Basics – Data Types and Variables - Class and Objects - Access Modifiers – Operators.

UNIT II CONTROL STRUCTURES, FUNCTIONS AND CLOSURES 6

Scala Conditional Statements - Loops – while, do while – break statement – Functions – Closures – Local and First-class functions – Tail recursion.

UNIT III SCALA COLLECTIONS AND STRING 6

Scala Collections – List – Sets – Map – Tuples - Scala String - Interpolation – String Context - Pattern Matching Regular Expression.

UNIT IV SCALA FUNCTIONAL OBJECTS 6

Functional Objects-Rational class - Auxiliary constructors - Method overloading - Basic types and operations – Composition and Inheritance – parameter less methods – parametric fields – Polymorphism and dynamic binding.

UNIT V TRAITS, PACKAGES, ASSERTIONS AND UNIT TESTING 6

Traits-Need-Example-Packages and Imports – Assertions – Unit testing -Junit- Combining Scala and Java -Annotations – using Scala from Java

TOTAL (L:30): 30 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	The students will be able to develop solutions to computational problems using Scala.	**3**
CO2	The students will be able to structure simple Scala programs for solving problems.	**3**
CO3	The students will be able to do pattern matching using Scala regular expression.	**3**
CO4	The students will be able to code in Scala programs using functional objects and also use polymorphism.	**3**
CO5	The students will be able to make use of traits, unit testing and annotations features of Scala.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Martin Odersky, Lex Spoon and Bill Venners, "Programming in Scala", Fifth Edition, Artima Press,2021.
2. Dean Wampler," Programming Scala: Scalability = Functional Programming + Objects", Third Edition, O'Reilly Publications,2021.

REFERCENCES

1. Alvin Alexander," Scala Cookbook: Recipes for Object-Oriented and Functional Programming", Second Edition, O'Reilly Publications,2021
2. Aleksandar Prokopec, "Learning Concurrent Programming in Scala", Second Edition, Packt Publishing,2017.
3. Cay Horstmann, "Scala for the Impatient", Second Edition, Addison-Wesley, 2017.
4. Andrew Phillips, Nermin Serifovic, "Scala Puzzlers: The Fun Path to Deeper Understanding", First Edition, Artima Inc,2014.
5. Paul Chiusano, Runar Bjarnason, "Functional Programming in Scala", First Edition, Manning Publications,2014.

VD22003 **POWER BI**

L	T	P	C
2	0	0	0

OBJECTIVES

- To learn the architecture and fundamental concepts in Power BI.
- To write queries on user data for business needs in Power BI.
- To learn data models and to build dashboards for generating different kinds of reports.
- To write formula expression language to handle complex computations and complex expressions by adding value to data in Power BI.
- To learn different visual sync slicers for creating visual effects using grouping function.

UNIT I POWER BI OVERVIEW **6**

Introduction to Power BI- Power BI Ecosystem-Architecture Power BI Desktop vs Power BI Pro-Power BI Data Sources-Power BI for MAC and Windows OS-Types of Reports in Real-World-Interactive & Paginated Reports. Analytical & Mobile Reports-Power BI Licensing Plans – Types-Power BI Dev & Prod Environments-Power BI Tools-Installing Power BI & Connecting to Data.

UNIT II POWER QUERY **6**

Importing Data-Data Types-Replacing Values-Merge Columns-Extract Values-Remove Duplicates-Remove Columns-Filters-Date Functions-Conditional Columns-Unpivot-Merge Queries-Parameters-Data Profiling-Web Scraping-Mathematical Functions.

UNIT III DATA MODELING AND BASIC REPORT DESIGN **6**

Introduction-Working with the query Editor-Working with the data model and creating a visualization-Data Modeling-Relationships-Role Level Security. Basic Report Design-Visual Types-Canvas, Visualizations and Fields-Memory Tables-In-Memory xvelocity Database-Table and Tree Map Visuals-Grid-PBIX and PBIT File Formats-Visual Interaction, Data Points-Edit Visual Interactions-Format Options.

UNIT IV DAX EXPRESSIONS **6**

DAX introduction-Calculated Columns-Calendar Table-Building a Measure-Measures Table - CALCULATE - FILTER vs KEEPFILTERS – Iterators - RELATED vs RELATEDTABLE - SELECTED VALUE – DIVIDE - Logical Operators – Variables – TREATAS – SWITCH - Text Functions CONCATENATEX - Time Intelligence - Expression Based Titles - Tabular Editor - Calculation Groups.

UNIT V VISUAL SYNC, GROUPING **6**

Visual Sync, Grouping-Slicer Visual : Real-time Usage-Orientation, Selection Properties-Single & Multi Select, CTRL Options-Slicer : Number, Text and Date Data-Slicer List and Slicer Dropdowns-Visual

Sync Limitations with Slicer-Disabling Slicers, Clear Selections-Grouping : Real-time Use-List Grouping and Binning Options-Grouping Static / Fixed Data Values-Grouping Dynamic / Changing Data-Bin Size and Bin Limits (Max, Min)-Bin Count and Grouping Options-Grouping Binned Data, Classification.

TOTAL (L:30): 30 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	The students will be able to install Power BI in different environment and to develop solutions for business needs.	**3**
CO2	The students will be able to manipulate data using Power BI query management.	**3**
CO3	The students will be able to create data models and generate different types of reports.	**3**
CO4	The students will be able to solve complex calculations and complex expressions in Power BI using DAX.	**3**
CO5	The students will be able to make use of sync slicers and grouping functions for creating visual effects.	**3**

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Alan Murray, "Power BI for Job seekers: Learn how to create interactive dashboards and reports, and gain insights from the data", First Edition, BPB Publications,2023.
2. Jack A Hyman, "Microsoft Power BI For Dummies", Kindle Edition,2022.

REFERCENCES

1. Chandraish Sinha, "Mastering Power BI: Build Business Intelligence Applications Powered with DAX Calculations, Insightful Visualizations, Advanced BI Techniques, and Loads of Data Sources", First Edition, BPB Publications,2021.
2. Errin O'Connor, "Microsoft Power Bi Dashboards Step By Step", First Edition, Pearson Education,2020.
3. Alberto Ferrari and Marco Russo, "Introducing Microsoft Power BI", First Edition, Microsoft Press,2016.
4. Jeremey Arnold, "Learning Microsoft Power BI: Transforming Data into Insights", First Edition, O'Reilly Media Publications,2022.

VD22004

GENERATIVE AI FOR SOFTWARE DEVELOPMENT

L	T	P	C
2	0	0	0

OBJECTIVES

- Understand the foundation of Generative AI
- Explore Generative Models in Software Development
- Explore Large Language Models in Software Development

UNIT I INTRODUCTION TO PROMPT ENGINEERING **10**

Prompt Engineering Fundamentals - Generative Texts - Generative Images - Generative Videos - Generative Codes

UNIT II CHATGPT **10**

ChatGPT Alternatives - OpenAI APIs - Building ChatGPT powered applications - Neural network fundamentals

UNIT III LARGE LANGUAGE MODELS **10**

Deep learning and its architectures - Transformer and Large Language Model (LLM) - Training LLM for natural language processing - Generative Adversarial Networks (GAN) for image generation - Basics of various AI tools - Embarking the Generative AI journey

TOTAL (L:30): 30 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply the suitable Prompts in Generative AI	3
CO2	Apply the Generative Models in Software Development	3
CO3	Design Large Language Models for Generative AI Applications	4

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Generative AI in Software Development: Beyond the limitations of Traditional Coding, Jesse Sprinter, ISBN-13 - 979-8865197393 Edition-1 Oct 2023.