SRI VENKATESWARA COLLEGE OF ENGINEERING,

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

B. Tech. Artificial Intelligence and Data Science

CURRICULUM AND SYLLABUS

REGULATION – 2022

CHOICE BASED CREDIT SYSTEM

SRI VENKATESWARA COLLEGE OF ENGINEERING,

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REGULATIONS 2022

B.Tech ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Artificial Intelligence and Data Science program will prepare its graduates:

1. Technical Proficiency and Problem-Solving: Graduates will demonstrate technical competence in artificial intelligence and data science, utilizing advanced algorithms and analytical techniques to solve complex problems, and contribute effectively to industry, academia, and entrepreneurship at both national and global levels.
2. Continuous Learning and Innovation: Graduates will engage in lifelong learning and professional development, continually enhancing their skills in AI and data science to develop impactful solutions that address the evolving needs of society.
3. Leadership and Ethical Practice: Graduates will develop strong leadership and collaboration skills to drive innovation in AI and data science, ensuring their contributions positively impact society and the environment.

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. Leveraging engineering principles to develop AI- based models that address real-world problems in diverse fields, providing innovative solutions.
2. Use learning models and algorithms to analyze data and make advanced business decisions, driving progress in data science.

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. Tech ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

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.	MA22253	Mathematics for Data Science	BS	3	1	0	4	4	NIL	F
6.	AD22201	Data Structures and Algorithm Analysis	PC	3	0	0	3	3	NIL	F
7.	AD22202	Object Oriented Paradigm and Programming	PC	3	0	0	3	3	NIL	F
Practical Subjects										
8.	AD22211	Data Structures and Algorithm Analysis Laboratory	PC	0	0	3	1.5	3	NIL	F
9.	AD22212	Object Oriented Paradigm and Programming Laboratory	PC	0	0	3	1.5	3	NIL	F
			Total	**18**	**2**	**8**	**24**	**28**	-	-

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
Theory Subjects										
1.	MA22356	Statistics for Data Science	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.	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
Practical Subjects										
7.	CS22311	Database Management Systems Laboratory (Common to CS & AD)	PC	0	0	3	1.5	3	Nil	F
8.	AD22311	Artificial Intelligence Laboratory	PC	0	0	3	1.5	3	Nil	F
			Total	**18**	**1**	**8**	**23**	**27**	**-**	**-**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
Theory Subjects										
1.	MA22455	Queuing Theory and Optimization	BS	3	1	0	4	4	Nil	F
2.	MA22456	Mathematics for Machine Learning	BS	3	1	0	4	4	Nil	F
3.	CS22401	Operating Systems (Common to CS and AD)	PC	3	0	0	3	3	Nil	F
4.	CS22402	Machine Learning Techniques (Common to CS and AD)	PC	3	0	0	3	3	Nil	F
5.	AD22401	Web Development and Analytics	PC	3	0	0	3	3	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.	AD22411	Machine Learning Techniques Laboratory	PC	0	0	3	1.5	3	Nil	F
9.	AD22412	Web Development and Analytics Laboratory	PC	0	0	3	1.5	3	Nil	F
			Total	**18**	**2**	**9**	**24.5**	**29**	**-**	**-**

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.	AD22501	Internet of Things and Applications (Common to AD and CS)	PC	3	0	0	3	3	Nil	F
4.	AD22502	Automata Theory	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
Practical Subjects										
7.	CS22511	Computer Networks Laboratory (Common to CS and AD)	PC	0	0	3	1.5	3	Nil	F
8.	AD22511	Internet of Things and its Applications Laboratory	PC	0	0	3	1.5	3	Nil	F
9.	HS22511	Interview and Career Skills Laboratory (Common to All)	EEC	0	0	3	2	3	Nil	F
			Total	**18**	**1**	**9**	**24**	**28**	**-**	**-**

SEMESTER VI

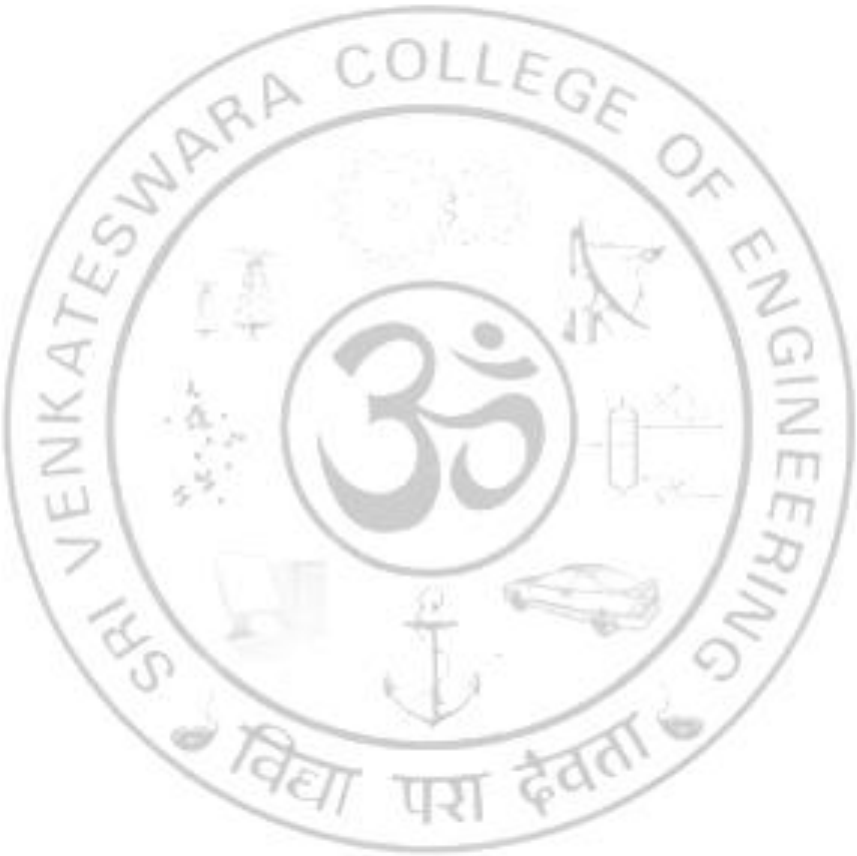
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
Theory Subjects										
1.	CS22601	Cryptography and Network Security (Common to CS and AD)	PC	3	0	0	3	3	Nil	F
2.	AD22609	Deep Learning Algorithms: Theory and Practices	PC	3	0	2	4	5	Nil	F
3.	AD22601	Reinforcement Learning Techniques	PC	3	0	0	3	3	Nil	F
4.	AD22602	Healthcare Analytics	PC	3	0	0	3	3	Nil	F
5.	****	Professional Elective II	PE	3	0	0	3	3	Nil	M
6.	****	Open Elective II	OE	3	0	0	3	3	Nil	M
7.	****	Mandatory Course	MC	3	0	0	0	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.	AD22611	Reinforcement Learning Techniques Laboratory	PC	0	0	3	1.5	3	Nil	F
10.	AD22612	Internship	EEC	-	-	-	2	-	Nil	M
			Total	**21**	**0**	**8**	**24**	**29**	-	-

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.	AD22811	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: INTELLIGENT SYSTEMS

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	AD22021	Human Computer Interaction	PE	3	0	0	3	3	Nil	M
2.	AD22022	Business Intelligence	PE	3	0	0	3	3	Nil	M
3.	AD22023	Fuzzy Logic Techniques	PE	3	0	0	3	3	Nil	M
4.	AD22024	Web Mining	PE	3	0	0	3	3	Nil	M
5.	AD22025	Kernel methods for Pattern Analysis	PE	3	0	0	3	3	Nil	M
6.	AD22026	Agent Based Intelligent System	PE	3	0	0	3	3	Nil	M
7.	AD22027	Evolutionary Computing	PE	3	0	0	3	3	Nil	M
8.	AD22028	Generative AI	PE	3	0	0	3	3	Nil	M
9.	AD22020	Capstone Project	PE	0	0	4	2	4	Nil	M

VERTICAL 3: FINTECH AND HEALTHCARE

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	AD22031	Finance Engineering	PE	3	0	0	3	3	Nil	M
2.	AD22032	Fintech Payment System	PE	3	0	0	3	3	Nil	M
3.	AD22033	Smart Contracts and Solidity	PE	3	0	0	3	3	Nil	M
4.	AD22034	Clinical Information Systems	PE	3	0	0	3	3	Nil	M
5.	AD22035	AI and ML for Healthcare	PE	3	0	0	3	3	Nil	M
6.	AD22036	Data Science in Intelligent Healthcare	PE	3	0	0	3	3	Nil	M
7.	AD22037	Smart and Interactive Healthcare Technologies	PE	3	0	0	3	3	Nil	M
8.	AD22038	Computer Vision in Healthcare Applications	PE	3	0	0	3	3	Nil	M
9.	AD22030	Capstone Project	PE	0	0	4	2	4	Nil	M

VERTICAL 4: 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 5: 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 6: 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 7: DIVERSIFIED GROUP-I

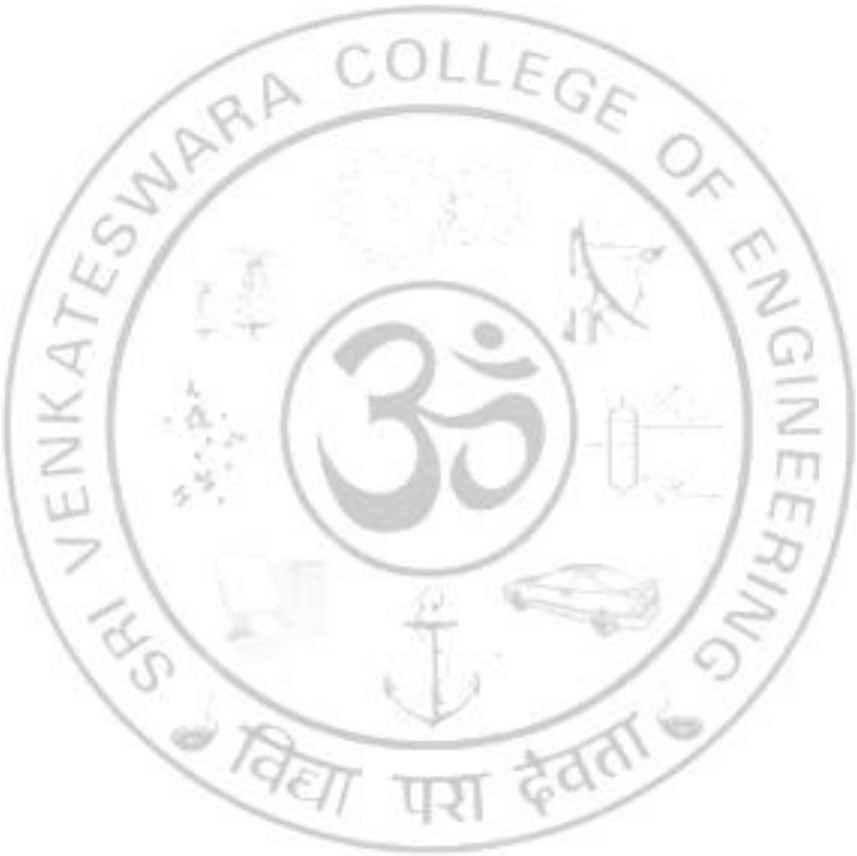
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS	PREREQUISITE	POSITION
				L	T	P	C			
1.	CS22081	Unix Internals (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
2.	CS22082	Distributed Computing (Common to CS and AD)	PE	3	0	0	3	3	Nil	M
3.	CS22083	Quantum Computing (Common to CS and AD)	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*

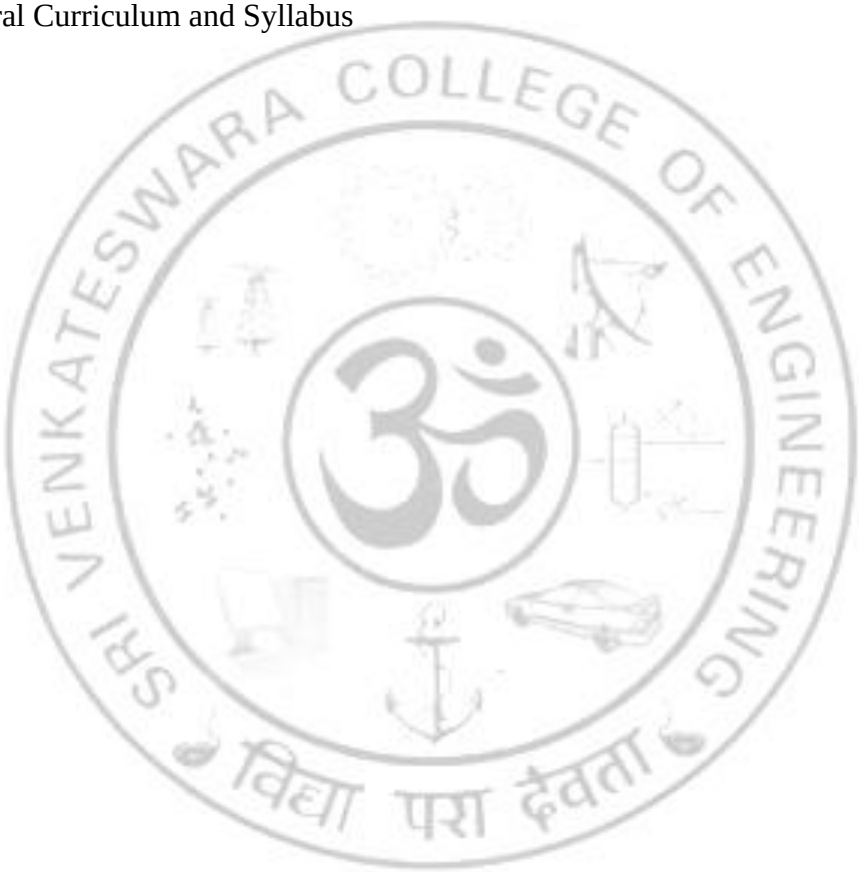
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL HOURS
				L	T	P	C	
1.	VC22001	Basics of Entrepreneurship Development (Common to all branches)	VC	2	0	0	0	2
2.	VC22002	Advances in Entrepreneurship Development (Common to all branches)	VC	2	0	0	0	2
3.	VC22003	Communicative German (Common 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

S.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	10	4	11					36
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc (ES)	8.5								8.5
4	Professional Core courses (PC)		9	19	13.5	16	16	3		76.5
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	24.5	24	24	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
2	1	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

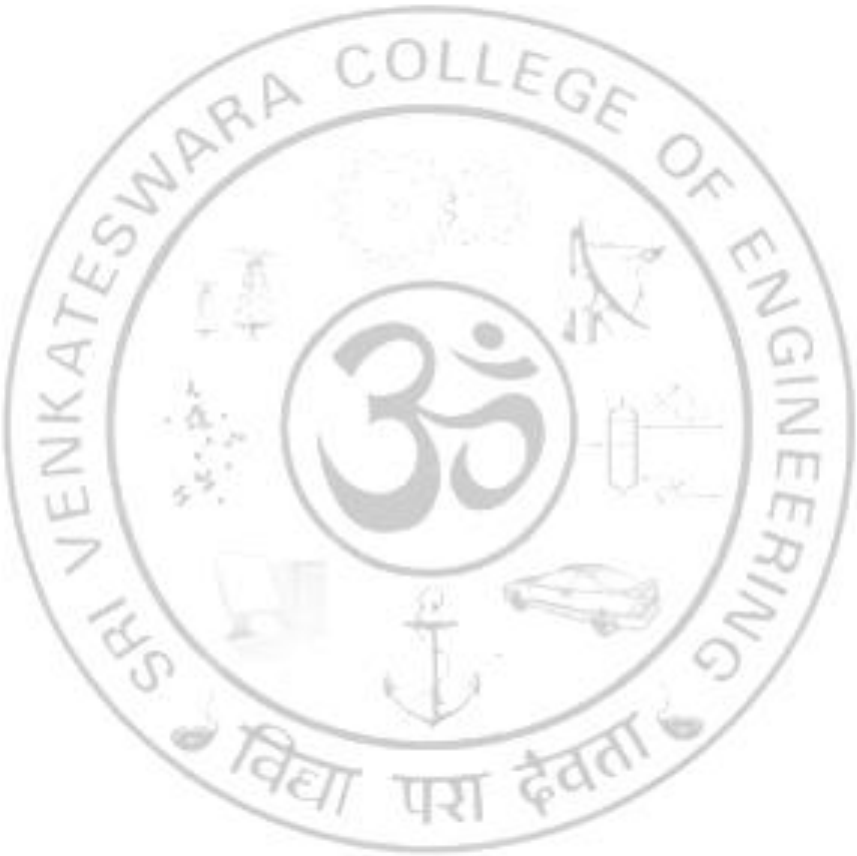
பாடநூல்கள்:
REFERCENCES:

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).

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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

MA22253 MATHEMATICS FOR DATA SCIENCE

L	T	P	C
3	1	0	4

OBJECTIVES

The Student should be made to:

- Learn the basic concepts of Relations and Functions
- Extend the logical and mathematical maturity and ability to deal with abstraction
- Learn the applications of algebraic structures.
- Apply the concepts of Rings, Fields and Polynomials.
- Understand the concepts and significance of lattices and Boolean algebra which are widely used in data science.

UNIT I SETS RELATIONS AND FUNCTIONS 9+3

Basic concepts of Set theory – Inclusion and Equality of sets – Power sets-St operations – Binary Relation, Partial Ordering Relation, Equivalence Relation – Sum and Product of functions – Bijective functions – Inverse and composite functions.

UNIT II LOGICS AND PROOFS 9+3

Propositional Logic – Propositional equivalences – Normal forms – Principal Conjunctive Normal Forms – Principal Disjunctive Normal Forms – Inference Theory-Predicates and Quantifiers – Nested Quantifiers – Introduction to proofs – Proof methods and strategy.

UNIT III ALGEBRAIC STRUCTURES 9+3

Algebraic systems – Semi groups and Monoids - Groups – Subgroups – Homomorphism‘s – Normal subgroup and cosets – Lagrange‘s theorem.

UNIT IV RINGS AND FIELDS 9+3

Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n – Ring homomorphism. Rings - Polynomial rings - Irreducible polynomials over finite fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 9+3

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

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

Activities: Students shall be exposed to MATLAB programming to solve simple algebraic equations.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT Level
CO1	Perform operations on various discrete structures such as sets, functions and relations.	**3**
CO2	Test the logic of a programme, having acquired knowledge of the necessary concepts.	**3**
CO3	Identify structures on many levels as an application of the concepts and properties of algebraic structures.	**3**
CO4	Apply the basic notions of groups, rings, fields which will be used to solve related problems.	**3**
CO5	Execute the simplification of Boolean algebraic expression.	**3**

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

TEXT BOOKS

1. Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, New Delhi, 2018.
2. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Publications. Co. Ltd., New Delhi, Special Indian Edition, 2018.
3. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structure with Applications to Computer Science", Tata Mc Graw Hill Education (India) Edition 2018.

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1. Lidl, R. and Pitz, G, "Applied Abstract Algebra", Springer Verlag, New Delhi, 2nd Edition, 2006.
2. Seymour Lipschutz, MarcLipson, "Discrete Mathematics, Schaum's Outlines Series", McGraw-Hill Education, 2016.
3. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics: A Computer Oriented Approach", 4th Edition, Tata McGraw–Hill Education Pvt. Ltd, 2017.

Web Link:

1. http://home.iitk.ac.in/~arlal/book/mth202.pdf
2. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf
3. https://nios.ac.in/media/documents/SrSec311NEW/311_Maths_Eng/311_Maths_Eng_Lesson2.pdf

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	2	-
3	3	3	2	2	-	-	-	-	-	-	-	3	-	-
4	3	3	2	2	-	-	-	-	-	-	-	3	3	-
5	3	3	2	2	-	-	-	-	-	-	-	3	-	2

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

AD22201 **DATA STRUCTURES AND ALGORITHM ANALYSIS**

L	T	P	C
3	0	0	3

OBJECTIVES

The students should be able to:

- Learn the algorithm design and analysis techniques with orders of growth
- Understand and implement the linear data structures and its applications
- Understand the tree data structures, priority queues and string matching
- Learn various graph algorithms
- Learn the advanced algorithm design techniques

UNIT I FOUNDATIONS OF ALGORITHM ANALYSIS **9**

Fundamentals of algorithmic problem solving – Problem types - Growth of Functions - Asymptotic Notations – Brute force approach: Analysis of Non recursive Algorithms - Divide and Conquer: Analysis of recursive algorithms – The backward substitution and the master method for solving recurrences - Sorting: Selection sort - Bubble sort – Insertion Sort - Merge Sort - Quick sort – Radix sort – Bucket sort - Searching: Linear Search – Binary Search.

UNIT II LINEAR DATA STRUCTURES **9**

List: Array Implementation of List – Linked List – Doubly Linked List – Circular Linked List; Stack: Array and Linked List Implementation – Applications; Queues: Array and Linked List Implementation – Applications; Hashing: Hash Function – Separate Chaining – Open Addressing – Linear Probing

UNIT III TREES ALGORITHMS **9**

Trees: Binary trees – Binary Search Trees – AVL Trees – Splay Trees – B-Trees - Binary Heap Operations – Heap sort and Priority Queues. String Matching: Naïve String matching algorithm – Rabin-Karp algorithm – Knuth-Morris-Pratt algorithm – Suffix trees.

UNIT IV GRAPH ALGORITHMS **9**

Representation of Graphs – Breadth First Search – Depth First Search - Topological Sort – Shortest Path Algorithms: Dijkstra’s Algorithm - Floyd Warshall's algorithm – Minimum Spanning Tree: Prim’s Algorithm – Kruskal’s Algorithm

UNIT V ADVANCED ALGORITHM DESIGN TECHNIQUES **9**

Dynamic Programming: Longest Common Subsequence; Optimal Binary Search trees. Greedy Algorithm: Huffman Codes; Backtracking: n-Queens Problem - Subset-sum Problem; Branch and Bound: Assignment Problem – Knapsack Problem- Introduction to P, NP, NP-complete and NP-Hard problems.

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 and analyse time and space complexities of algorithms using different design techniques for various computing problems	**2**
CO2	Solve problems using suitable linear data structures	**3**
CO3	Solve problems using suitable nonlinear tree data structures	**3**
CO4	Demonstrate the use of graph algorithms for solving problems	**3**
CO5	Design algorithms using advanced algorithm design techniques	**3**

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. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2013
3. 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

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	-	-	-	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

AD22202 **OBJECT ORIENTED PARADIGM AND PROGRAMMING**

L	T	P	C
3	0	0	3

OBJECTIVES

- Familiar with the basic concepts of object oriented programming.
- Familiar with the basic concepts of C++ programming language.
- Familiar with the generic programming, exception and file handling in C++.
- Understand object oriented concepts and basic characteristics of Java.
- Understand the advanced programming concepts in Java.

UNIT I OBJECT ORIENTED PARADIGM **9**

Object oriented programming concepts – objects – classes – data members and member functions - abstraction and encapsulation – inheritance – polymorphism. Introduction to C++ – classes – access specifier – function and data members – default arguments –friend functions – const and volatile functions - static members – Objects – pointers and objects – constant objects – nested classes- constructors – types of constructor –destructors.

UNIT II POLYMORPHISM AND INHERITANCE **9**

Compile time polymorphism- function overloading –operator overloading –overloading through member functions and friend functions – type conversion - Runtime Polymorphism – virtual function – pure virtual functions – abstract class - RTTI- Inheritance –types of Inheritance – virtual base class.

UNIT III TEMPLATES, EXCEPTION HANDLING AND FILES **9**

Templates –Types of templates - Exception handling – try-catch-throw paradigm– exception specification – terminate and Unexpected functions – Uncaught exception - Streams and formatted I/O – I/O manipulators - file handling – object serialization – namespaces - Standard template library.

UNIT IV JAVA OOPS CONCEPTS **9**

Data types – Variables – Arrays – Operators - Control statements - Classes, objects, and methods - Method overloading and overriding – Inheritance - Super classes- sub classes –Protected members – constructors in sub classes – the Object class – abstract classes and methods- final methods and classes Interfaces and packages.

UNIT V ADVANCED JAVA PROGRAMMING **9**

Exception handling - built-in exceptions - creating own exceptions - Multithreaded programming - thread life cycle, creating threads, Inter-thread communication - The I/O classes – Generics - String handling.

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 object oriented programming for practical problem solutions.	**2**
CO2	Apply generic data type for the data type independent programming which relates to reusability	**3**
CO3	Design the exception handling techniques for resolving run-time errors and handle large data set using file I/O	**3**
CO4	Develop Java programs using object oriented concepts	**3**
CO5	Design and develop real world problems in Java.	**3**

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.
2. Herbert Schildt, Java: The Complete Reference, Eleventh Edition, 11th Edition, McGraw-Hill, 2018.

REFERCENCES

1. Deitel and Deitel, "C++ How to Program", Tenth Edition, Pearson Education, 2017
2. Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Herbert Schildt, ―C++: The Complete Reference, Fourth Edition, McGraw Hill, 2013
4. Bjarne Stroustrup, "The C++ programming language", Fourth Edition, Addison Wesley, 2013.
5. Ira Pohl, ― Object oriented programming using C++, Second Edition, Pearson Education Asia, 2012

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
4	3	3	3	-	3	-	-	-	-	-	-	3	2	3
5	3	3	3	-	3	-	-	-	-	-	-	3	2	3

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

AD22211 **DATA STRUCTURES AND ALGORITHM ANALYSIS LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES

The students should be able to:

- Learn the applications of different linear data structures
- Understand the tree data structures and its representation
- Implement the graph algorithms and its applications

LIST OF EXPERIMENTS

1. Sorting - Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Radix Sort, Bucket Sort
2. Searching Linear Search, Binary Search
3. List - Array and Linked List Implementation
4. Stack - Array and Linked List Implementation
5. Queue - Array and Linked List Implementation
6. Applications of Stack - Infix to Postfix Expression, Evaluation of Postfix Expression
7. Hashing Implementation of Separate chaining and Open Addressing (Linear Probing)
8. Binary Search Tree with Tree traversal Techniques – Preorder, Post order and In order
9. AVL tree
10. Binary Heap
11. String Matching algorithms
12. Graph Traversal Algorithm Breadth-first search, Depth-first search
13. Shortest Path Algorithm Dijkstra’s algorithm, Floyd – Warshall’s algorithm
14. Minimum Spanning Tree - Kruskal's algorithm, Prim's algorithm

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C / C++ and Java compiler 30 Nos. (or) Server with C/C++ and Java 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	Understand the applications of linear data structure to solve the real word problems.	2
CO2	To perform various traversals in tree data structure.	3
CO3	Demonstrate the use of graph algorithms for the shortest path finding problems to find shortest path using graph algorithms.	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	3

3-High, 2-Medium, 1-Low

AD22212 **OBJECT ORIENTED PARADIGM AND PROGRAMMING LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES

This course will develop the student's ability to

- Be familiarized with good programming design methods
- To get a clear understanding of object-oriented concepts
- To understand object oriented programming through C++ and JAVA
- Getting exposure in implementing various OOPS Concepts
- Appreciate recursive algorithms

LIST OF EXPERIMENTS

Implement the following topics:

C++

1. Programs using functions
   - Functions with default arguments
   - Implementation of call by value, call by address and call by reference
   - Friend function
2. Classes with data members, member functions, constructors and destructors
   - Static data member and static member function
   - Const data member and const member function
   - Constructors and destructors
3. Compile time polymorphism
   - Function Overloading
   - Unary and Binary Operator Overloading using member functions
   - Unary and Binary Operator Overloading using friend functions
4. Inheritance
   - Single Inheritance
   - Multiple Inheritance
   - Multilevel Inheritance
   - Hierarchical Inheritance
   - Hybrid Inheritance
5. Runtime Polymorphism
   - Virtual functions
   - Pure virtual functions
   - Virtual base class
   - Type conversion
6. Templates
   - Function Templates
   - Class Templates
7. Exception Handling
8. File Handling
   - Sequential access

- Random access

9. RTTI
10. Standard Template Library

Java

11. Simple Java application
    - -for understanding references to an instant of a class
    - handling strings in JAVA
12. Package creation
    - Handling in built packages
    - Creating user defined packages
13. Interfaces
    - developing user defined interfaces
    - use predefined interfaces
14. Threading
    - creation of threading in java applications
    - multi-threading
15. Exception handling
    - Handling pre-defined exceptions
    - Handling user-defined exceptions

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C++ compiler 30 Nos. 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 solve real world problems using C++ and Java.	**3**
CO2	Understand various exception handling mechanisms.	**2**
CO3	To develop multi-threading applications using java.	**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	-	-	2	3	3
2	3	3	3	3	3	-	-	-	3	-	-	2	3	3
3	3	3	3	3	3	-	-	-	3	-	-	2	3	3

3-High, 2-Medium, 1-Low

MA22356 **STATISTICS FOR DATA SCIENCE**

L	T	P	C
3	1	0	4

OBJECTIVES

The student should be made to:

- Understand the basic concepts of the probability and to apply the same for Engineering Problems
- Understand the fundamentals of one and two dimensional random variables and to introduce some standard distributions applicable to data science.
- Select the appropriate statistical procedure and apply relevant statistical tests depending on the data provided.
- Analyze the various designs of experiments.
- Become familiar with basic methods of statistical process control.

UNIT I DESCRIPTIVE STATISTICS AND PROBABILITY 9+3

Introduction – Measures of central tendency-Mean, Median, Mode – Measures of Dispersion – Range, Interquartile range, Standard deviation – Probability – Axioms of probability – Conditional probability – Bayes' theorem.

UNIT II RANDOM VARIABLES 9+3

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson and Normal distributions. Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Central limit theorem (for independent and identically distributed random variables) – Applications using MATLAB (only for assignment).

UNIT III TESTING OF HYPOTHESIS 9+3

Sampling distributions – Population and Samples – Estimation of parameters – Statistical hypothesis - Large sample test based on Normal distribution for single mean, single proportion, difference of means and difference of proportions – Small sample test based on t, F and chi-square distributions for mean, variance - Tests for independence – Goodness of fit.

UNIT IV ANALYSIS OF VARIANCE 9+3

Basic principles of experimentation-Analysis of variance-One-way classification – Completely Randomised design - Two-way classifications - Randomised block design-Multiple comparison- Latin square design-problems.

UNIT V STATISTICAL QUALITY CONTROL 9+3

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

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 fundamental knowledge of the concepts of probability.	**2**
CO2	Achieve an understanding of standard distributions which is more relevant to Data Science and its applications	**2**
CO3	Test a hypothesis by measuring and examining a random sample of the population.	**4**
CO4	Classify and apply the related analysis of variance techniques in all fields of scientific experimentation.	**3**
CO5	Apply statistical quality control theory on real time problems.	**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 Indian Reprint, 2010.
2. Richard A J, Irwin Miller, John Freund, Miller and Freund's - Probability and Statistics for Engineers, Pearson Education, Asia, 9th Edition, 2020.

REFERCENCES

1. Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
2. Walpole R E, Myres, R H, Myres SL and Ye K, Probability and Statistics for Engineers and Scientists, Pearson Education, Asia, Eighth Edition, 2011.
3. Spiegel M R, Schiller J and Srinivasan R A, Schaum Outline of Theory and Problems of Probability and Statistics, Tata McGraw Hill Edition, 2004.

Web Link:

1. https://nptel.ac.in/courses/103/106/103106112/
2. https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/lecture-notes/

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	3	-	-	-	-	-	-	-	-	-	-	-	-
3	3	3	2	3	-	-	-	-	-	-	-	-	-	2
4	3	3	2	3	-	-	-	-	-	-	-	-	-	2
5	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

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

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

AD22311 ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES

- To design and implement search strategies.
- To implement game playing and CSP techniques.
- To develop systems with logical and probabilistic reasoning.

LIST OF EXPERIMENTS

1. Implement intelligent agents – Vacuum World Problem
2. Implement basic search strategies – 8-Puzzle, 8 - Queens problem
3. Implement A* algorithm – Route-Finding problem
4. Implement Minimax algorithm for game playing (Alpha-Beta pruning)
5. Solve constraint satisfaction problems (Cryptarithmetic, MapColouring)
6. Study of Prolog
7. Implement forward chaining, backward chaining, and resolution strategies in First-order logic
8. Building Naive Bayes model
9. Probabilistic Inferencing in Bayesian Network
10. Implementation of policy search in Reinforcement learning

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C/C++/Java/Python/Prolog/JESS compiler 30 Nos.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Design and implement search strategies	**3**
CO2	Implement game playing and CSP techniques	**3**
CO3	Develop logical reasoning and probabilistic systems	**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	2	3	3	2
2	3	2	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

MA22455 **QUEUING THEORY AND OPTIMIZATION**

L	T	P	C
3	1	0	4

OBJECTIVES

- Understand the concepts of Linear Programming Problems and its Applications.
- Learn the basic concepts of Transportation and Assignment problems.
- Understand the fundamental concepts of Queueing systems and its applications.
- Gain more knowledge in analysing queuing models.
- Understand the basic concepts of Optimization and apply the same to problems in Machine Learning

UNIT I QUEUEING MODELS **9+3**

Markovian queues – Birth and Death processes – Single and multiple server queueing models—Little's formula- Queues with finite waiting rooms - Finite source models.

UNIT II ADVANCED QUEUEING MODELS **9+3**

M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/EK/1 as special cases-Series queues – Open Jackson networks.

UNIT III LINEAR PROGRAMMING MODELS **9+3**

Mathematical Formulation –Graphical solution of LP models – Simplex method – Artificial Variable Techniques—Variants of Simplex method- Primal and Dual relationships - Dual simplex method-post optimal Analysis

UNIT IV TRANSPORTATION AND ASSIGNMENT MODELS **9+3**

Mathematical Formulation of Transportation problem – Methods for finding Initial Basic Feasible solution – Optimum solution – Degeneracy - Mathematical Formulation of Assignment Models – Hungarian Algorithm – Variants of Assignment problem.

UNIT V CLASSICAL OPTIMIZATION THEORY **9+3**

Unconstrained and Constrained optimization - Numerical optimization techniques for constrained and unconstrained optimization: KKT conditions - Newton's method - Steepest descent method - Penalty function method.

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	Identify, formulate Linear Programming Problems and analyze the same.	**3**
CO2	Analyze and evaluate the various methods under transportation, assignment models.	**3**
CO3	Acquire skills in analyzing queueing models.	**3**
CO4	Design networks using Queueing theories in domain specific situations.	**3**
CO5	Apply optimization techniques to problems in Machine Learning	**3**

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

TEXT BOOKS

1. Taha H.A. "Operations Research", Pearson Education, Asia, 8th Edition, 2007.
2. Gross.D. and Harris.C.M, "Fundamentals of Queueing Theory", Wiley student Edition,2004.

REFERCENCES

1. Hira and Gupta "Problems in Operations Research", S. Chand and Co., 2008
2. J. Nocedal and S. J. Wright, Numerical Optimization. New York: Springer Science+Business Media, 2006.
3. Winston. W.L. "Operations Research", Fourth Edition, Thomson – Brooks/Cole, 2003

WEB LINKS

1. https://archive.nptel.ac.in/courses/111/103/111103159/
2. https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-ee93/
3. https://archive.nptel.ac.in/courses/111/104/111104027/
4. https://archive.nptel.ac.in/courses/110/106/110106062/
5. https://archive.nptel.ac.in/courses/111/107/111107104/

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	3		2										
3	3	3	3	2								2		2
4	3	3	2									2		
5	3	3		3									2	

3-High, 2-Medium, 1-Low

MA22456 **MATHEMATICS FOR MACHINE LEARNING**

L	T	P	C
3	1	0	4

OBJECTIVES

- Apply the concepts of basic principles of Combinatorics and its Applications.
- Understand the concepts of vector spaces.
- Understand the fundamental concepts of Principal component Analysis.
- Acquaint the knowledge of the basic concepts of solving algebraic and transcendental equations.
- Provide the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.

UNIT I COMBINATORICS **9+3**

Mathematical induction – Strong induction and well ordering – The basics of counting – The Pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications

UNIT II VECTOR SPACES **9+3**

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT III PRINCIPAL COMPONENT ANALYSIS **9+3**

Data Reduction Techniques - Definition of Population Principal Components - Principal Components obtained by Standardized variables - Rules to retain number of Principal Components using Scree Plot.

UNIT IV SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS **9+3**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT V INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION **9+3**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

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	Apply the Counting Principles to compute the running time algorithm.	**3**
CO2	Explain the fundamental concepts of Linear Algebra.	**3**
CO3	Demonstrate the use of the concepts of Principal component Analysis	**4**
CO4	Solve algebraic, transcendental and linear system of equations.	**3**
CO5	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.	**3**

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

TEXT BOOKS

1. M. P. Deisenroth, A. A. Faisal, C. S. Ong, "Mathematics for Machine Learning", Cambridge University Press, 2020.
2. Kenneth H. Rosen, "Discrete Mathematics & its Applications", Tata McGraw-Hill (SIE), 7th edition, 2017.
3. Grewal, B.S., and Grewal J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 11th edition, 2013.

REFERCENCES

1. Alvin C.Rencher, "Methods of Multivariate Analysis", 2nd Edition, Wiley Inter-science, 2002
2. Friedberg, A.H., Insel, A.J. and Spence, L., "Linear Algebra", Prentice Hall of India, New Delhi, 2004.
3. Iyengar, S.R.K., and Jain, R.K, "Numerical Methods", New Age International Publishers, 2012.

WEB LINKS

1. **https://archive.nptel.ac.in/courses/111/107/111107105/**
2. **https://archive.nptel.ac.in/courses/111/106/111106155/**
3. **https://archive.nptel.ac.in/courses/111/101/111101115/**

COURSE ARTICULATION MATRIX

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

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

AD22401 WEB DEVELOPMENT AND ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the concepts of Internet, Protocol layers and layered architecture to plan and develop web pages using HTML and CSS.
- To understand Client-side scripting using JavaScript.
- To learn Server side and Dynamic content generation.
- To provide students with a deep, critical and systematic understanding of the most significant technologies for developing web applications.
- To have knowledge on data collection and analysis in Web Analytics.

UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 9

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

UNIT II CLIENT-SIDE PROGRAMMING 9

Java Script: An introduction to JavaScript–Comments-Keywords-Data types- Operators-Statements-Functions-JavaScript DOM Model-Date and Objects, -Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript.

UNIT III SERVER-SIDE PROGRAMMING 9

Java Servlet: An introduction to Java Servlet-Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example.

UNIT IV RICH INTERNET APPLICATION SERVER TECHNOLOGIES 9

Web Servers: Introduction- HTTP Transactions- Multitier Application Architecture-Client-Side Scripting versus Server-Side Scripting- Accessing Web Servers- Microsoft Internet Information Services - Apache HTTP Server.

UNIT V WEB ANALYTICS AND ITS TOOLS 9

Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.Web Analytic Tools: Google Analytics, Mix panel, Adobe Analytics, Open Web Analytics.

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 and build well-structured web pages using HTML and CSS.	**2**
CO2	Design and Implement Dynamic Web Page with Validation using JavaScript and its Events.	**3**
CO3	Design and Implement Server-Side Programming using Servlets.	**3**
CO4	Install, Configure and Maintaining a Web Server.	**4**
CO5	Gathering, Synthesizing and Analysis of Website data.	**4**

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

TEXT BOOKS

1. Paul J. Deitel, Harvey M.Deitel, Pearson International Edition ," Internet and World Wide Web, How to Program", Fourth Edition.

2. Avinash Kaushik, Wiley Publishing," Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity".

REFERENCES

1. Chris Bates, "Web Programming, Building Internet Applications, ″ Second Edition, Wiley Dreamtech.

2. Uttam K Roy," Web Technologies", Oxford University Press.

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	3		2	2
2	2	3	2						2	3	2		3	2
3	3	2	2						3	2	2		2	2
4	3		2	2	2				2	2	3	2	2	3
5	3		2	2	2				2	2	3	2	2	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 LAB**

(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

AD22411 **MACHINE LEARNING LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES

- To understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis.
- 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 **Linear Regression** model to predict the car price and evaluate the error rate and R^2 value.
2. Implement **Naïve Bayes Classifier** to diagnose CORONA infection using standard WHO Data Set.
3. Implement **decision tree based ID3 algorithm**. Use the iris data set for building the decision tree and apply this knowledge to classify a new sample.
4. Implement **K – Nearest Neighbour** to classify the patients suffering from breast cancer.
5. Implement **Simple Perceptron** to represent a boolean function that is linearly separable for AND, OR, NAND and NOR Logic Gates.
6. Implement **Multilayer Perceptron** model to classify a set of documents and measure the accuracy, precision, and recall.
7. Build **Logistic Regression** to predict the rainfall for the next day and apply this knowledge to classify a new sample
8. Build and train a **Support Vector Machine** model using Universal Bank records to classify the customers who are eligible for taking a Credit Card or not.
9. Implement **K-Means Clustering** to segment the customers to analyze their spending behaviour.
10. Implement **XGBoost Regression** to predict the house 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:

Python compiler in Ubuntu OS.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply suitable algorithms for selecting the appropriate features for analysis.	**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

AD22412 **WEB DEVELOPMENT AND ANALYTICS LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- To understand the basics of web page development using HTML, CSS and JavaScript.
- To build dynamic web page using Servlets.
- To collect the data and perform the Web Analytics.

List of Experiments:

1.Create a web page with the following using HTML

a) To embed a map in a web page
b) To fix the hot spots in that map
c) Show all the related information when the hot spots are clicked
d) Use table, Lists, Frames and Images

2. Cascading Style Sheets

a) Cascading style sheets.
b) Embedded style sheets.
c) Inline style sheets.

3.Javascript:

a) Write a JavaScript program to determine whether a given year is a leap year or not?
b) Write a JavaScript program to convert temperatures to and from Celsius, Fahrenheit.

4.Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.

5.Write programs in Java using Servlets:

a) To invoke servlets from HTML forms
b) Session tracking

6.Write programs in Java to create three-tier applications using servlets for conducting on-line examinations for displaying student mark lists. Assume that student information is available in a database which has been stored in a database server.

7. Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies.

8. Compare different web analytics tools, set up experiments and Tests, Analyze and Interpret the Results.

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)
- 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	Design a well-structured web page using HTML, CSS and JavaScript.	**2**
CO2	Design dynamic web page using Servlets.	**3**
CO3	Collect, clean and analyze the website data.	**4**

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

REFERENCES:

1. Paul J. Deitel, Harvey M.Deitel, Pearson International Edition ," Internet and World Wide Web, How to Program", Fourth Edition.

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

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", FifthEdition, 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

AD22501 **INTERNET OF THINGS AND ITS APPLICATIONS**

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, 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 exemplifying the application of IoT in various domains.	**2**
CO3	Students will be able to understand the differences and similarities between IoT and M2M.	**2**
CO4	Students will be able to interpret the different IoT platforms design methodology.	**2**
CO5	Students will be illustrating various IoT physical devices.	**2**

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

AD22502 **AUTOMATA THEORY**

L	T	P	C
3	0	0	3

OBJECTIVES

- To learn the various computing models and the design principles of Compiler.
- To understand the various analysis techniques.
- To understand the various syntax directed translation schemes.
- To learn how to optimize the code.
- To analyze how to obtain specific object code from source language.

UNIT I INTRODUCTION TO FINITE AUTOMATA 9

Introduction- Basic Mathematical Notations and Techniques- Finite State Machine – Basic Definitions – Finite Automaton – DFA & NFA – Finite Automaton with ξ- moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NFA's with and without ξ -moves – Equivalence of finite Automaton and regular expressions –Minimization of DFA.

UNIT II LEXICAL AND SYNTAX ANALYSIS 9

Lexical Analysis-Translators -The Phases of Compiler-Errors Encountered in Different Phases- Compiler Construction Tools- Role of Lexical Analyzer-Specification of Tokens–LEX.
Syntax Analysis-Role of the Parser- Top Down Parsing - Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-SLR Parser-YACC.

UNIT III SYNTAX DIRECTED TRANSLATION 9

Syntax Directed Definitions - Intermediate Code Generation-Representation and Implementation Types And Declarations -Type Checking –Control Flow Statements-Back Patching –Procedures.

UNIT IV CODE OPTIMIZATION AND RUN TIME ENVIRONMENT 9

Code Optimization -Principal Sources of Optimization – DAG – Data flow analyses: constant propagation, Liveliness analysis, common sub expression elimination.
Run-time Environment- Source Language issues – Storage Organization – Storage Allocation Strategies– Access to non-local names – Parameter Passing – Dynamic Storage Allocation.

UNIT V CODE GENERATION 9

Issues in the design of code generator – The target machine – Runtime Storage management– Basic Blocks and Flow Graphs – Next-use Information – A simple Code generator– 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	Examine the various deterministic and non-deterministic machines for a language processing system.	**2**
CO2	Formulate and to analyze various phases of compilation.	**3**
CO3	Choose the compiler construction tools for analysis and synthesis phase.	**3**
CO4	Examine the various optimization techniques.	**3**
CO5	Design code generators for the specified machine.	**3**

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

TEXT BOOKS

1. John. E. Hopcroft, Rajiv Motwani and Jeffrey D Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson Education, 2014.
2. Alfred Aho, Ravi Sethi and Jeffrey D Ullman, "Compilers Principles, Techniques and Tools", Second Edition, Pearson Education, 2013.

REFERCENCES

1. Alexander Meduna, Petr Zemek," Regulated Grammars and Automata", Springer, 2014.
2. Torben Mogensen, "Basics of Compiler Design", Springer, 2010.

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	-	-	-	-	-	3	-	3	3

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

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

AD22511

INTERNET OF THINGS AND ITS APPLICATIONS LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES

- To learn the Arduino / Raspberry Pi peripherals and programming.
- To be familiar with various sensors and actuators.
- To have hands on experience on Store, Retrieve and explore the data from the sensors.

LIST OF EXPERIMENTS

1. Install the IDE of the Arduino and study the programming in the development environment.
2. Implement the following using Arduino
    a. Peripheral interfacing with IoT kit
    b. Working with LED, SWITCH and BUZZER
    c. Simulation of Traffic Light
    d. Controlling LED intensity using PWM signal
3. Study the Temperature sensor and Write Program for monitoring temperature using Arduino.
4. Implement RFID, NFC using Arduino.
5. Implement MQTT protocol using Arduino.
6. Implement a experimental setup using Relay Controls and Motion detection.
7. Store, Retrieve and explore the data from the sensors to Cloud Environment.
8. Study and Configure Raspberry Pi.
9. WAP for LED blink using Raspberry Pi.
10. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
11. Develop Video Surveillance application using IoT
12. A project to be implemented covering all IoT phases using Raspberry Pi / Arduino.

TOTAL (P:45): 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- Arduino Uno - 8 Nos
- Raspberry Pi - 1 No
- DHT sensor - 8 Nos
- PIR Sensor - 8 Nos
- Ultrasonic Sensor - 8 Nos
- Node MCU - 8 Nos
- A to B cable - 8 Nos
- LED
- USB cables
- Jumper Wires

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Students will be able to write program in the Arduino IDE.	**3**
CO2	Students will be able to implement the IoT applications.	**3**
CO3	Students will be able to leverage sensors date in the cloud environment.	**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

AD22609 **DEEP LEARNING ALGORITHMS: THEORY AND PRACTICES**

L	T	P	C
3	0	2	4

OBJECTIVES

- To understand the basic concepts of deep learning and linear networks.
- To gain knowledge on building multilayer perceptron.
- To provide insights on convolutional neural networks and modern CNN architectures.
- To introduce basic and advanced recurrent neural networks for sequence learning.
- To learn about various attention mechanism.

UNIT I LINEAR NEURAL NETWORKS 9+6

Introduction to deep learning - Linear Neural Networks for Regression: Linear Regression – Generalization – Weight Decay. Linear Neural Networks for Classification: Softmax Regression – Generalization in Classification – Environment and Distribution Shift.

Activities:

1. Linear Regression - Generating the Synthetic Regression Dataset, Reading the Dataset, Initializing Model Parameters, Defining the Model, Defining the Loss Function, Defining the Optimization Algorithm, Training and Testing.
2. Softmax Regression - Initializing Model Parameters, Defining the Model, Defining the Loss Function, Classification Accuracy, Model Training and Prediction

UNIT II DEEP NEURAL NETWORKS 9+6

Multilayer Perceptron: Implementation- Forward Propagation, Backward Propagation and Computational Graphs – Numerical Stability and Initialization – Generalization in Multilayer Perceptron – Dropout – Layers and Modules – Parameter Management – Parameter Initialization – Lazy Initialization – Custom Layers – Computing Devices: Neural Networks – Tensors – GPUs.

Activities:

1. Solving XOR problem using Multilayer Perceptron.
2. Speech recognition using Deep Neural Network.

UNIT III CONVOLUTIONAL NEURAL NETWORKS 9+6

Fully Connected Layers to convolutions – Convolutions for Images – Padding and Stride – Multiple Input and Multiple Output Channels – Pooling – Modern Convolutional Neural Networks: LeNet, AlexNet, VGG, NiN, GoogleNet, ResNet, ResNeXt, DenseNet – Hyperparameter tuning – Grid Search, Randomized Search, Bayesian Optimization.

Activities:

1. Handwritten Digit Recognition using Convolutional Neural Network to digitize human handwritten digits.

2. Image-based object classification using GoogleNet.

UNIT IV RECURRENT NEURAL NETWORKS 9+6

Working with sequences – Conversion of raw data into sequence data - Language Models – Recurrent Neural Networks – Backpropagation through time – Modern Recurrent Neural Networks: Long Short Term Networks – Gated Recurrent Units – Deep Recurrent Neural Networks - Bidirectional Recurrent Neural Networks – Machine Translation – Encoder – Decoder Architecture – Sequence to Sequence Learning for Machine Translation.

Activities:

1. Categorize opinions in text using Long Short Term Networks.
2. Machine Translation using Gated Recurrent Units.

UNIT V ATTENTION MECHANISM AND TRANSFORMERS 9+6

Attention Pooling by Similarity – Attention Scoring Functions – The Bahdanau Attention Mechanism – Multi – Head Attention – Self Attention and Positional Encoding – The Transformer Architecture – Transformers for Vision – Large Scale Pretraining with Transformers – Generative Adversarial Networks – Transfer Learning.

Activities:

1. Stock predictions with Multi-Head Attention.
2. Image Augmentation using Generative Adversarial Networks.

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	Build linear neural network models for regression and classification.	**2**
CO2	Implement multilayer perceptron for real world problems.	**3**
CO3	Construct various convolutional neural network frameworks.	**3**
CO4	Construct solutions for sequential problems using recurrent neural networks and its variants.	**3**
CO5	Develop deep learning architectures using attention mechanism to solve complex problems.	**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, 2016.
3. Simon Haykin, “Neural Networks and Learning Machines”, Pearson, 2009.

REFERCENCES

1. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 2018.
2. Charniak E, ”Introduction to deep learning” MIT Press, 2019.
3. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner's Approach”, O'Reilly Media, 2017.
4. Umberto Michelucci, “Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks”, Apress, 2018.
5. Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O'Reilly Media, 2017.

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

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	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

AD22602 **HEALTHCARE ANALYTICS**

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the health data formats, health care policy, and standards.
- Learn the significance and need of data analysis and data visualization.
- Understand the health data management frameworks.
- Learn the use of machine learning and deep learning algorithms in healthcare.
- Apply healthcare analytics for critical care applications.

UNIT I INTRODUCTION TO HEALTHCARE ANALYTICS **9**

Introduction to Healthcare Analytics- Data Sources-Data Types-Electronic Health Records (EHR) - Components of EHR-Standards for EHR-Coding Systems-Benefits of EHR-Barriers and Challenges of using EHR Data-Phenotyping Algorithms - Clinical Document Architecture-Aims and objectives of CDA-Levels of CDA- CDA identifiers- Design of a CDA document- Introduction-DICOM and other standards-Biomedical Imaging Modalities.

UNIT II E-HEALTH DATA SOURCES **9**

Body Area Networks- Mobile Health Technologies -Social Networks on Healthcare-Cloud Computing on e-Health-Security and Privacy in e-Health Applications over the Cloud-Medicare value-based programs: The Hospital Value Based Purchasing (HVBP) program, The Hospital Readmission Reduction (HRR) program, The Hospital-Acquired Conditions (HAC) program.

UNIT III BIOMEDICAL DATA PROCESSING **9**

Revisit of Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.

UNIT IV DATA ANALYTICS FOR HEALTHCARE **9**

Natural Language Processing for Clinical Text Mining- Temporal Data Mining for Healthcare Data-Information Retrieval for Healthcare- Case Study: Gene Expression data analysis in cloud.

UNIT V CASE STUDIES **9**

Early identification of a disease from clinical data-Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies –Identification of retinopathy- ECG Data Analysis-Descriptive Model for Point-of-Care.

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 various types of clinical data and clinical standards.	**2**
CO2	Select appropriate e-technologies for healthcare systems.	**3**
CO3	Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications	**2**
CO4	Measure and analyze the quality of healthcare systems.	**3**
CO5	Design a suitable prediction model for real time healthcare analytics.	**4**

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

TEXT BOOKS

1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.

REFERCENCES

1. Joel J.P.C. Rodrigues, Sandra, Isabel de la Torre Díez, "e-Health Systems: Theory and Technical Applications", ISTE Press and Elsevier,2016.
2. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
3. Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.

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	1	3	3	3
2	3	3	3	3	3	2	-	-	3	2	1	3	3	3
3	3	3	3	3	3	2	-	-	3	2	1	3	3	3
4	3	3	3	3	3	2	-	-	3	2	1	3	3	3
5	3	3	3	3	3	2	-	-	3	2	1	3	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

AD22611 **REINFORCEMENT LEARNING TECHNIQUES LABORATORY**

L	T	P	C
0	0	3	1.5

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

LIST OF EXPERIMENTS

1. Implement value iteration and policy iteration algorithms
2. Elucidate value iteration and policy iteration in Jacks' Car Rental problem
3. Implement Q-learning algorithm for frozen lake environment
4. Implement First-Visit Monte Carlo Policy evaluation for Blackjack game
5. Develop a simple reinforcement learning algorithm for agents to learn the game tic-tac-toe
6. Apply value iteration to find the optimum policy for grid world environment
7. Generate random walk using Markov process
8. Implement Q-Learning algorithm for Recycling Robot
9. Implement Off-Policy TD algorithm for Cliff Walking
10. Implement On-Policy TD algorithm for Frozen Lake environment

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	Apply the basic concepts of probability theory and random variables.	3
CO2	Estimate Monte-Carlo methods and various Temporal Difference learning algorithms.	4
CO3	Analyze function approximation and policy gradient methods.	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

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 global issues and perform their 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 GLOBAL ISSUES **9**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

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 robo ethics in technology.	**4**
CO5	Students apply ethics in their professional role.	**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

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

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	1	-	-	-	1	2	1	1	3	1
2	2	1	1	2	1	-	-	-	1	2	1	1	3	3
3	2	3	1	1	3	-	-	-	2	1	1	2	3	2
4	3	1	3	3	2	-	-	-	2	2	3	1	2	1
5	3	1	1	3	3	-	-	-	2	3	3	3	1	3

3-High, 2-Medium, 1-Low

AD22021 **HUMAN COMPUTER INTERACTION**

L	T	P	C
3	0	0	3

OBJECTIVES

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To understand and analyze the cognitive models in Human-Computer Interaction (HCI) and their relevance in designing user interfaces.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.

UNIT I FOUNDATIONS OF HCI **9**

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies.

UNIT II DESIGN & SOFTWARE PROCESS **9**

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III MODELS AND THEORIES **9**

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI **9**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies.

UNIT V WEB INTERFACE DESIGN **9**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies.

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 effective dialog for HCI	**3**
CO2	Design effective HCI for individuals and persons with disabilities.	**3**
CO3	Assess the importance of user feedback.	**4**
CO4	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.	**2**
CO5	Develop meaningful user interface.	**3**

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

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction‖, 3rd Edition, Pearson Education, 2008 (UNIT I, II & III)
2. Brian Fling, ―Mobile Design and Development‖, First Edition, O'Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, ―Designing Web Interfaces‖, First Edition, O'Reilly, 2009. (UNIT-V)

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

AD22022 **BUSINESS INTELLIGENCE**

L	T	P	C
3	0	0	3

OBJECTIVES

- Be exposed with the basics of decision support and business intelligence system.
- Understand the knowledge delivery and visualization of Business data to support decision making.
- Be exposed with data storage and processing of data using different data analysis tools and techniques.
- Understand the concepts of web analytics and social analytics which supports for business intelligence.
- Be exposed to the Future Trends, Privacy and Managerial Consideration in Business Analytics.

UNIT I DECISION SUPPORT AND BUSINESS INTELLIGENCE 9

Definition, concept and need for Business Intelligence – Changing Business Environments and Computerized Decision Support, Managerial Decision Making, Computerized Support for Decision Making, An Early framework for Computerized decision support, Concept of Decision Support Systems, A framework for Business Intelligence, Major Tools and Techniques, Decision Making – Introduction and Definitions, Models, Phases of the decision-Making process, Decision Support System – Concepts, Methodologies and Technologies, Classifications, Components of Decision Support Systems.

UNIT II KNOWLEDGE DELIVERY 9

The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Automated reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Heatmap, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

UNIT III DATA STORAGE FOR BUSINESS INTELLIGENCE 9

Data Mining Concepts and Applications, Data Mining Applications, Data Mining Process, Data Mining Methods, Artificial Neural Networks for Data Mining, Data Warehousing – Definitions and Concepts, Process Overview, Architectures, ETL Process, Data warehouse development, Real-Time Data Warehousing.

UNIT IV WEB AND SOCIAL ANALYTICS FOR BUSINESS INTELLIGENCE 9

Text and Web Mining – Text mining applications and tools, Web Mining – Overview, Web content mining and web structure mining, Web usage Mining, Web Analytics Maturity Model and Web Analytics Tools-Social Analytics and Social Network Analysis-Social Media Definitions and

Concepts-Social Media Analytics.

UNIT V **FUTURE TRENDS, PRIVACY AND MANAGERIAL CONSIDERATION IN ANALYTICS** **9**

Internet of Things- Cloud Computing and Business Analytics-Location based Analytics for Organizations- Issues of legality, privacy and Ethics-Impacts of Analytics in organizations-Advanced Visualization – Rich Report, Future beyond Technology.

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 exposed with the basics of decision support and business intelligence system.	**2**
CO2	Students will be able to understand the knowledge delivery and visualization of Business data to support decision making.	**3**
CO3	Students will be able to exposed with data storage and processing of data using different data analysis tools and techniques.	**2**
CO4	Students will be able to understand the concepts of web analytics and social analytics which supports for business intelligence.	**2**
CO5	Students will be able to exposed to the Future Trends, Privacy and Managerial Consideration in Business Analytics.	**2**

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

TEXT BOOKS

1. Ramesh Sharda, Dursun Delen, Efraim Turban, "BUSINESS INTELLIGENCE, ANALYTICS, AND DATA SCIENCE: A Managerial Perspective", 4th Edition, Pearson 2017.
2. Efraim Turban, Ramesh Sharda, DursunDelen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 2013.
3. GalitShmueli, Nitin R. Patel and Peter C. Bruce, ―Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner, Wiley, 2016.

REFERENCES

1. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycleof Decision Making", Addison Wesley, 2003.
2. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager's Guide", Second Edition, 2012.
3. Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App",

McGraw-Hill, 2007.

4. Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, "The Data Warehouse Lifecycle Toolkit", Wiley Publication Inc.,2007.

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

AD22023 **FUZZY LOGIC TECNHIQUES**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand basic Fuzzy logic principles.
- To understand fuzzy set operations and properties of fuzzy member functions for perceptron network classifications.
- To understand the basic areas of fuzzy rules on aggregation and arithmetic operations.
- To apply fuzzy inference system in real world framework and industrial applications.
- To make decisions on neuro fuzzy systems and to de-fuzzify the inferences.

UNIT I INTRODUCTION TO FUZZY LOGIC PRINCIPLES 9

Basic concepts of fuzzy logic- Applications of fuzzy logic- Crisp sets: Basic types and concepts, Characteristics and significance of paradigm shift, Fuzzy sets vs Crisp sets, Representation of fuzzy sets, , linguistic variable, possibility distributions, fuzzy rules, fuzzy rule based inference system-Fuzzification -defuzzification types, Alternate fuzzy logic operations, Adaptation of fuzzy systems.

UNIT II ADVANCED FUZZY LOGIC APPLICATIONS 9

Fuzzy Sets Classical sets, set operation-types of membership functions, designing membership functions, Foundations of pattern classification & regression, Rosenblatt Perceptron, Training Neural networks- learning vector quantization – counter propagation networks – industrial applications.

UNIT III ARITHMETIC AND AGGREGATION OF FUZZY RULES 9

Fuzzy operations and Fuzzy airthmetic Types of operations, Fuzzy complements, Fuzzy intersection:t-norms, Fuzzy union: tco-norms,Combination of operations, Aggregation of fuzzy rules-Aggregation operation, Fuzzy numbers, Airthmetic operations on intervals, Airthmetic operations on Fuzzy numbers, Lattice of Fuzzy numbers, Fuzzy equation**.**

UNIT IV FUZZY INFERENCE SYSTEMS 9

Fuzzy rule based Models: Non-Additive Rule Models – Additivie Rule Models – Fuzzy Systems and machine learning: Mamdani Fuzzy model –Single Antecedent with three rules-Two Antecedent with four rules working models- Fuzzy Inference System and reinforcement learning –Optimization techniques in Fuzzy-Q-learning.

UNIT V FUZZY DECISION MAKING, CLASSIFICATION & HYBRID FORMATION 9

Fuzzy synthetic evaluation: Fuzzy ordering, Preference and consensus, Multiobjective decision making under fuzzy states and fuzzy actions. Integration of Fuzzy logic in optimization Techniques Fuzzy relations cluster analysis, Neuro fuzzy and fuzzy Genetic system-applications to engineering problems.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Gain knowledge on various basic Fuzzy logic principles and Crisp sets.	**2**
CO2	Explore various fuzzy set operations and properties of fuzzy member functions for perceptron network classifications.	**3**
CO3	Analyze the basic areas of fuzzy rules on aggregation and arithmetic operations.	**3**
CO4	Apply fuzzy inference system in real world framework and industrial applications.	**3**
CO5	Examine multi-objective decisions on neuro fuzzy systems and to de-fuzzify the inferences.	**3**

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

TEXT BOOKS

1. Timothy J. Ross(2010) Fuzzy Logic With engineering applications-Third Edition © 2010 John Wiley & Sons, Ltd.
2. J.-S. R. Jang, C.-T. Sun and E. Mizutani, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence," Prentice-Hall, Upper Saddle River, 2004.

REFERENCES

1. M. Ganesh "Introduction To Fuzzy Sets And Fuzzy Logic" :Phi Learning Pvt. Ltd.,2006 Isbn 8120328612, 9788120328617.
2. Neural Networks, Fuzzy Logic, Genetic Algorithms: Synthesis And Applications By Rajasekharan Andrai – Phi Publication (16 June 2013).
3. Simon O. Haykin, Mcmaster University, Ontario Canada: Neural Networks And Learning Machines 3e - Pearson Education India; Third Edition (1 April 2016) - Isbn-10 : 9789332570313.
4. Nauck, D.D. (2005). Learning Algorithms For Neuro-Fuzzy Systems. In: Gabrys, B., Leiviskä, K., Strackeljan, J. (Eds) Do Smart Adaptive Systems Exist?. Studies In Fuzziness And Soft Computing, Vol 173. Springer, Berlin, Heidelberg. Https://Doi.Org/10.1007/3-540-32374-0_7

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

AD22024 **WEB MINING**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the need for web mining and differentiate between Web and Data mining.
- To deal with the evaluation of information concerning satisfying user information needs.
- To gain knowledge in social structures using network and graph theory.
- To acquire knowledge about web crawling and how it works.
- To be familiar with text analysis techniques, web usage mining methods, and processes.

UNIT I WEB DATA MINING AND DATA MINING FOUNDATIONS 9

Web and the Internet – Categories of Web Mining - Web Mining and Data Mining, Integration in Web Mining, Data Mining Foundations – Association Rules and Sequential Patterns – Extended Model, Mining Algorithm, Rule Generation, Mining Class Association Rules, Sequential Patterns - Mining Sequential Patterns on GSP and Prefix Span, Generating Rules from Sequential Patterns.

UNIT II INFORMATION RETRIEVAL AND WEB SEARCH 9

Basic Concepts of Information Retrieval, Information Retrieval Models – Relevance Feedback, Evaluation Measures, Text and Web Page Preprocessing – Stop word Removal, Stemming, Web Page Preprocessing, Duplicate Detection, Inverted Index and Its Compression – Inverted Index - Latent Semantic Indexing, Web Search, Meta Search, Web Spamming.

UNIT III SOCIAL NETWORK ANALYSIS 9

Social Network Analysis, Co-Citation and Bibliographic Coupling, Page Rank, HITS Algorithm, Community Discovery - Bipartite Core Communities, Maximum Flow Communities, Email Communities, Overlapping Entities of Named Entities. Advantages and Disadvantages of Social Network Analysis.

UNIT IV WEB CRAWLING 9

Web Crawling – A Basic Crawler Algorithm- Breadth First Crawlers, Preferential Crawlers, Implementation Issues – Fetching, Parsing, Stop word Removal, Link Extraction and Canonicalization, Spider Traps, Page Repository, Universal Crawlers, Focused Crawlers, Topical Crawlers, Crawler Ethics and Conflicts.

UNIT V OPINION MINING AND WEB USAGE MINING 9

Problem Definition of Opinion Mining - Document Sentiment Classification - Sentence Subjectivity and Sentiment Classification, Opinion Lexicon Expansion - Aspect-Based Opinion Mining - Mining Comparative Opinions - Opinion Search and Retrieval - Opinion Spam Detection - Web Usage Mining – Data Modeling for Web Usage Mining, Discovery and Analysis of Web usage Patterns.

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 web mining and its algorithm.	**2**
CO2	The students will be able to deal with Information Retrieval with the least time and least effort.	**2**
CO3	The students will be able to integrate and describe the types and tools of Social Network Analysis.	**3**
CO4	The students will be able to attain knowledge about Web Crawling.	**3**
CO5	The students will be able to analyze web usage mining methods.	**4**

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

TEXT BOOKS

1. Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data by Bing Liu (Springer Publications), Second Edition, 2011.

REFERENCES

1. Jiawei Han, Micheline Kamber, "Data Mining: Concepts and Techniques", Third Edition, Elsevier Publications.
2. Soumen Chakrabarti, "Mining the Web: Discovering Knowledge from Hypertext Data", First Edition, 2002.
3. Zdravko Markov, Daniel T. Larose, "Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage", John Wiley & Sons, Inc., 2007.
4. Guandong Xu, Yanchun Zhang, Lin Li, "Web Mining and Social Networking: Techniques and Applications", Springer; 1st Edition, 2010.
5. Anthony Scime, "Web Mining: Applications and Techniques", Idea Group Publishing, 2005.

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

AD22025 KERNEL METHODS FOR PATTERN ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES

- To provide the broad spectrum of problem formulations for kernel-based unsupervised and supervised learning methods
- To show the mapping from the original vector space to the kernel-induced intrinsic vector space
- To cover conventional unsupervised learning models for cluster discovery
- To introduce Kernel ridge regressors and variants
- To introduce Support Vector Machines and variants

UNIT I MACHINE LEARNING AND KERNEL SPACES 9

Introduction; Feature representation and dimension reduction: Feature representation in vector space-Conventional similarity metric Euclidean inner product; The learning subspace property (LSP) and kernelization of learning models: The LSP-Kernelization of the optimization formulation for learning models; Generalized inner products and kernel functions.

UNIT II KERNEL-INDUCED VECTOR SPACES 9

Introduction - Mercer kernels and kernel induced similarity metrics; Training data independent intrinsic feature vectors; Training data dependent empirical feature vectors; The kernel-trick for non-vectorial data analysis.

UNIT III FEATURE SELECTION AND UNSUPERVISED LEARNING 9

Principal Component Analysis and Kernel Principal Component Analysis; Feature Selection; Unsupervised learning models for cluster Analysis: Unsupervised learning for cluster discovery-Kernel methods for cluster analysis.

UNIT IV KERNEL RIDGE REGRESSORS AND VARIANTS 9

Kernel-based regression and regularization analysis: Linear least squares error analysis Kernel based regression analysis-Regularization via radial basis functions (RBF) networks.

UNIT V SUPPORT VECTOR MACHINES AND VARIANTS 9

Support vector machines (SVM): Introduction-Linear support vector machines; SVM with fuzzy separation; Kernel based support vector machines; Empirical space SVM for trimming of training vectors; Support vector learning models for outlier detection.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Represent features for any application and reduce dimension	**3**
CO2	Come up with new kernel functions that satisfy Mercer theorem	**4**
CO3	Learn kernels for unsupervised methods	**2**
CO4	Experiment kernel regressors for various applications	**3**
CO5	Learn models for classification problems using SVMs	**2**

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

TEXT BOOKS

1. Kung SY. Kernel methods and machine learning. Cambridge University Press; 2014.
2. Shawe-Taylor J, Christianini N (2004) Kernel Methods for Pattern Analysis. Cambridge University Press.

REFERCENCES

1. "An Introduction to Support Vector Machines and Other Kernel-based Learning Methods" by Nello Cristianini and John Shawe-Taylor, Cambridge University Press, 2000.
2. "Pattern Recognition and Machine Learning" by Christopher M. Bishop, Springer New York, 2006.
3. "Learning with Kernels: Support Vector Machines, Regularization, Optimization, and Beyond" by Bernhard Scholkopf and Alexander J. Smola, MIT Press, 2018.
4. "Kernel Methods in Computational Biology" by Bernhard Scholkopf, Koji Tsuda, and Jean-Philippe Vert, MIT Press, 2004.

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	-
2	3	3	3	2	-	2	-	-	-	-	-	-	2	-
3	3	3	3	2	-	2	-	-	-	-	-	-	2	-
4	3	3	3	2	1	2	-	-	-	-	-	-	2	2
5	3	3	3	2	1	2	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

AD22026 AGENT BASED INTELLIGENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES

- To brief on Agents, Multi agents and Intelligent agents.
- To explain on Multi agent systems.
- To understand the various search algorithms for agents.
- To understand Rational Decision Making and Learning in multi agent systems.
- To implement an Intelligent agent systems.

UNIT I INTRODUCTION 9

Intelligent Agents – Agents – Abstract Architectures- Purely Reactive Agents – Perception – Agents with State – Concrete Architectures – Logic-based architectures – Reactive Architectures – Belief-Desire- Intention Architectures – Layered Architectures – Agent Programming Languages.

UNIT II MULTIAGENT SYSTEMS 9

Characteristics of Multiagent Environments – Agent Communications – Agent Interaction Protocols: Coordination Protocol – Cooperation Protocol – Contract Net – Blackboard Systems – Negotiation – Multiagent Belief Maintenance – Market Mechanisms – Societies of Agents.

UNIT III SEARCH ALGORITHMS FOR AGENTS 9

Constraint Satisfaction Problem – Filtering Algorithm – Hyper-Resolution-based Consistency Algorithm – Asynchronous Backtracking – Asynchronous weak commitment search – Path-Finding Problem: Asynchronous Dynamic Programming – Learning Real-time A* - Real-time A* - Moving Target Search – Real-time Bidirectional Search - Real-time Multiagent Search – Two-player Games – Min-max procedure – Alpha-Beta Pruning.

UNIT IV RATIONAL DECISION MAKING AND LEARNING 9

Evaluation Criteria – Voting – Auctions – Bargaining – Market Mechanisms – Contract Nets – Coalition Formation - Principal Categories – Differencing Features – Credit-Assignment Problem – Learning and Activity Coordination – Learning about and from other agents – Learning and Communication.

UNIT V APPLICATIONS 9

Agents for workflow and business process management; Agents for distributed sensing; Agents for information retrieval and management; Agents for electronic commerce; Agents for human-computer interfaces; Agents for virtual environments; Agents for social simulation.

TOTAL (L:45): 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Brief on Agents, Multi agents and Intelligent agents.	**2**
CO2	Elaborate on Multi agent systems.	**4**
CO3	Understand the various search algorithms for agents.	**2**
CO4	Understand Rational Decision Making and Learning in multi agent systems.	**3**
CO5	Implement an Intelligent agent systems.	**3**

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

TEXT BOOKS

1. Gerhard Weiss, "Multiagent Systems : A Modern Approach to Distributed Artificial Intelligence", MIT Press, 2016.
2. Lin Padgham, Michael Winikoff, "Developing Intelligent Agent Systems – A practical Guide", Wiley, 2005.

REFERENCES

1. Jeffrey M Bradshaw, "Software Agents", The MIT Press, 2010.
2. Michael Wooldridge, "An Introduction to Multi Agent Systems", second edition John Wiley and Sons ltd., 2009.
3. Yoav Shoham, Kevin Leyton-Brown, "Multiagent Systems: Algorithmic, Game theoretic and Logical foundations", Cambridge, 2008.
4. Tomas Salamon, 'Design of Agent Based Models: Developing Computer Simulations for a better understanding of social Processes", Academic series, 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

AD22027 **EVOLUTIONARY COMPUTATION**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand Evolutionary Algorithms in the context of meta-heuristics and their important parametric components
- To understand the importance of Fitness Evaluation in Evolutionary Algorithm
- Learn to formulate a problem as an optimization problem and apply Evolutionary Algo
- To understand the cooperative and competitive dynamics within the optimization process
- To understand and appreciate the state-of-the-art research in Evolutionary computation

UNIT I INTRODUCTION TO EVOLUTIONARY COMPUTATION 9

Introduction to Evolutionary Computation —. Basic concepts in evolution and natural selection- Overview of evolutionary algorithms- Evolutionary Algorithms (Genetic Algorithms, Genetic Programming, Differential Evolution, Evolution Strategies, Covariance Matrix Adaptation etc.)

UNIT II FITNESS, SELECTION, PROCESS MANAGEMENT 9

Different Components of Evolutionary Algorithms - Fitness Landscapes – Adaptive Parameter Control and Tuning – Constraint Handling – Niching and Fitness Sharing – Memetic Algorithms – Ensemble Evolutionary Algorithms- Hybridization with other techniques

UNIT III MULTI-OBJECTIVE EVLOUTIONARY ALGORITHMS 9

Multi-Objective Optimization – Hyper-Heuristics Special Forms of Evolution (Co-evolution and Speciation) – Experimental (statistical) Methods for the analysis of Evolutionary Algorithms.

UNIT IV INTERACTIVE EVOLUTIONARY ALGORITHMS 9

Theoretical Analysis of Evolutionary Algorithms – Interactive Evolutionary Algorithms – Experiment design and analysis involving Evolutionary Algorithms.

UNIT V EVOLUTIONARY STRATEGIES AND DIFFERIAL EVOLUTION 9

Evolutionary Machine Learning – Surrogate Assisted Optimization – Neuro Evolution – Quality Diversity Algorithms – Open Ended Evolution - Applications of Evolutionary Algorithms.

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 evolutionary computation basic concepts and evolutionary algorithm.	**2**
CO2	Understand appropriate evolutionary algorithms for a problem.	**3**
CO3	Implement and compare different MOEAs for various problem domain.	**3**
CO4	Analyze the state-of-the-art evolutionary computation research literature.	**4**
CO5	Apply suitable evolutionary algorithms for a real world application.	**3**

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

TEXT BOOKS

1. A. E. Eiben and J. E. Smith, "An Introduction to Evolutionary Computing", Natural Computing Series, Springer, 2nd Edition, 2015.
2. Eyal Wirsansky, "Hands-On Genetic Algorithms with Python: Applying Genetic Algorithms to Solve Real-World Deep Learning and Artificial Intelligence Problems", Packt Publishing, 2020.

REFERCENCES

1. Iaroslav Omelianenko, "Hands-on Neuro evolution with Python: Build High- Performing Artificial Neural Network Architectures using Neuro evolution-based Algorithm", Pack Publishing, 2019.
2. Slim Bechikh, Rituparna Datta and Abhishek Gupta (Eds.), "Recent Advances in Evolutionary Multi-objective Optimization", Adaptation, Learning, and Optimization Book – 20, Springer, 2017.
3. Nelishia Pillay and Rong Qu, "Hyper-Heuristics: Theory and Applications", Springer,2018.
4. Hitoshi Iba, "Evolutionary Approach to Machine Learning and Deep NeuralNetworks: Neuro-Evolution and Gene Regulatory Networks", Springer, 2018.

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

AD22028 **GENERATIVE AI**

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the fundamental concepts and applications of generation AI.
- Ability to apply mathematical principles in the analysis and design of algorithms.
- Ability to design, implement, and evaluate machine learning models.
- Ability to analyze and design algorithms for generative tasks.
- Ability to apply advanced algorithms for image generation and manipulation.

UNIT I INTRODUCTION TO GENERATIVE AI **9**

Definition and scope of Generative AI - Historical overview of generative models -Applications of Generative Models in various fields - image synthesis, text generation.

UNIT II PROBABILITY AND STATISTICS FOR GENERATIVE MODELS **9**

Probability theory basics - Statistical concepts relevant to generative modeling - Maximum likelihood estimation (MLE) - Maximum A posteriori(MAP) estimation.

UNIT III DEEP LEARNING FRAMEWORK **9**

Basics of neural networks - Deep learning architecture (feed forward, convolution, recurrent) - Training Deep neural networks - Transfer learning and fine tuning for generative tasks, TensorFlow or PyTorch basics.

UNIT IV GENERATIVE MODELS - AUTO ENCODERS AND GAN **9**

Introduction to auto encoders - Variational Auto encoders (VAEs) - Introduction to Generative Adversarial Networks(GANs) - GAN architecture and components - Training GANs - GAN Applications in Image Generation, Style transfer.

UNIT V ADVANCED TOPICS AND APPLICATIONS **9**

Sequence Generation Models (RNNs, LSTMs, GRUs) - Reinforcement learning for Generative Tasks - Ethical and Social Implications of Generative AI. Generative Models for text and language generation - Meta learning, few-shot learning, and Self -Supervised 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 fundamental concepts and applications of Generative AI.	**2**
CO2	Apply probability and statistical concepts to generative modeling.	**3**
CO3	Interpret proficiency in neural network concepts and deep learning techniques.	**2**
CO4	Implement an autoencoder-based generative models.	**3**
CO5	Explore and understand advanced topics in Generative AI.	**2**

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

TEXT BOOKS

1. David Foster "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" O'Reilly Media,2nd Edition,2023.
2. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville,2016, kindle edition, MIT Press.

REFERENCES

1. "Generative Adversarial Networks and Deep Learning theory & applications"-Roshani Raut, Pranav D Pathak, Sachin R Sakhale , Sonali Patil ,kindle Edition,2023,chapman publisher.
2. Hands-On Generative Adversarial Networks with Keras , Rafael Valle, Pack Publisher, May 2019.
3. Natural Language Processing in Action" - Lane, Howard, and Hapke,1st edition,2019, manning publisher.
4. "Generative AI for leaders"- Amir Husain, AM Press,2023.

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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	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

AD22031 **FINANCE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the principles and practices of financial engineering.
- To apply mathematical models for pricing and risk assessment in finance.
- To analyze the impact of financial decisions on software engineering projects.
- To explore advanced financial instruments and derivatives.
- To develop skills in using computational methods for financial analysis.

UNIT I INTRODUCTION **9**

Overview of Finance Engineering - Evolution and Significance - Role in Risk Management - Types of Financial Instruments-Financial Market Structures -Regulatory Environment and Compliance.

UNIT II MATHEMATICAL MODELS IN FINANCE **9**

Time Value of Money - Probability and Statistics in Financial Modeling - Stochastic Calculus - Cryptographic Elements in Financial Transactions- Monte Carlo Simulations -Optimization Techniques in Finance.

UNIT III FINANCIAL INSTRUMENTS AND DERIVATIVES **9**

Options, Futures, and Swaps - Pricing Models for Derivatives - Risk Management Strategies - Smart Contracts in Financial Engineering -Credit Derivatives - Exotic Options.

UNIT IV FINANCE INNOVATION AND TECHNOLOGY **9**

Financial Modeling with Python - Data Analysis and Visualization in Finance - Implementation of Financial Models - Decentralized Organizations in Finance- Artificial Intelligence in Finance -Fintech Innovations and Trends.

UNIT V CASE STUDIES AND APPLICATIONS **9**

Blockchain Technology in Finance - Distributed Ledger Technology for Business - Case Studies in Internet of Things and Supply Chain Management - Evaluation and Impact Analysis - Machine Learning Applications in Finance.

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 principles of financial engineering.	**2**
CO2	Apply mathematical models for pricing and risk assessment.	**3**
CO3	Analyze the impact of financial decisions on software engineering projects.	**4**
CO4	Explore advanced financial instruments and derivatives.	**4**
CO5	Develop skills in using computational methods for financial analysis.	**3**

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

TEXT BOOKS

1. Lawrence C. Galtiz, Irwin, "Financial Engineering", McGraw-Hill Education.
2. Hull, J. C. 2013, Introduction to Futures and Options Markets, 9th edition, Prentice Hall of India.
3. Marshall, J. F. and Bansal, V. K. 2006. Financial Engineering: A Complete Guide to Financial Innovation, Prentice Hall of India.

REFERCENCES

1. Yves Hilpisch," Python for Finance 2e: Mastering Data-Driven Finance", 2nd Edition 2019.
2. Simon Benninga and Tal Mofkadi," Financial Modeling",Fiftth Edition 2022.
3. Daniel Drescher," Blockchain Basics: A Non-Technical Introduction in 25 Steps Paperback" 2017.

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	3	-	-	1	-	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

AD22032 **FINTECH PAYMENT SYSTEM**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the fundamentals of financial technology (FinTech) in the context of payment systems.
- To explore the technologies and innovations driving FinTech payment systems.
- To analyze the challenges and opportunities in the FinTech payment industry.
- To examine the regulatory and security aspects of FinTech payment systems.
- To gain practical knowledge of implementing and managing FinTech payment solutions.

UNIT I INTRODUCTION **9**

Definition and Evolution of FinTech Payment Systems - Role of FinTech in Modern Payment Ecosystem - Overview of Digital Currencies and Mobile Payments - Trends and Innovations in FinTech.

UNIT II TECHNOLOGIES IN FINTECH PAYMENTS **9**

Blockchain and Distributed Ledger Technology in Payments – Crypto currencies and Their Impact on Payment Systems - Mobile Wallets and Contactless Payments - Application Programming Interfaces (APIs) in Payment Integration.

UNIT III CHALLENGES AND OPPORTUNITIES **9**

Security and Privacy Concerns - Regulatory Landscape of FinTech Payment Systems - Financial Inclusion through FinTech - Risks and Risk Management in FinTech.

UNIT IV PAYMENT SYSTEM INTEGRATION **9**

Real-time Payment Systems - Peer-to-Peer (P2P) Payment Platforms - Cross-Border Payments and Remittances - FinTech Startups and Collaborations with Traditional Banks.

UNIT V CASE STUDIES AND FUTURE TRENDS **9**

Case Studies of Successful FinTech Payment Implementations -Future Trends in FinTech Payments - Impact of Artificial Intelligence on Payment Systems - Ethical and Social Implications of FinTech

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 FinTech payment systems.	**2**
CO2	Explore the technologies driving FinTech payments.	**3**
CO3	Analyze challenges and opportunities in FinTech payments.	**4**
CO4	Examine regulatory and security aspects of FinTech payment systems.	**3**
CO5	Gain practical knowledge of implementing FinTech payment solutions.	**4**

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

TEXT BOOKS

1. Pranay Gupta and T. Mandy Tha , “Fintech: The New DNA of Financial Services”, 2018.
2. Paul Vigna and Michael J. Casey, "The Age of Cryptocurrency: How Bitcoin and Digital Money are Challenging the Global Economic Order", 2015

REFERENCES

1. Daniel Drescher, “Blockchain Basics: A Non-Technical Introduction in 25 Steps”, 2017.

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

AD22033 **SMART CONTRACTS AND SOLIDITY**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basic concepts of Blockchain and crypto currency.
- To understand the Smart Contracts in Blockchain.
- To learn the tools and programming skills required to generate Smart Contracts.
- To understand the usage of solidity in smart contracts.
- To assess the efficiency of the creating and deploying of DApp.

UNIT I INTRODUCTION TO BLOCKCHAIN **9**

Blockchain Overview – History and Origin of Blockchain - Concepts of Blockchain Systems - Physical Ledger Technology and Security - Digital Ledger Technology - Cryptographic Hash Functions - Digital Signatures - Crypto currencies - Blockchain Applications - Blockchain and Bitcoin - Bitcoin Mining - Consensus algorithms.

UNIT II BLOCKCHAIN BASICS OF SMART CONTRACTS **9**

Blockchain Basics- Mining- Elliptic curve cryptography – Peer to Peer Network- Web 3.0 – Blockchain Security - Smart Contracts – Purpose of Smart Contracts - Features of Smart Contracts - Life Cycle of a Smart Contract - Introduction to Ethereum Higher Level Languages.

UNIT III INTRODUCTION TO SOLIDITY **9**

Solidity Overview - Smart Contracts - Programming Fundamentals - Integers and Different kinds of variables in solidity - Functions - Visibility - Conditionals - Types of Visibility Specifier - Operators – loops – Keywords - Constructors & Functions, Variables, Getters & Setters, Arrays, Memory vs Storage, Mappings in Solidity.

UNIT IV ADVANCED SOLIDITY **9**

Structs - Error Handling and Restrictions – Libraries - Global Variables in Solidity - Abstract Contracts – Inheritance – Interfaces – Events – Creation of token in solidity – Ethereum Virtual Machine – Message calls.

UNIT V DECENTRALIZED APP CREATION **9**

Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application, Deploying DApp, Validation, And Testing of DApp.

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 and objectives of Blockchain.	**2**
CO2	Evaluate the various functionalities and features in an Ethereum to generate Smart Contracts.	**4**
CO3	Introduce the Solidity language in creation of a Smart Contracts	**5**
CO4	Incorporate the advanced solidity in creation of smart contracts.	**4**
CO5	Incorporate Smart Contracts in decentralized applications.	**5**

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

TEXT BOOKS

1. Tiana Laurence, Blockchain for Dummies, John Wiley & Sons, Second Edition, 2019.
2. Andreas Antonopoulos and Gavin Wood, Mastering Ethereum: Building Smart Contracts and Dapps, O′Reilly Publisher, First Edition, 2018

REFERENCES

1. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House, First 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	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

AD22034 **CLINICAL INFORMATION SYSTEM**

L	T	P	C
3	0	0	3

OBJECTIVES

- The objective of this course is to gain insight and situational experience with clinical information systems.
- To examine the effective use of data and information technology to assist in the migration away from paper-based systems and improve organizational performance.
- To understand the various approaches and challenges in health care systems.
- To gain insights and understanding of the impacts placed on patients and health care providers.
- To gain knowledge on data storage and retrieval of data in health care systems.

UNIT I INTRODUCTION TO CLINICAL INFORMATION SYSTEMS 9

Introduction to clinical information systems – contemporary issues in healthcare – Major trends in healthcare management – Types of Healthcare data- workflow and related tools for workflow design – Electronic Health Records (EHR) databases – Business Process Re-engineering - Healthcare IT & portable technology.

UNIT II ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN HEALTH CARE 9

Artificial intelligence in health care – Purpose of AI - healthcare industry - Electronic medical records - Clinical decision support systems – Telemedicine - Healthcare Informatics and Decision Support - Machine learning for natural language - Machine learning for vision - Human-computer interaction.

UNIT III HEALTH IT INFRASTRUCTURE 9

Data management - Hardware, software and information processing - Electronic Medical Record - Patient billing and administrative systems - Implications of HITECH and PPACA

UNIT IV PRIVACY AND SECURITY IN CLINICAL SYSTEMS 9

Foundations of IT governance - IT and business alignment - Healthcare Security Challenges - HIPAA Rules and Changes - Healthcare Data & Information - Privacy and Security for Health Information - Legal Health records - Consumer Health Informatics.

UNIT V STORAGE MANAGEMENT IN CIS 9

Data mining in health care - Big data analytics in health care - IBM Watson - Issues in sustainability and interoperability.

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 basics of clinical information systems.	**2**
CO2	To learn how to apply information technology and related tools in workflow design.	**4**
CO3	To explore the "benefits and barriers" associated with electronic health records.	**5**
CO4	Explain strategies to minimize major barriers to the adoption of electronic health records.	**4**
CO5	Explain the principles of health care data exchange and standards.	**5**

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

TEXT BOOKS

1. Edward H. Shortliffe; Leslie E. Perreault, Medical Informatics – Computer Applications in Healthcare and Biomedicine, Springer-Verlag New York Publishers, 2014
2. Karen Wager, Frances Lee, and John Glaser, Managing Health Care Information Systems" Josey-Bass Publishers, Fifth Edition, 2022.

REFERENCES

1. Arnold, M. (2016). Digital health news update: Machine learning meets health search. Decision Resources Group.
2. Blenner, S. R., Kollmer, M., Rouse, A. J., Daneshvar, N., Williams, C., Andrews, L. B. (2016) Privacy Policies of Android Diabetes Apps and Sharing of Health Information. JAMA, 315(10), 1051
3. Sittig and Ash, Clinical Information Systems – Overcoming Adverse Consequences, Jones & Bartlett Learning Publishers, 2009.

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

AD22035 **AI AND MLFOR HEALTH CARE**

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the healthcare foundation and its needs.
- Learn AI systems reliance in healthcare.
- Understand the consequences of AI in health systems.
- Know various Machine learning technologies for handling data in healthcare.
- Analyze AI and ML techniques to implement in healthcare models.

UNIT I HEALTHCARE FOUNDATIONS 9

Healthcare delivery - Healthcare financing - Healthcare policy – Handling Patient data: the journey from patient to computer - Standardized clinical codesets - Breaking down healthcare analytics: population, medical task, data format, disease.

UNIT II AI IN HEALTHCARE 9

National Academy of Medicine-Collaboration for a Value & Science-Driven Learning Health System-Digital Health Learning Collaborative-Publication Genesis, Publication Workflow-Important Definitions-AI Systems Reliance on Data-Promoting Trust, Equity, and Inclusion in Health Care AI-Publication Organization

UNIT III POTENTIAL TRADE-OFFS AND UNINTENDED CONSEQUENCES OF ARTIFICIAL INTELLIGENCE 9

Introduction-Hype Versus Hope-AI Hurts to Patients and the Health System – Reshaping of Medicine and Health-Transformation of Patient, Provider, and Computer Interactions-Acceptance, Trust, and Liability in a Human and Machine,AI Future-Health Care Provider Roles. Model Development-Learning a Model-Data Quality

UNIT IV MACHINE LEARNING FOUNDATIONS FOR HEALTHCARE 9

Model frameworks for medical decision making: Tree-like reasoning, Probabilistic reasoning and Bayes theorem, Criterion tables and the weighted sum approach, Pattern association and neural networks - Machine learning pipeline: Loading the data, Cleaning and preprocessing the data, Exploring and visualizing the data, selecting features, Training the model parameters, Evaluating model performance

UNIT V APPLICATION OF AI AND ML IN HEALTH CARE 9

Introduction0Settings for Application of AI in Health Care-Applications of AI in Clinical Care Delivery-Framework and Criteria for AI Selection and Implementation in Clinical Care. Semantic and NLP-Based Retrieval From Covid-19 Ontology, Future of Telemedicine with ML: Building a Telemedicine Framework for Lung Sound Detection

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 healthcare policy to standardize the clinical code sets.	**3**
CO2	Apply reliance to the data in healthcare AI	**3**
CO3	Implementing models of human and artificial intelligence, specifically computational models of intelligence.	**3**
CO4	Develop applications to help with diagnosis, treatment, and monitoring of diseases through machine intelligence algorithms	**3**
CO5	Design a suitable model for real-time healthcare applications.	**3**

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

TEXT BOOKS

1. Kumar, Vikas Vik. Healthcare Analytics Made Simple: Techniques in healthcare computing using machine learning and Python. Packt Publishing Ltd, 2018.
2. Michael Matheny,Sono Thadaney Israni,Mahnoor Ahmed, Danielle Whicher, Artificial Intelligence in Health Care, National Academy of Medicine,2022.

REFERCENCES

1. Arjun Parnesar, Machine Learning and AI for Healthcare,Apress,2019.
2. Dolores Derrington,Artificial Intelligence for Health and Health Care, JASON,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	2	-	2	-	-	-	-	-	-	2	-
2	3	3	3	2	-	2	-	-	-	-	-	-	2	-
3	3	3	3	2	-	2	-	-	-	-	-	-	2	-
4	3	3	3	2	1	2	-	-	-	-	-	-	2	2
5	3	3	3	2	1	2	-	-	-	-	-	-	2	2

3-High, 2-Medium, 1-Low

AD22036 DATA SCIENCE IN INTELLIGENT HEALTHCARE

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand the role of data science in healthcare.
- Learn data collection and prediction models.
- Understand the classification algorithm and data science technology.
- Know various technologies for handling data in health data science.
- Analyze the advancement of data science in healthcare.

UNIT I DATA SCIENCE IN HEALTHCARE 9

Introduction-Background and history-Conflicting perspectives of a Data Scientist in Healthcare- Data analytical processes- Major types of analytics-Biomedical data science tools science challenges-Benefits of Data Science in Healthcare- Use Cases of Data Science in Healthcare

UNIT II DATA TO MODEL 9

Data collection-Data sources- Data at scale- standards in healthcare data- Preparing data for predictive modeling- Extracting features from Time Series- Prediction modeling methodology- Diving deeper into models- Reporting standards and critical appraisals of predictive models.

UNIT III CLASSIFICATION ALGORITHM AND SPECIFIC TECHNOLOGY 9

Classification algorithm- Performance analysis using medical examples- Role of deep learning in improving healthcare- Data-to-Text technology- Clinical Natural language processing-Innovative tools to gather health-relevant data- Integrating health data sources.

UNIT IV R FOR HEALTH DATA SCIENCE 9

Summarizing data- Data analysis- Workflow with continuous outcome variables- one sample t-tests-Multiple testing- non-parametric tests- Finafit approach- Linear regression- Categorical outcome variable- Logistic regression- The problem of missing data- Encryption

UNIT V ADVANCED DATA SCIENCE FOR HEALTHCARE 9

Discovering drugs- Virtual assistance- Wearables- Tracking Patient Health- Diagnostics- Predictive Analytics in Healthcare- Medical Image Analysis- Medical Data Privacy and Detecting Fraud- -Case Study: Value-Based Health Care Supported by Data Science

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 role of data science in healthcare.	**3**
CO2	Apply prediction model in data collection and extracting feature.	**3**
CO3	Applying innovative tools in data collection and implementing classification algorithms.	**3**
CO4	Develop applications using R.	**3**
CO5	Design suitable data science model for real-time healthcare.	**3**

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

TEXT BOOKS

1. Sergio Consoli, Diego Reforgiato Recupero, Milan Petkovic, Data Science for Healthcare Methodologies and Applications, Springer, 2019.
2. Pieter Kubben · Michel Dumontier Andre Dekker, Fundamentals of Clinical Data Science, Springer,2019.

REFERENCES

1. Ewen Harrison and Riinu Pius , R for Health Data Science, CRC Press, 2021.
2. Hari Singh, Ravindara Bhatt, Prateek Thakral, Dinesh Chander Varma, Data Science for Effective healthcare systems, CRC Press, 2023.

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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

AD22037 **SMART AND INTERACTIVE HEALTHCARE TECHNOLOGIES**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the types of sensors in healthcare technologies.
- To understand the different applications and metrics of connected healthcare Devices.
- To understand the Data Analytics in Healthcare.
- To understand the types of Cyber Attacks.
- To understand the methods of cryptographic algorithms for secured Medical Devices.

UNIT I SENSORS IN HEALTHCARE 9

Introduction – IoT and Digitization – IoT Architectures – The Core IoT Functional Stack - Sensors and Actuators– Smart Objects – Connecting Smart Objects - Medical Sensors and Bio Sensors – Immuno Sensors – DNA Bio Sensors – Nano BioSensors – Types of Medical Sensors – Case Studies: Biometric Identity Management for patients, Medical Data Securities.

UNIT II HEALTHCARE STRATEGIES 9

Basic Concepts, Health Care Metrics – Impact of IoT in Health Care – Smart Medical Devices – Remote Monitoring in Smart Connected Devices – Challenges in Interactive HealthCare – Data Security in Healthcare – Protocols in Medical Data Security, Performance metrics in protocols.

UNIT III DATA ANALYTICS IN HEALTHCARE 9

Introduction to Data Analytics – Types of Data Analytics, Descriptive Analytics – Predictive Analytics – Prescriptive Analytics – Discovery Analytics - Random Forest Method – K – Nearest Neighbors(KNN) – Kernal Density Estimator.

UNIT IV CYBER ATTACKS IN SMART HEALTHCARE SYSTEM 9

Authentication and Authorization in HealthCare Applications, Data Auditing – Data Authentication – Sybil attacks – Man in the Middle Attacks - Medjacking Attacks - Cryptojacking Attacks, Sensor tracking attacks, Reverse Engineering Attacks, Dumpster Driving Attacks – SQL Injection Attacks – Blue Bugging Attacks – De-Synchronization Attacks – Firmware Based Attacks – Remote Access Trojan Attacks – Rainbow Table Attacks – MIoT Protocol Security features.

UNIT V SECURITIES IN SMART HEALTHCARE 9

Data Encryption and Decryption – Security and Privacy Mechanisms for Access Control, Privacy Disclosure – Data Encryption Standard - Advanced Encryption Standard - Diffie Hellman Algorithm - Elliptic Curve Cryptography – Multi-recipient public key encryption – Secret-Sharing Techniques.

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 types of sensors in healthcare technologies.	**2**
CO2	The students will be able to understand the different applications and metrics of connected healthcare Devices.	**2**
CO3	The students will be able to understand Data Analytics in Healthcare.	**3**
CO4	The students will be able to understand the types of cyber attacks in medical IoT.	**3**
CO5	The students will be able to understand the methods of cryptographic algorithms for secured Medical Devices.	**2**

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

TEXT BOOKS

1. William Stalling, "Cryptography and Network Security Principles and Practices", Pearson edition 2017.
2. David Hanes, Gonzalo Salguerio, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017.

REFERENCES

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things – A Hands-on Approach, Orient Blakswan Private, First Edition, 2015.
2. R Pass et.al, Fruitchain, "A Fair Blockchain", PODC 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	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

AD22038 **COMPUTER VISION IN HEALTHCARE APPLICATIONS**

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the Motion Analysis in healthcare.
- To understand the different applications of camera and Image Formulation.
- To understand Radiometry in Healthcare.
- To understand the Color Perception and its Effects.
- To understand Texture in healthcare Applications.

UNIT I MOTION ANALYSIS IN HEALTHCARE 9

Introduction of Computer Vision- Basics of Image Formation- Motion field of rigid objects – Notation of Optical flow – Estimating motion field – Estimation Motion Field – Horn and Schunck algorithm – Lucas and Kanade Algorithm – Using and Evaluation of Motion field –3D reconstruction- Shape from Shading and photometric stereo shape from Texture-shape from focus – Locating Object from Space.

UNIT II SENSING CAMERAS 9

Image Formation and Image Models – Pinhole Cameras – Cameras with Lenses – Sensing CCD Cameras – Sensor Models — Elements of Analytical Euclidean Geometry – Camera Parameters and the Perspective Projection, Affine Cameras – Affine Projection Equations – Geometry Camera Calibration.

UNIT III RADIOMETRY 9

Measuring Light – Light in Space – Light at Surfaces – Important Special Cases, Sources, Shadows and Shading– Qualitative Radiometry – Sources and their Effects – Local Shading Models – Photometric Stereo – Interreflections, Global Shading Models.

UNIT IV COLOR PERCEPTION 9

The Physics of Color, Color Matching, Color Receptors, Color Representation, Linear Color Spaces – Non-Linear Color Spaces, Spacial and Temporal Effects – A model for Image Color – Surface Color from Image Color.

UNIT V TEXTURE REPRESENTATION 9

Representing Texture – Analysis using Oriented Pyramids – Synthesizing Textures for Rendering – Shape from Texture – Case Studies, Medical Imaging - Diagnostic Applications - Lab Test Automation.

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 concept of motion analysis.	**2**
CO2	The students will be able to understand the different applications and metrics of connected healthcare Devices.	**2**
CO3	The students will be able to understand different applications of Cameras used in the health care industry.	**3**
CO4	The students will be able to understand the radiometry in healthcare.	**3**
CO5	The students will be able to understand the textures in Healthcare Applications.	**3**

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

TEXT BOOKS

1. Forsyth & Ponce, "Computer Vision-A Modern Approach", Pearson Education, Second Edition, 2015.

REFERENCES

1. M.K. Bhuyan, " Computer Vision and Image Processing: Fundamentals and Applications", CRC Press, First Edition 2019.
2. Richard Szeliski, "Computer Vision- Algorithms & Applications", Springer.

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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	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

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	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

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	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

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	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

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	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

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	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

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	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

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	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

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	2	2	1	1	2	-	-	-	1	1	1	2	3	3
2	2	2	2	2	2	-	-	-	1	1	1	3	3	3
3	2	3	1	2	2	-	-	-	1	1	1	2	2	3
4	2	2	2	3	2	-	-	-	1	1	1	2	2	2
5	2	3	2	2	2	-	-	-	2	1	1	3	2	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	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

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	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

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	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

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	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

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	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

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	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

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	2	3	3	3	-	-	-	3	1	3	2	3	1
2	2	3	3	2	3	-	-	-	3	2	3	2	2	1
3	1	3	2	2	1	-	-	-	3	1	1	2	1	3
4	1	2	1	3	2	-	-	-	3	3	1	1	2	1
5	2	3	1	2	1	-	-	-	3	3	3	2	1	2

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	2	3	1	-	-	2	1	-	-	2	2
2	3	1	2	1	-	-	-	-	-	1	2	2	-	1
3	3	3	3	3	3	1	-	-	2	1	-	-	2	2
4	3	3	3	3	3	-	-	-	2	-	2	3	2	2
5	1	1	3	2	3	-	-	-	2	-	-	-	1	1

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	2	2	1	3	-	-	-	1	3	3	2	2	2
2	1	1	2	3	3	-	-	-	1	2	3	1	3	2
3	2	3	2	3	3	-	-	-	2	3	1	1	3	3
4	1	2	1	2	2	-	-	-	1	2	1	3	3	3
5	3	3	3	3	3	-	-	-	3	1	1	1	3	2

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	2	2	2	1	2	1	-	-	-	1	-	-	1	-
2	1	1	2	-	-	1	-	-	-	-	-	-	1	-
3	2	2	3	1	-	1	-	-	-	2	-	-	-	-
4	3	3	2	2	2	1	-	-	-	2	-	-	2	-
5	1	1	1	-	2	1	-	-	-	-	-	-	1	-

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	2	2	2	1	2	1	-	-	-	1	-	-	1	-
2	1	1	2	-	-	1	-	-	-	-	-	-	1	-
3	2	2	3	1	-	1	-	-	-	2	-	-	-	-
4	3	3	2	2	2	1	-	-	-	2	-	-	2	-
5	1	1	1	-	2	1	-	-	-	-	-	-	1	-

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.