R.M.K. ENGINEERING COLLEGE

[An Autonomous Institution]

R.S.M Nagar, Kavaraipettai, Gummidipoondi Taluk, Thiruvallur District, Tamil Nadu- 601 206
Affiliated to Anna University, Chennai / Approved by AICTE, New Delhi/ Accredited by NAAC with A+ Grade
An ISO 9001:2015 Certified Institution / All the Eligible UG Programs are accredited by NBA, New Delhi.

B.E. COMPUTER SCIENCE AND DESIGN

REGULATIONS - 2020

CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES

The Computer Science and Design Graduates of R.M.K. Engineering College will:

PEO 1. Apply the ideologies of computer science, system design, mathematics, science and basic engineering to solve real world problems.

PEO 2. Act as a member of multi-disciplinary teams and implement efficient system design technology solutions in global standards.

PEO 3. Shine in the field of software design industry or in higher studies with the essence of Computer Science and Design.

PEO 4. Have ethics, leadership and social responsibility with an appropriate insight of the varying public needs.

PROGRAMME OUTCOMES (POs)

On successful completion of the programme,

Engineering Graduates will be able to:

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 analyze 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 engineering activities 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 responsibilities relevant 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

After the successful completion of the program, the graduates will be able to:

- Apply knowledge acquired from the basic system design and core software areas of Computer Science and Design for solving real world problems.

- Apply recent technologies and robust analytical skills to produce quality software in scientific and business applications.

- Excel in emerging computer languages and design methodologies for innovative career paths as an entrepreneur and pursue higher studies.

Mapping of POs/PSOs to PEOs

Contribution   1: Reasonable   2: Significant   3: Strong

PEOs & POs

The B.E. Computer Science and Design program outcomes leading to the achievement of the objectives are summarized in the following table.

PROGRAM EDUCATIONAL OBJECTIVES	PROGRAM OUTCOMES											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
I	3	3	3	3	2	2	2	1	1	1	1	1
II	3	3	3	3	2	1	1	1	3	3	1	3
III	3	3	3	3	2	2	2	3	3	3	2	1
IV	2	2	2	2	2	3	2	3	3	1	1	1

PROGRAM EDUCATIONAL OBJECTIVES	PROGRAM SPECIFIC OUTCOMES		
	PSO1	PSO2	PSO3
I	3	3	3
II	2	3	2
III	3	3	3
IV	1	1	1

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Course Outcomes and Programme Outcomes is given in the following table.

YEAR	SEMESTER	COURSE NAME	Programme Outcome (PO)											
			1	2	3	4	5	6	7	8	9	10	11	12
YEAR I	SEMESTER 1	Communicative English & Life Skills		✓							✓	✓		✓
		Engineering Mathematics I	✓	✓	✓	✓	✓	✓	✓					✓
		Physics for Computer Science and Information Technology	✓	✓	✓	✓								
		Engineering Chemistry	✓	✓				✓	✓					✓

Year	Semester	Course	1	2	3	4	5	6	7	8	9	10	11	12
		Problem Solving and C Programming	✓	✓	✓						✓			✓
		Basic Electrical, Electronics and Measurement Engineering	✓	✓	✓						✓			✓
		Induction Program						✓	✓	✓	✓	✓	✓	✓
		Physics & Chemistry Laboratory	✓	✓			✓				✓			✓
		C Programming Laboratory	✓	✓	✓						✓			✓
		Interpersonal Skills - Listening & Speaking									✓	✓		✓
	SEMESTER 2	Technical English									✓		✓	✓
		Engineering Mathematics II	✓	✓	✓	✓	✓	✓						✓
		Environmental Science and Engineering	✓	✓			✓	✓				✓		✓
		Computer Aided Engineering Graphics	✓		✓		✓					✓		
		Data Structures	✓	✓	✓									✓
		Python Programming (Lab Integrated)	✓	✓	✓		✓			✓	✓	✓		✓
		Engineering Practices Laboratory	✓	✓	✓						✓			✓
		Data Structures Laboratory	✓	✓	✓					✓	✓	✓		✓
		Advanced Reading & Writing									✓	✓		✓
YEAR II	SEMESTER 3	Discrete Mathematics	✓	✓	✓	✓								
		Digital Principles and Computer Architecture	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
		Database Management Systems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Object Oriented Programming	✓	✓	✓									
		Design Thinking	✓	✓	✓	✓	✓	✓	✓					
		Universal Human Values-2: Understanding Harmony						✓	✓	✓	✓	✓	✓	✓
		Database Management Systems Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Object Oriented Programming Laboratory	✓	✓	✓					✓	✓	✓		✓
		Mini Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Year	Semester	Course	1	2	3	4	5	6	7	8	9	10	11	12
		Aptitude and Coding Skills - I	✓	✓							✓	✓		
	SEMESTER 4	Probability and Statistics	✓	✓	✓	✓					✓	✓		✓
		Human Computer Interaction	✓	✓	✓	✓	✓	✓	✓					
		Design and Analysis of Algorithms	✓	✓	✓	✓	✓				✓			✓
		Design Programming (Lab Integrated)	✓	✓	✓	✓	✓				✓			✓
		Information Design and Visualization	✓	✓	✓	✓	✓	✓	✓					
		Operating System Design	✓	✓	✓	✓	✓	✓	✓					
		Information Design and Visualization Laboratory	✓	✓	✓	✓	✓	✓	✓		✓			✓
		Operating System Design Laboratory	✓	✓	✓	✓	✓	✓	✓		✓			✓
		Internship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Aptitude and Coding Skills - II	✓	✓							✓	✓		
YEAR III	SEMESTER 5	Web Technology	✓		✓	✓	✓	✓			✓		✓	✓
		Computer Graphics and Animation	✓		✓	✓	✓	✓			✓			✓
		Augmented and Virtual Reality(Lab Integrated)	✓	✓	✓		✓	✓			✓		✓	✓
		Open Elective I*												
		Professional Elective I												
		Computer Graphics and Animation Laboratory	✓		✓	✓	✓	✓			✓			✓
		Web Technology Laboratory	✓		✓	✓	✓	✓			✓		✓	✓
		Advanced Aptitude and Coding Skills – I	✓	✓							✓	✓		
		Mini Project and Design Thinking Practices Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SEMESTER 6	Compiler Design (Lab integrated)	✓	✓	✓	✓					✓			✓
		Computer Networks(Lab Integrated)	✓	✓	✓		✓				✓	✓	✓	✓
		Mobile Computing(Lab Integrated)	✓	✓	✓		✓				✓	✓	✓	✓
		Professional Elective II												
		Professional Elective III												

YEAR	SEM	Course												
		Advanced Aptitude and Coding Skills - II	✓	✓	✓						✓	✓		
		Internship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
YEAR IV	SEMESTER 7	Cloud Computing(Lab Integrated)	✓	✓	✓		✓				✓	✓	✓	✓
		Open Elective II*												
		Professional Elective IV												
		Professional Elective V												
		Professional Elective VI												
	SEMESTER 8	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

PROFESSIONAL ELECTIVE

		COURSE NAME	Programme Outcome (PO)											
			1	2	3	4	5	6	7	8	9	10	11	12
YEAR III	SEMESTER 5 / SEMESTER 6	Game Artificial Intelligence	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
		Social, Text and Media Analytics	✓		✓	✓			✓		✓	✓		✓
		Multimedia Security	✓		✓	✓			✓			✓		✓
		UI/UX Design(Lab Integrated)	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
		Product Centric Agile Development (Lab Integrated)	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
		3D Printing and Design	✓	✓	✓		✓		✓		✓		✓	✓
		Artificial Intelligence	✓	✓	✓	✓	✓		✓			✓	✓	✓
		Cyber Physical Systems	✓		✓	✓			✓		✓	✓		✓
		Web Security	✓		✓	✓			✓		✓	✓		✓
		Natural Language Processing	✓								✓	✓		✓
		Image Processing	✓	✓	✓	✓	✓		✓			✓	✓	✓
		Computer Vision	✓				✓	✓	✓		✓	✓		✓
		Software Project Management	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
		High Performance Computing	✓		✓	✓			✓			✓		✓
		Internet of Things	✓	✓	✓	✓	✓		✓		✓	✓		✓
		Introduction to innovation, IP Management and Entrepreneurship	✓	✓				✓	✓	✓	✓			✓
		Professional Ethics in Engineering	✓	✓				✓	✓	✓	✓			✓
		Principles of Management	✓	✓				✓	✓	✓	✓	✓		✓
		Essence of Indian Traditional Knowledge	✓	✓				✓	✓	✓	✓			✓
		Software Quality Assurance	✓	✓	✓			✓		✓	✓	✓	✓	✓
		Semantic Web	✓		✓	✓			✓		✓	✓		✓

Year	Semester	Course	1	2	3	4	5	6	7	8	9	10	11	12
		Block Chain Technologies	✓		✓				✓		✓	✓		✓
YEAR IV	SEMESTER 7	Large Scale Information Storage and Retrieval	✓					✓	✓		✓	✓		✓
		GPU Computing	✓	✓	✓			✓	✓		✓	✓		
		Digital Marketing	✓	✓				✓	✓	✓	✓	✓		✓
		3D Modelling and Design(Lab Integrated)	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
		Optimization algorithms based Design	✓	✓	✓	✓	✓		✓		✓	✓	✓	
		Design Patterns	✓	✓				✓	✓	✓	✓	✓		
		Game Design(Lab Integrated)	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
		Design of Embedded Systems	✓	✓	✓		✓	✓	✓		✓	✓	✓	
		Web Development Frameworks	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
		Intelligent Robots	✓				✓	✓	✓		✓	✓	✓	✓
		Bigdata and Cloud Databases	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
		Pattern Recognition	✓	✓				✓	✓	✓	✓	✓		
		Computational Intelligence	✓				✓	✓	✓		✓	✓	✓	✓
		Intelligent Agent Technology	✓	✓			✓	✓	✓		✓	✓	✓	✓
		Service Oriented Architecture	✓	✓	✓			✓	✓		✓	✓		
		Image and Video Analytics	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
		Nature Inspired Computing Techniques	✓				✓	✓	✓		✓	✓	✓	✓
		Game Theory & Programming	✓	✓				✓	✓		✓	✓		
		Lean Six Sigma	✓	✓	✓				✓	✓	✓	✓		
		Indian Constitution	✓	✓	✓				✓	✓	✓	✓	✓	
		Machine Learning	✓	✓	✓	✓	✓		✓		✓	✓	✓	
		Professional Readiness For Innovation, Employability And Entrepreneurship	✓	✓	✓		✓		✓		✓	✓	✓	

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B.E. COMPUTER SCIENCE AND DESIGN

REGULATIONS - 2020

CHOICE BASED CREDIT SYSTEM

I - VIII SEMESTERS CURRICULAM & I - IV SYLLABI

SEMESTER I

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20EL101	Communicative English & Life Skills	HS	2	2	0	0	2
2.	20MA101	Engineering Mathematics - I	BS	5	3	2	0	4
3.	20PH101	Physics for Computer Science and Information Technology	BS	3	3	0	0	3
4.	20CH101	Engineering Chemistry	BS	3	3	0	0	3
5.	20GE101	Problem Solving and C Programming	ES	3	3	0	0	3
6.	20EE102	Basic Electrical, Electronics and Measurement Engineering	ES	3	3	0	0	3
7.		Induction Program	MC	3 Weeks	-	-	-	-
PRACTICALS								
8.	20PC111	Physics & Chemistry Laboratory	BS	4	0	0	4	2
9.	20GE111	C Programming Laboratory	ES	4	0	0	4	2
10.	20EL111	Interpersonal Skills (Listening & Speaking)	HS	2	0	0	2	1

			TOTAL	29	17	2	10	23

SEMESTER II

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20EL201	Technical English	HS	2	2	0	0	2
2.	20MA201	Engineering Mathematics - II	BS	5	3	2	0	4
3.	20CH102	Environmental Science and Engineering	HS	3	3	0	0	3
4.	20ME103	Computer Aided Engineering Graphics	ES	6	2	0	4	4
5.	20CS201	Data Structures	PC	3	3	0	0	3
6.	20CS202	Python Programming (Lab Integrated)	ES	5	3	0	2	4
PRACTICALS								
7.	20EM111	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	20CS211	Data Structures Laboratory	PC	4	0	0	4	2
9.	20EL211	Advanced Reading & Writing	HS	2	0	0	2	1
			TOTAL	34	16	2	16	25

SEMESTER III

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20MA302	Discrete Mathematics	BS	5	3	2	0	4
2.	20AI301	Digital Principles and Computer Architecture	ES	3	3	0	0	3
3.	20IT403	Database Management Systems	PC	3	3	0	0	3
4.	20CS302	Object Oriented	PC	3	3	0	0	3

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
		Programming						
5.	20CB505	Design Thinking	PC	4	2	2	0	3
6.	20GE301	Universal Human Values-2: Understanding Harmony	HS	4	2	2	0	3
PRACTICALS								
7.	20IT412	Database Management Systems Laboratory	PC	4	0	0	4	2
8.	20CS311	Object Oriented Programming Laboratory	PC	4	0	0	4	2
9.	20CS312	Mini Project	EEC	2	0	0	2	1
10.	20CS313	Aptitude and Coding Skills - I	EEC	2	0	0	2	1
			TOTAL	34	16	6	12	25

SEMESTER IV

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20MA402	Probability and Statistics	BS	5	3	2	0	4
2.	20CS907	Human Computer Interaction	PC	3	3	0	0	3
3.	20CS402	Design and Analysis of Algorithms	PC	4	2	2	0	3
4.	20CD401	Design Programming(Lab Integrated)	PC	5	3	0	2	4
5.	20CD402	Information Design and Visualization	PC	3	3	0	0	3
6.	20CD403	Operating System Design	PC	3	3	0	0	3
PRACTICALS								
7.	20CD411	Information Design and Visualization Laboratory	PC	4	0	0	4	2
8.	20CD412	Operating System Design Laboratory	PC	4	0	0	4	2
9.	20CD413	Internship	EEC	-	-	-	-	1

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
10.	20CS414	Aptitude and Coding Skills - II	EEC	2	0	0	2	1
			TOTAL	33	17	4	12	26

SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20CD501	Web Technology	PC	3	3	0	0	3
2.	20CD502	Computer Graphics and Animation	PC	3	3	0	0	3
3.	20CD503	Augmented and Virtual Reality(Lab Integrated)	PC	5	3	0	2	4
4.		Open Elective I*	OE	3	3	0	0	3
5.		Professional Elective I	PE	3	3	0	0	3
PRACTICALS								
6.	20CD511	Computer Graphics and Animation Laboratory	PC	4	0	0	4	2
7.	20CD512	Web Technology Laboratory	PC	4	0	0	4	2
8.	20CS512	Advanced Aptitude and Coding Skills – I	EEC	2	0	0	2	1
9.	20CS513	Mini Project and Design Thinking Practices Laboratory	EEC	2	0	0	2	1
			TOTAL	29	15	0	14	22

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20CS601	Compiler Design (Lab integrated)	PC	4	2	0	2	3
2.	20CD601	Computer Networks	PC	5	3	0	2	4
3.	20CS932	Mobile Computing (Lab Integrated)	PC	4	2	0	2	3

SI. No		COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
4.		Professional Elective II	PE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
		PRACTICALS						
6.	20CS614	Advanced Aptitude and Coding Skills-II	EEC	2	0	0	2	1
7.	20CD612	Internship	EEC	-	-	-	-	1
			TOTAL	21	13	0	8	18

SEMESTER VII

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
		THEORY						
1.	20CD701	Cloud Computing (Lab Integrated)	PC	5	3	0	2	4
2.		Open Elective II*	OE	3	3	0	0	3
3.		Professional Elective IV	PE	3	3	0	0	3
4.		Professional Elective V	PE	3	3	0	0	3
5.		Professional Elective VI	PE	6	0	0	6	3
			TOTAL	20	12	0	8	16

SEMESTER VIII

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
		PRACTICALS						
1.	20CD811	Project Work	EEC	16	0	0	16	8
			TOTAL	16	0	0	16	8

TOTAL NO. OF CREDITS:163

*Course from the curriculum of other UG programmes

HUMANITIES AND SOCIAL SCIENCES (HS)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20EL101	Communicative English & Life Skills	HS	2	2	0	0	2
2.	20EL111	Interpersonal Skills (Listening & Speaking)	HS	2	0	0	2	1
3.	20EL201	Technical English	HS	2	2	0	0	2
4.	20EL211	Advanced Reading & Writing	HS	2	0	0	2	1
5.	20CH102	Environmental Science and Engineering	HS	3	3	0	0	3
6.	20GE301	Universal Human Values-2: Understanding Harmony	HS	4	2	2	0	3

BASIC SCIENCES (BS)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20MA101	Engineering Mathematics - I	BS	5	3	2	0	4
2.	20PH101	Physics for Computer Science and Information Technology	BS	3	3	0	0	3
3.	20CH101	Engineering Chemistry	BS	3	3	0	0	3
4.	20PC111	Physics & Chemistry Laboratory	BS	4	0	0	4	2
5.	20MA201	Engineering Mathematics - II	BS	5	3	2	0	4
6.	20MA302	Discrete Mathematics	BS	5	3	2	0	4
7.	20MA402	Probability and Statistics	BS	5	3	2	0	4

ENGINEERING SCIENCES (ES)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20GE101	Problem Solving and C Programming	ES	3	3	0	0	3
2.	20EE102	Basic Electrical, Electronics and Measurement Engineering	ES	3	3	0	0	3
3.	20GE111	C Programming Laboratory	ES	4	0	0	4	2
4.	20ME103	Computer Aided	ES	6	2	0	4	4

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
		Engineering Graphics						
5.	20CS202	Python Programming (Lab Integrated)	ES	5	3	0	2	4
6.	20EM111	Engineering Practices Laboratory	ES	4	0	0	4	2
7.	20AI301	Digital Principles and Computer Architecture	ES	3	3	0	0	3

PROFESSIONAL CORE (PC)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20CS201	Data Structures	PC	3	3	0	0	3
2.	20CS211	Data Structures Laboratory	PC	4	0	0	4	2
3.	20IT403	Database Management Systems	PC	3	3	0	0	3
4.	20CS302	Object Oriented Programming	PC	3	3	0	0	3
5.	20CB505	Design Thinking	PC	4	2	2	0	3
6.	20IT412	Database Management Systems Laboratory	PC	4	0	0	4	2
7.	20CS311	Object Oriented Programming Laboratory	PC	4	0	0	4	2
8.	20CS907	Human Computer Interaction	PC	3	3	0	0	3
9.	20CS402	Design and Analysis of Algorithms	PC	4	2	2	0	3
10.	20CD401	Design Programming (Lab Integrated)	PC	5	3	0	2	4
11.	20CD402	Information Design and Visualization	PC	3	3	0	0	3
12.	20CD403	Operating System Design	PC	3	3	0	0	3
13.	20CD411	Information Design and Visualization Laboratory	PC	4	0	0	4	2
14.	20CD412	Operating System Design Laboratory	PC	4	0	0	4	2
15.	20CD501	Web Technology	PC	3	3	0	0	3
16.	20CD502	Computer Graphics and Animation	PC	3	3	0	0	3
17.	20CD503	Augmented and Virtual Reality (Lab	PC	5	3	0	2	4

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
		Integrated)						
18.	20CD511	Computer Graphics and Animation Laboratory	PC	4	0	0	4	2
19.	20CD512	Web Technology Laboratory	PC	4	0	0	4	2
20.	20CS601	Compiler Design (Lab integrated)	PC	4	2	0	2	3
21.	20CD601	Computer Networks (Lab Integrated)	PC	5	3	0	2	4
22.	20CS931	Mobile Computing (Lab Integrated)	PC	4	2	0	2	3
23.	20CD701	Cloud Computing (Lab Integrated)	PC	5	3	0	2	4

PROFESSIONAL ELECTIVES (PE)

SEMESTER V/VI – PROFESSIONAL ELECTIVES – I / II /II

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20CD901	Game Artificial Intelligence	PE	3	3	0	0	3
2.	20CD902	Social, Text and Media Analytics	PE	3	3	0	0	3
3.	20CD903	Multimedia Security	PE	3	3	0	0	3
4.	20CD904	UI/UX Design(Lab Integrated)	PE	4	2	0	2	3
5.	20CD905	Product Centric Agile Development (Lab Integrated)	PE	4	2	0	2	3
6.	20CD906	3D Printing and Design	PE	3	3	0	0	3
7.	20AI401	Artificial Intelligence	PE	3	3	0	0	3
8.	20CS901	Cyber Physical Systems	PE	3	3	0	0	3
9.	20CS902	Web Security	PE	3	3	0	0	3
10.	20AI702	Natural Language Processing	PE	3	3	0	0	3
11.	20CS904	Image Processing	PE	3	3	0	0	3
12.	20CS905	Computer Vision	PE	3	3	0	0	3

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
13.	20CS906	Software Project Management	PE	3	3	0	0	3
14.	20CS911	High Performance Computing	PE	3	3	0	0	3
15.	20CS913	Internet of Things	PE	3	3	0	0	3
16.	20CB404	Introduction to innovation, IP Management and Entrepreneurship	PE	3	3	0	0	3
17.	20CE917	Professional Ethics in Engineering	PE	3	3	0	0	3
18.	20ME926	Principles of Management	PE	3	3	0	0	3
19.	20IT917	Essence of Indian Traditional Knowledge	PE	3	3	0	0	3
20.	20CS909	Software Quality Assurance	PE	3	3	0	0	3
21.	20AI911	Semantic Web	PE	3	3	0	0	3
22.	20CS920	Blockchain Technologies	PE	3	3	0	0	3

PROFESSIONAL ELECTIVES (PE)

SEMESTER VII – PROFESSIONAL ELECTIVE – IV / V /VI

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20CD907	Large Scale Information Storage and Retrieval	PE	3	3	0	0	3
2.	20CD908	GPU Computing	PE	3	3	0	0	3
3.	20CD909	Digital Marketing	PE	3	3	0	0	3
4.	20CD910	3D Modelling and Design(Lab Integrated)	PE	4	2	0	2	3
5.	20CD911	Optimization algorithms based Design	PE	3	3	0	0	3
6.	20CD912	Design Patterns	PE	3	3	0	0	3
7.	20CD913	Game Design(Lab Integrated)	PE	4	2	0	2	3

8.	20CD914	Design of Embedded Systems	PE	3	3	0	0	3
9.	20CD915	Web Development Frameworks	PE	4	2	0	2	3
10.	20AI918	Intelligent Robots	PE	3	3	0	0	3
11.	20AI909	Bigdata and Cloud Databases	PE	3	3	0	0	3
12.	20AI913	Pattern Recognition	PE	3	3	0	0	3
13.	20AI919	Computational Intelligence	PE	3	3	0	0	3
14.	20AI917	Intelligent Agent Technology	PE	3	3	0	0	3
15.	20CS922	Service Oriented Architecture	PE	3	3	0	0	3
16.	20AI915	Image and Video Analytics	PE	3	3	0	0	3
17.	20AI902	Nature Inspired Computing Techniques	PE	3	3	0	0	3
18.	20CS924	Game Theory & Programming	PE	3	3	0	0	3
19.	20CS930	Lean Six Sigma	PE	3	3	0	0	3
20.	20IT927	Indian Constitution	PE	3	3	0	0	3
21.	20AI502	Machine Learning	PC	3	3	0	0	3
22.	20IT928	Professional Readiness For Innovation, Employability And Entrepreneurship	PC	6	0	0	6	3

OPEN ELECTIVE COURSES (OE)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20CE001	Climate Change and its Impact	OE	3	3	0	0	3
2.	20CE002	Geographic Information System	OE	3	3	0	0	3
3.	20CE003	Air Pollution and Control Engineering	OE	3	3	0	0	3
4.	20CE004	Waste Water Treatment	OE	3	3	0	0	3
5.	20EC002	MATLAB Programming	OE	3	3	0	0	3
6.	20EC003	Medical Electronics	OE	3	3	0	0	3
7.	20EC004	Industrial IoT Applications	OE	3	3	0	0	3

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
8.	20EC008	Introduction to Embedded System	OE	3	3	0	0	3
9.	20EE702	Conventional & Renewable Energy Systems	OE	3	3	0	0	3
10.	20EE910	Electric and Hybrid Vehicle	OE	3	3	0	0	3
11.	20EE925	Energy Management and Auditing	OE	3	3	0	0	3
12.	20EI702	Industrial Data Networks	OE	3	3	0	0	3
13.	20EI903	Robotics and Automation	OE	3	3	0	0	3
14.	20ME001	Introduction to Nanotechnology	OE	3	3	0	0	3
15.	20CB004	Business Strategy	OE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20CS312	Mini Project	EEC	2	0	0	2	1
2.	20CS313	Aptitude and Coding Skills - I	EEC	2	0	0	2	1
3.	20CD413	Internship	EEC	-	-	-	-	1
4.	20CS414	Aptitude and Coding Skills - II	EEC	2	0	0	2	1
5.	20CS512	Advanced Aptitude and Coding Skills - I	EEC	2	0	0	2	1
6.	20CS513	Mini Project and Design Thinking Practices Lab	EEC	2	0	0	2	1
7.	20CD612	Internship	EEC	-	-	-	-	1
8.	20CS614	Advanced Aptitude and Coding Skills - II	EEC	2	0	0	2	1
9.	20CD811	Project Work	EEC	16	0	0	16	8
			TOTAL	28	0	0	28	16

SUMMARY

S.NO	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	PERCENTAGE
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	3	6	3						12	7.36%
2.	BS	12	4	4	4					24	14.72%
3.	ES	8	10	3						21	12.88%
4.	PC		5	13	20	14	10	4		66	40.49%
5.	PE					3	6	9		18	11.04%
6.	OE					3		3		6	3.68%
7.	EEC			2	2	2	2		8	16	9.81%
8.	MC										
	TOTAL	23	25	25	26	22	18	16	8	163	
9.	Non Credit/ Mandatory										

HUMANITIES AND SOCIAL SCIENCES (HS) / BASIC SCIENCES (BS) /
ENGINEERING SCIENCES (ES) / PROFESSIONAL CORE (PC) / PROFESSIONAL
ELECTIVES (PE) / OPEN ELECTIVES (OE) / EMPLOYABILITY ENHANCEMENT
COURSES (EEC) / MANDATORY COURSES (MC)

REGULATIONS – 2020(2021-22)

CURRICULUM OF B.E (HONOURS) IN

COMPUTER SCIENCE AND DESIGN WITH SPECIALIZATION IN

CREATIVE MEDIA DESIGN/ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CREATIVE MEDIA DESIGN

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20CD916	Digital Audio and Video Design (Lab Integrated)	PE	5	3	0	2	4
2.	20CD917	Film Making (Lab Integrated)	PE	5	3	0	2	4
3.	20CD918	Multimedia Data Compression and Storage (Lab Integrated)	PE	5	3	0	2	4
4.	20CD812	Capstone Project	PE	12	0	0	12	6

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
							18	18

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20AI302	Introduction to Data Science(Lab Integrated)	PE	5	3	0	2	4
2.	20AI501	Data Exploration and Visualization (Lab Integrated)	PE	5	3	0	2	4
3.	20AI703	Deep Learning Techniques (Lab Integrated)	PE	5	3	0	2	4
4.	20CD812	Capstone Project	PE	12	0	0	12	6
		TOTAL		27	9	0	18	18

REGULATIONS – 2020(2021-22)

B. E. (HONOURS) IN COMPUTER SCIENCE AND DESIGN

Additional 18 credits to be completed from the courses offered in the Professional Elective Pool I/II/III/IV/V/VI.

REGULATIONS – 2020(2021-22)

B.E. CSD WITH MINOR DEGREE

SI. No	Name of the Minor Degree	Offering Department
1.	IoT	ECE
2.	Full Stack Engineering	IT

REGULATIONS – 2020(2021-22)

MINOR DEGREE CURRICULUM OFFERED BY

DEPARTMENT OF COMPUTER SCIENCE AND DESIGN

(FOR OTHER B.E. / B.TECH PROGRAMMES)

MINOR DEGREE-VIRTUAL AND AUGMENTED REALITY

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20CD502	Computer Graphics and Animation	PC	3	3	0	0	3
2.	20CD511	Computer Graphics and Animation Laboratory	PC	4	0	0	4	2
3.	20CD913	Game Design(Lab Integrated)	PE	4	2	0	2	3
4.	20CD503	Augmented and Virtual Reality(Lab Integrated)	PE	5	3	0	2	4
5.	20CD812	Capstone Project	PE	12	0	0	12	6
		TOTAL		28	8	0	20	18

SEMESTER I

20EL101	COMMUNICATIVE ENGLISH & LIFE SKILLS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The Course will enable learners to:

- Strengthen their basic reading and writing skills.
- Comprehend listening contexts competently.
- Improve their speaking skills to speak fluently in real contexts.
- Develop vocabulary of a general kind and enhance their grammatical accuracy.

UNIT I	COMMUNICATION BASICS	06

Listening - short texts- short formal and informal conversations. Speaking- introducing oneself - exchanging personal information. Reading - practice in skimming - scanning and predicting. Writing-completing sentences - developing hints- free writing – Everyday expressions- collocations. Life Skills - Overview of Life Skills: significance of life skills.

UNIT II	COMMUNICATION INTERMEDIATE	06

Listening- telephonic conversations. Speaking – sharing information of a personal kind — greeting – taking leave. Reading – short comprehension passages - pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions / open-ended questions) - Writing – paragraph writing- topic sentence - main ideas, short narrative descriptions using some suggested vocabulary and structures. Life skills – Self-awareness: definition, need for self-awareness; Coping with Stress and Emotions.

UNIT III	COMMUNICATION VANTAGE	06

Listening – listening to longer texts and filling up the table - Speaking- asking about routine actions and expressing opinions. Reading- Long texts (cloze reading) - Writing- jumbled sentences - product description - use of reference words and discourse markers. Grammar – Tenses - phrasal verbs - Wh – Questions, yes or no questions and direct / indirect questions – countable & uncountable nouns – modal verbs. Life skills – Assertiveness vs Aggressiveness

UNIT IV	SYNERGISTIC COMMUNICATION	06

Listening - listening to dialogues or conversations and completing exercises based on them - Speaking- speaking about oneself- speaking about one's friend – Reading - different types of texts- magazines - Writing - letter writing, informal or personal letters - e-mails-conventions of personal email - Language development - synonyms – antonyms. Life Skills –Problem Solving Techniques.

UNIT V	COMMUNICATION HIGHER	06

Listening – listening to TED talks - Speaking – role play – Reading - Biographies – Writing-writing short essays (analytical & issue-based essays) – dialogue writing. Life Skills – Leadership & Decision making.

	TOTAL: 30 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Read articles of a general kind in magazines and newspapers efficiently and identify different life skills.

CO2: Participate efficiently in informal conversations and develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.

CO3: Comprehend conversations and short talks delivered in English.

CO4: Write short essays of a general kind and personal letters and emails in English.

CO5: Develop vocabulary of a general kind by enriching their reading skills.

CO6: Use appropriate thinking and problem- solving techniques to solve new problems.

TEXT BOOKS:
1. Kumar, Suresh E and Sreehari, P. Communicative English. Orient Black Swan, 2007.
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP,2015.

REFERENCES:
1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Dhanavel, S P. English and Soft Skills, Volume Two, Orient Black Swan, ISBN 978 93 528769142.
3. Elbow, Peter. Writing Without Teachers. London: Oxford University Press, 1973. Print.
4. Larry James, The First Book of Life Skills; First Edition, Embassy Books, 2016.
5. Larsen, Kristine, Stephen Hawking: A Biography, Greenwood: Publishing Group,2005.
6. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student 's Book & Workbook) Cambridge University Press, New Delhi: 2005.

20MA101	**ENGINEERING MATHEMATICS – I**	**L**	**T**	**P**	**C**
		3	**2**	**0**	**4**

OBJECTIVES:

The syllabus is designed to:
- Explain the concepts of matrix algebra.
- Make the students understand the idea of curvature, evolutes and envelopes.
- Impart the knowledge of functions of several variables.
- Introduce the concepts of Gamma and Beta integral.

- Develop an understanding on the basics of multiple integrals.

UNIT I	MATRICES	9+6

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II	APPLICATIONS OF DIFFERENTIAL CALCULUS	9+6

Curvature in Cartesian and Polar Co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes (excluding Evolute as envelope of normals).

UNIT III	FUNCTIONS OF SEVERAL VARIABLES	9+6

Limits – Continuity – Partial derivatives (excluding Euler's theorem) – Total derivative – Differentiation of implicit functions – Jacobian 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	GAMMA, BETA INTEGRALS AND APPLICATIONS	9+6

Gamma and Beta Integrals – Properties – Relation between Gamma and Beta functions, Evaluation of integrals using Gamma and Beta functions.

UNIT V	MULTIPLE INTEGRALS	9+6

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids.

	TOTAL: 75 PERIODS

OUTCOMES:

After the successful completion of the course, the student will be able to:

CO1: Diagonalize a matrix by orthogonal transformation.
CO2: Determine the Evolute and Envelope of curves.
CO3: Examine the maxima and minima of function of several variables.
CO4: Apply Gamma and Beta integrals to evaluate improper integrals.
CO5: Evaluate the area and volume by using multiple integrals.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
3. T. Veerarajan, "Engineering Mathematics", Tata McGraw Hill, 2nd Edition, New Delhi, 2011.

REFERENCES:
1. M. K. Venkataraman, "Engineering Mathematics, Volume I", 4th Edition, The National Publication Company, Chennai, 2003.
2. Sivaramakrishna Dass, C. Vijayakumari, "Engineering Mathematics", Pearson Education India, 4th Edition 2019.
3. H. K. Dass, and Er. Rajnish Verma,"Higher Engineering Mathematics", S. Chand Private Limited, 3rd Edition 2014.
4. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 6th Edition, New Delhi, 2008.
5. S.S. Sastry, "Engineering Mathematics", Vol. I & II, PHI Learning Private Limited, 4th Edition, New Delhi, 2014.

20PH101	PHYSICS FOR COMPUTER SCIENCE AND INFORMATION TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

1. To learn the fundamental concepts of physics and apply this knowledge to scientific, engineering and technological problems.

2. To make the students enrich basic knowledge in electronics and quantum concepts and apply the same in computing fields.

UNIT I	LASER AND FIBRE OPTICS	9

Population of energy levels – Einstein's A and B coefficients derivation -Resonant cavity - Optical amplification (qualitative) - Semiconductor lasers: homojunction and heterojunction- Engineering applications of lasers in data storage (qualitative).
Fibre optics: Principle, numerical aperture and acceptance angle -V-number - Types of optical fibres (Material, refractive index and mode) -Losses in optical fibre - Fibre optic communication- Fibre optic sensors (pressure and displacement).

UNIT II	MAGNETIC PROPERTIES OF MATERIALS	9

Magnetic dipole moment - atomic magnetic moments - Origin of magnetic moments- Magnetic permeability and susceptibility - Magnetic material classifications- Diamagnetism - Paramagnetism- Ferromagnetism -Antiferro magnetism- Ferrimagnetism - Ferromagnetism: Domain Theory- M versus H behaviour- Hard and soft magnetic materials - Examples and uses - Magnetic principle in computer data storage - Magnetic hard disc (GMR sensor)- Introduction to Spintronics.

UNIT III	ELECTRICAL PROPERTIES OF MATERIALS	9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity expression - Wiedemann-Franz law - Success and failures of CFT- Particle in a three dimensional box - Degenerate states - Effect of temperature on Fermi function- Density of energy states and average energy of electron at 0 K - Energy bands in solids.

UNIT IV	SEMICONDUCTOR PHYSICS	9

Intrinsic Semiconductors – Energy band diagram -Direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors- Band gap determination-Extrinsic semiconductors - n-type and p-type semiconductors (qualitative) - Variation of Fermi level with temperature and impurity concentration - Hall effect and its

applications.

UNIT V	INTRODUCTION TO NANO DEVICES AND QUANTUM COMPUTING	9

Introduction to nanomaterial -Electron density in bulk material - Size dependence of Fermi energy - Quantum confinement - Quantum structures - Density of states in quantum well, quantum wire and quantum dot structure - Band gap of nanomaterial- Tunneling: single electron phenomena and single electron transistor - Quantum dot laser.
Quantum computing: Introduction - Differences between quantum and classical computation.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Know the principle, construction and working of lasers and their applications in fibre optic communication.

CO2: Understand the magnetic properties of materials and their specific applications in computer data storage.

CO3: Analyze the classical and quantum electron theories and energy band structures.

CO4: Evaluate the conducting properties of semiconductors and its applications in various devices.

CO5: Comprehend the knowledge on quantum confinement effects.

CO6: Apply optical, magnetic and conducting properties of materials, quantum concepts at The nanoscale in various applications.

TEXT BOOKS:

1. M.N. Avadhanulu and P.G. Kshirsagar, "A text book of Engineering Physics", S. Chand and Company, New Delhi, 2014.
2. R.K. Gaur and S.L. Gupta, "Engineering Physics", Dhanpat Rai Publications (P) Ltd., Eighth Edition., New Delhi, 2001.
3. A. Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2017.
4. V. Rajendran, "Materials Science", Tata McGraw-Hill, 2011.
5. R.A.Serway and J.W. Jewett, "Physics for Scientists and Engineers", Ninth Edition., Cengage Learning, 2014.
6. C.Kittel, "Introduction to Solid State Physics", 8thEdition., John Wiley & Sons, NJ, USA, 2005.
7. G.W.Hanson, "Fundamentals of Nanoelectronics", Pearson Education,2008.

REFERENCES:

1. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", 9th Edition., John Wiley & sons, 2011.
2. R.P. Feynman, "The Feynman Lectures on Physics - Vol. I, II and III", The New Millennium Edition, 2012.
3. N.W. Aschroft and N.D.Mermin, "Solid State Physics", Harcourt College Publishers, 1976.
4. S.O. Pillai, "Solid state physics", New Age International, 2015.
5. M.A.Wahab, "Solid State Physics", 3rd Edition, Narosa Publishing House Pvt. Ltd., 2015
6. N.Garciaand A.Damask, "Physics for Computer Science Students",Springer-Verlag,2012.
7. B.Rogers, J. Adams and S.Pennathur,"Nanotechnology: Understanding Small

System", CRC Press, 2014.
8. C.P. Williams, "Explorations in Quantum Computing", Springer-Verlag London, 2011.

20CH101	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The goal of this course is to achieve conceptual understanding of the applications of chemistry in engineering and technology. The syllabus is designed to:

- Understand the role of chemistry in everyday life.
- Develop an understanding of the basic concepts of electro chemistry and its applications.
- Learn the principles and generation of energy in different types of batteries, fuel cells, nuclear reactors, solar cells and wind mills.
- Make them acquire basic knowledge of polymers, their classification and the applications of speciality polymers in engineering and technology.
- Understand the preparation, properties and applications of nanomaterials in various fields.

UNIT I	CHEMISTRY IN EVERYDAY LIFE	8

Importance of chemistry in everyday life - food additives - types (colours, preservatives, flavours and sweeteners), effects - food adulteration – types of adulteration (intentional, incidental) - effects of food adulterants – cosmetics and personal care products (fairness creams, perfumes, deodorants, shampoos)- effects – beverages-classification – carbonated beverages – nutritive values and effects.

Water – impurities – industrial uses of water – hardness, external treatment (demineralization) –
desalination (reverse osmosis).

UNIT II	ELECTROCHEMISTRY	10

Introduction – terminology - conductance of electrolytes- specific conductance, equivalent conductance, molar conductance- factors affecting conductance- origin of electrode potential- single electrode potential, standard electrode potential- measurement of single electrode potential-reference electrodes (standard hydrogen electrode, calomel electrode) - electrochemical series, applications – measurement of EMF of the cell – Nernst equation (derivation), numerical problems.

Chemical sensors – principle of chemical sensors- breath analyzer and Clark oxygen analyzer.

UNIT III	ENERGY STORAGE DEVICES AND ENERGY SOURCES	9

Batteries – primary battery (alkaline battery) - secondary battery (Pb-acid battery, Ni-metal hydride battery, Li-ion battery) - fuel cells (H_2-O_2 fuel cell).

Nuclear Energy –nuclear reactions – fission, fusion, differences, characteristics– nuclear chain reactions –light water nuclear reactor – breeder reactor.

Renewable energy sources- solar energy – thermal conversion (solar water heater and heat collector) - photovoltaic cell– wind energy.

UNIT IV	POLYMERS	9

Introduction – monomer, functionality, degree of polymerization – classification based on sources and applications – effect of polymer structure on properties - types of polymerization (addition, condensation) - thermoplastic and thermosetting resins –

preparation, properties and applications of Teflon, polyvinyl chloride, polycarbonate, Bakelite.

Special polymers - biodegradable polymers - properties and applications of polycaprolactone, polyhydroxyalkanoate – properties and applications of electrically conducting polymers (poly aniline, polyvinylidene fluoride).

UNIT V	NANOCHEMISTRY	9

Introduction – synthesis – top-down process (laser ablation, chemical vapour deposition), bottom-up process (precipitation, electrochemical deposition) – properties of nanomaterials – types (nanorods, nanowires, nanotubes-carbon nanotubes, nanocomposites).

Applications of carbon nanotubes – applications of nanomaterials in electronics, information technology, medical and healthcare, energy, environmental remediation, construction and transportation industries.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Illustrate the role of chemistry in everyday life and the industrial uses of water.

CO2: Construct electrochemical cells and to determine the cell potential.

CO3: Compare and analyse the different energy storage devices and to explain potential energy sources.

CO4: Classify different types of polymeric materials and to discuss their properties and applications.

CO5: Explain basic concepts of nanochemistry and to enumerate the applications of nanomaterials in engineering and technology.

TEXT BOOKS:

1. P. C. Jain and Monika Jain, "Engineering Chemistry", 17th edition, Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 2018.
2. Prasanta Rath, "Engineering Chemistry", 1st edition, Cengage Learning India Pvt. Ltd., Delhi, 2015.

REFERENCES:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", 12th edition, S. Chand & Company, New Delhi, 2010.
2. Kirpal Singh, "Chemistry in daily life", 3rd edition, PHI Learning Pvt. Ltd., 2012.
3. J. C. Kuriacose and J. Rajaram, "Chemistry in Engineering and Technology", Volume-1 & Volume -2, Tata McGraw-Hill Education Pvt. Ltd., 2010.
4. Geoffrey A. Ozin, Andre C. Arsenault, Ludovico Cademartiri, "Nanochemistry: A Chemical Approach to Nanomaterials", 2nd edition, RSC publishers, 2015.
5. Prasanna Chandrasekhar, "Conducting polymers, fundamentals and applications - A Practical Approach", 1st edition, Springer Science & Business Media, New York, 1999.

20GE101	PROBLEM SOLVING AND C PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:	

OBJECTIVES:

The syllabus is designed to:

- To make the students understand the fundamentals of problem solving using Algorithm and Flowchart.
- To teach the basic programming constructs for solving simple problems.
- To introduce the basic concepts of arrays and strings.
- To acquaint the students about functions, pointers, structures and their relationship.
- To impart knowledge on the concepts of file handling.

UNIT I	INTRODUCTION TO ALGORITHM AND C	9

Introduction to Computer System – Block diagram, Program Development Life Cycle

General problem Solving concepts: Algorithm and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops.

Imperative languages: Introduction to imperative language, syntax and constructs of a specific language (ANSI C), Applications

Types, Operators: Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations, Basic I/O using scanf, printf, Operators – Types, Precedence, Associativity, Proper variable naming and Hungarian Notation.

UNIT II	CONTROL FLOW STATEMENTS	7

Control Flow with discussion on structured and unstructured programming: Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, goto labels, structured and unstructured programming.

UNIT III	ARRAYS AND FUNCTIONS	10

Arrays and Strings – Initialization, Declaration – One Dimensional and Two-Dimensional arrays – Linear search, Binary Search, Matrix Operations (Addition and Subtraction)

Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation, Recursion, Pre-processor, Standard Library Functions and return types.

UNIT IV	STRUCTURES AND POINTERS	10

Basic Structures, Structures and Functions, Array of structures.

Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Initialisation of Pointer Arrays, Command line arguments, Pointer to functions, complicated declarations and how they are evaluated.

Pointer of structures, Self-referential structures, Table look up, typedef, unions, Bit-fields

UNIT V	FORMATTED I/O AND FILE PROCESSING	9

Formatted Output – fprintf, Formated Input – fscanf, Variable length argument list- Files - file access including FILE structure, fopen, fread, fwrite, stdin, sdtout and stderr, File Types – Text, Binary - Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

       CO1: Develop algorithmic solutions to simple computational problems

       CO2: Develop simple applications using basic constructs

CO3: Write programs using arrays and strings

CO4: Design and implement applications using functions, pointers and structures.

CO5: Design applications using sequential and random-access file processing.

TEXT BOOKS:

1. Brian W Kernighan and Dennis M Ritchie, The C Programming Language, Pearson Education India, 2nd Edition, 2015.

2. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.

REFERENCES:

1. B. Gottfried, Programming with C, Schaum Outline Series, Fourth Edition, 2018

2. Herbert Schildt, C: The Complete Reference, McGraw Hill, Fourth Edition, 2017

3. Yashavant Kanetkar, Let Us C, BPB Publications, 16th Edition, 2018.

4. Reema Thareja, "Programming in C", 2nd Edition, Oxford University Press, 2018.

5. Zed A. Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (like C)", (Zed Shaw's Hard Way Series), 1st Edition, Addison-Wesley Professional, 2015.

20EE102	BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The syllabus is designed to:

- To impart knowledge on fundamentals of electrical circuits and its analysis
- To interpret the basic principles of electrical machines and their performance
- To examine the different energy sources and protection methods
- To explore the different types of electronic circuits and its characteristics
- To acquire knowledge on the principles and operation of measuring instruments and transducers

UNIT I	ELECTRICAL CIRCUITS ANALYSIS	9

Ohms Law, Kirchhoff's Law- power- series and parallel circuit analysis with resistive, capacitive and inductive network - nodal analysis, mesh analysis- - star delta conversion.

UNIT II	POWER SYSTEM	9

Power Generation -Thermal-Hydro-wind and solar. construction and working principle. Protection-need for earthing, fuses and circuit breakers. Energy Tariff calculation for domestic loads.

UNIT III	ELECTRICAL MACHINES	9

DC Generator-Types, Construction, working principle, EMF equation, DC Motor- working Principle, - Three Phase Induction Motors- Types, Construction, working principle- Single Phase Induction Motors, –working Principle -Transformers-Types and construction, EMF equation- Basics of Stepper Motor- applications of various machines

UNIT IV	ELECTRONIC CIRCUITS	9

PN Junction-VI Characteristics of Diode, Rectifier- zener diode, Transistors OPAMP- configuration, differentiator, integrator, ADC- Types, Successive approximation type, DAC-

Types, Weighted resistor DAC and R-2R ladder type, Voltage regulator IC using LM 723, LM 317.

UNIT V	ELECTRICAL MEASUREMENT	9

Characteristic of measurement-errors in measurement, torque in indicating instruments- moving coil and moving iron meters, Induction type Energy meter and Dynamometer watt meter. Transducers- classification-Thermocouple, RTD, Strain gauge, LVDT, LDR and piezoelectric. Oscilloscope-CRO.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Analyse the electric circuits.

CO2: Classify the different types of electric machines and transformers

CO3: Study the different type of renewable sources and common domestic loads.

CO4: Acquire knowledge in basics of electronic circuits.

CO5: Describe the different types of measuring instruments and transducers.

TEXT BOOKS:

1. S.K.Bhattacharya, Basic Electrical and Electronics Engineering, Pearson (Covers Units 1,2,4 and 5)
2. C L Wadhwa, Generation Distribution and Utilization of Electrical Energy, New Age International: Unit 3 except Domestic refrigerator and air conditioner - construction and working principle)

REFERENCES:

1. S.B. Lal Seksena and Kaustuv Dasgupta, Fundaments of Electrical Engineering, Cambridge, 2016
2. B.L Theraja, Fundamentals of Electrical Engineering and Electronics. Chand & Co
3. S.K.Sahdev, Basic of Electrical Engineering, Pearson
4. John Bird, ―Electrical and Electronic Principles and Technology‖, Fourth Edition, Elsevier,
5. Mittle,Mittal, Basic Electrical Engineering‖, 2nd Edition, Tata McGraw-Hill Edition, 2016.
6. R.S Khurmi and J K Gupta, Textbook of Refrigeration and Air-conditioning (M.E.), S Chand & Co

20PC111	PHYSICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

The syllabus is designed to:

- Introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter, semiconductors and liquids.

LIST OF EXPERIMENTS (Any five experiments to be conducted)

1. Determination of wavelength and velocity of ultrasonic waves by Ultrasonic Interferometer.
2. Determination of thermal conductivity of a poor conductor by LEE'S Disc method.
3. (i) Determination of wavelength and divergence angle of semiconductor laser source using diffraction grating.

   (ii) Determination of particle size by using diffraction of semiconductor laser beam.

   (iii) Analysis of Numerical aperture and acceptance angle of an optical fiber.
4. Determination of Young's Modulus of a beam by non-uniform bending method.
5. Determination of the moment of inertia of the disc and rigidity modulus of wire by Torsional pendulum.
6. Spectrometer - Determination of wavelength of Mercury Spectrum using diffraction grating.
7. Determination of thickness of wire by air wedge method.
8. Determination of Young's Modulus of a beam by Uniform bending method.
9. Determination of band gap of a semiconductor.

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, based on hands-on experience of the students,

they will be able to

CO1: Use the ultrasonic interferometer and to determine the wavelength and velocity of ultrasonic waves of a liquid.

CO2: Examine the thermal conductivity of a bad conductor.

CO3: Determine the wavelength of mercury spectrum and also determine the wavelength of a laser source, particle size, divergence angle of semiconductor laser source using diffraction grating and to analyze the numerical aperture and acceptance angle of an optical fiber.

CO4: Examine the Young's modulus of a beam by uniform and non-uniform bending and to estimate the moment of inertia of the disc and rigidity modulus of wire by torsional pendulum.

CO5: Calculate the thickness of a thin wire by the interference pattern.

CO6: Determine the band gap of a semiconductor.

REFERENCES:

1. Physics laboratory manual, Department of Physics, R.M.K. Engineering College, 2019.
2. Wilson J.D. and Hernandez C.A., - Physics Laboratory Experiments, Houghton Mifflin Company, New York, 2005.

20PC111	CHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

The syllabus is designed to:

- To make the students acquire practical skills through volumetric and instrumental analysis.

LIST OF EXPERIMENTS (Any five experiments to be conducted)

1. Determination of total, temporary and permanent hardness of water by EDTA method.
2. Conductometric titration of strong acid vs. strong base.
3. Determination of strength of acids in a mixture using a conductivity meter.
4. Determination of strength of given hydrochloric acid using a pH meter.
5. Estimation of the iron content of the given solution using a potentiometer.
6. Estimation of the iron content of the water sample using a spectrophotometer (thiocyanate method).
7. Estimation of sodium present in water using a flame photometer.
8. Determination of the molecular weight of polyvinyl alcohol using Ostwald viscometer.
9. Determination of corrosion rate by weight loss method.
10. Determination of flash and fire point of a lubricating oil (Pensky Martens apparatus).
11. Determination of concentration of a given solution by constructing a galvanic cell.

| | **TOTAL: 30 PERIODS** |

OUTCOMES:

Based on hands-on experience, students will be able to:

CO1: Analyse the given hard water sample and estimate different types of hardness present.

CO2: Observe and analyse the change in conductivity of an acid(s) when added with base through conductometry.

CO3: Examine the change in pH when an acid is added with a base using pH meter.

CO4: Understand the redox reactions and its impact on emf values through potentiometry.

CO5: Determine the flash and fire point of an oil.

CO6: Assess the corrosion rate of a given metal.

CO7: Construct an electrochemical cell to determine the concentration of the given solution.

REFERENCES:

1. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas and B. Sivasankar, "Vogel's Quantitative Chemical Analysis", 6th edition, Pearson Education Pvt. Ltd., 2009.

20GE111	C PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

The syllabus is designed to:

- To make the students write simple programs using basic constructs
- To familiarize the concepts of strings, pointers, functions and structures
- To equip the students on the knowledge of file processing concepts

LIST OF EXPERIMENTS:

1. Constructing Flow charts using RAPTOR tools.
2. Programs using I/O statements and expression
3. Write a program to find whether the given line is horizontal or vertical.
4. Write a program to calculate the distance between two points p1(x1,y1), p2(x2,y2).
5. Write a program to calculate the force for the given mass and acceleration.
6. Write a program to calculate the Young's modulus.
7. Write a program to calculate the type of solution based on its pH value.
8. Write a program to temperature conversion (Fahrenheit to Celsius and vice versa)
9. Programs using decision-making constructs.
10. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
11. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
12. Check whether a given number is Armstrong number or not?
13. Given a set of numbers like, find sum of weights based on the following conditions.
    - 5 if it is a perfect cube.
    - 4 if it is a multiple of 4 and divisible by 6.
    - 3 if it is a prime number.

    Sort the numbers based on the weight in the increasing order as shown below

    <10, its weight>, <36, its weight>, <89, its weight>
14. Populate an array with height of persons and find how many persons are above the average

    height.
15. Populate a two dimensional array with height and weight of persons and compute the Body

    Mass Index of the individuals.
16. Given a string —a$bcd./fg‖ find its reverse without changing the position of special characters.(Example input:a@gh%;j and output:j@hg%;a)
17. Convert the given decimal number into binary, octal and hexadecimal numbers using user

    defined functions.
18. From a given paragraph perform the following using built-in functions:

    a. Find the total number of words.

    b. Capitalize the first word of each sentence.

    c. Replace a given word with another word.
19. Solve towers of Hanoi using recursion.
20. Sort the list of numbers using pass by reference.
21. Generate salary slip of employees using structures and pointers. Create a structure Employee with the following members:

    EID, Ename, Designation, DOB, DOJ, Basicpay

    Note that DOB and DOJ should be implemented using structure within structure.
22. Compute internal marks of students for five different subjects using structures and functions.

23. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
24. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
25. Mini project: Create a —Railway reservation system with the following modules
    - Booking
    - Availability checking
    - Cancellation
    - Prepare chart

	TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Write programs for simple applications making use of basic constructs, arrays and strings.

CO2: Develop programs involving functions, recursion, pointers, and structures.

CO3: Create applications using sequential and random-access file processing.

SOFTWARE REQUIREMENTS:

Turbo C

20EL111	**INTERPERSONAL SKILLS (LISTENING & SPEAKING)**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

OBJECTIVES:

The Course will enable learners to:

- Equip and strengthen the English language skills.
- Provide guidance and practice to engage in specific academic speaking activities and enhance
- Writing skills with specific reference to technical writing (interview skills).
- Improve general and academic listening skills.
- Demonstrate their presentation skills competently.

UNIT I		**6**

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics - taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II		**6**

Listen to a process information- give information, as part of a simple explanation – conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III		**6**

Deliver a five-minute informal talk - greet - respond to greetings - describe health and

symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail.

UNIT IV		6

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and participating in conversations.

UNIT V		6

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL: 30 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Listen and respond appropriately.

CO2: Participate in group discussions.

CO3: Make effective presentations.

CO4: Participate confidently and appropriately in conversations both formal and informal.

TEXT BOOKS:

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Dhanavel, S P. English and Soft Skills, Volume Two, Orient Black Swan, ISBN 978 93 528769142.

REFERENCES:

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

SEMESTER II

20EL201	TECHNICAL ENGLISH	L	T	P	C
		2	0	0	2

OBJECTIVES:

The Course prepares second semester Engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Demonstrate their speaking skills to make technical presentations, participate in

group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT I	INTRODUCTION - TECHNICAL ENGLISH	06

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newspapers- **Writing**- purpose statements – extended definitions - writing instructions – checklists – recommendations - Vocabulary Development- technical vocabulary. Language Development –subject verb agreement - compound words.

UNIT II	READING AND STUDY SKILLS	06

Listening- Listening to longer technical talks and completing exercises based on them - **Speaking** - describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing**- interpreting charts, graphs - Vocabulary Development- vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

UNIT III	TECHNICAL WRITING AND GRAMMAR	06

Listening- Listening to classroom lectures/ talks on engineering/technology -**Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing**-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

UNIT IV	REPORT WRITING	06

Listening- Listening to documentaries and making notes. **Speaking** – mechanics of presentations-**Reading** – reading for detailed comprehension- **Writing**- Report Writing (accident and survey) - minutes of a meeting - Vocabulary Development- finding suitable synonyms-paraphrasing-. Language Development- reported speech.

UNIT V	GROUP DISCUSSION AND JOB APPLICATIONS	06

Listening- TED talks; **Speaking** –participating in a group discussion -**Reading**– reading and understanding technical articles **Writing**– email etiquette- job application – cover letter –Résumé preparation (via email and hard copy)- Vocabulary Development- verbal analogies - Language Development- clauses- if conditionals.

		TOTAL: 30 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Read technical texts and write area- specific texts effortlessly.

CO2: Listen and comprehend lectures and talks in their area of specialization successfully.

CO3: Speak appropriately and effectively in varied formal and informal contexts.

CO4: Write reports and winning job applications.

TEXT BOOKS:
1. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
2. Sudharshana. N. P and Saveetha C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

REFERENCES:
1. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford:

      2007.
2. Herbert, A. J. The Structure of Technical English.Longman.1976.
3. Kumar, Suresh. E. Engineering English. Orient Black swan: Hyderabad,2015.
4. Means, L. Thomas and Elaine Langlois, English & Communication for Colleges. Cengage Learning, USA: 2007.
5. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi,2014.

20MA201	ENGINEERING MATHEMATICS – II	L	T	P	C
		3	2	0	4

OBJECTIVES:

The syllabus is designed to:

- Explain various techniques in solving ordinary differential equations.
- Make the students understand the concepts of vector differentiation and integration.
- Introduce the concepts of Laplace transforms and its applications.
- Develop an understanding on analytic function, conformal mapping and complex integration.

UNIT I	ORDINARY DIFFERENTIAL EQUATIONS	9+6

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.

UNIT II	VECTOR CALCULUS	9+6

Gradient, divergence and curl (excluding vector identities) – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (Statement only) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT III	LAPLACE TRANSFORMS	9+6

Laplace transforms – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions – Derivatives and integrals of transforms –Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform – Convolution theorem (Statement only) – Initial and final value theorems – Solution of linear ordinary differential equation of second order with constant coefficients using Laplace transformation techniques.

UNIT IV	COMPLEX DIFFERENTIATION AND CONFORMAL MAPPING	9+6

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (Statement only) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z + k, kz, 1/z, z2 and bilinear transformation.

UNIT V	COMPLEX INTEGRATION	9+6

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Statement and applications of Cauchy's residue theorem – Evaluation of real

definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

	TOTAL: 75 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Solve the higher order linear differential equations.

CO2: Determine the gradient of a scalar field, divergence and curl of a vector fields and interpret their physical meaning and evaluate line, surface and volume integrals by vector integration.

CO3: Apply Laplace Transforms method for solving linear ordinary differential equation.

CO4: Construct an analytic function and analyze conformal mapping.

CO5: Evaluate the real integrals using complex integration.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
3. T. Veerarajan, "Engineering Mathematics", Tata McGraw Hill, 2nd Edition, New Delhi, 2011.

REFERENCES:

1. M. K. Venkataraman, "Engineering Mathematics, Volume I", 4th Edition, The National Publication Company, Chennai, 2003.
2. Sivaramakrishna Dass, C. Vijayakumari, "Engineering Mathematics", Pearson Education India, 4th Edition 2019.
3. H. K. Dass, and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Limited, 3rd Edition 2014.
4. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 6th Edition, New Delhi, 2008.
5. S.S. Sastry, "Engineering Mathematics", Vol. I & II, PHI Learning Private Limited, 4th Edition, New Delhi, 2014.

20CH102	**ENVIRONMENTAL SCIENCE AND ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

The goal of this course is to enlighten and sensitize the students on environmental conservation and social issues. The course is designed to:

• Appreciate the natural resources of environment which are inherently created for supporting life.

• Learn scientific and technological solutions to current day pollution issues.

• Study the interrelationship between living organisms and environment

• Understand the integrated themes of biodiversity.

• Appreciate the importance of environment by assessing its impact on the human

world; envision the surrounding environment, its functions and its value.

UNIT I	NATURAL RESOURCES	11

Introduction - scope and importance of environment – need for public awareness.

Forest resources- Use and over-exploitation, deforestation - timber extraction, mining, dams and their effects on forests and tribal people. **Water resources** - Use and over-utilization of surface and ground water, conflicts over water, dams-benefits and problems. **Mineral resources**- Use and exploitation, environmental effects of extracting and using mineral resources. **Food resources**- World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. **Energy resources** - Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. **Land resources**- Land as a resource, land degradation, soil erosion and desertification – role of an individual in conservation of natural resources - case studies.

UNIT II	POLLUTION AND ITS MANAGEMENT	11

Pollution – causes, effects and control measures - Air pollution- Water pollution - Soil pollution - Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards - nuclear accidents and holocaust - role of an individual in prevention of pollution – case studies.

Waste management - causes, effects and control measures of municipal solid wastes, e-waste, plastic waste.

UNIT III	ECOSYSTEMS AND BIODIVERSITY	9

Introduction to ecosystems – structure and function of an ecosystem – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids - types, characteristic features, structure and functions of - Forest ecosystem - Grassland ecosystem - Desert ecosystem - Aquatic ecosystems (lakes, oceans)

Introduction to biodiversity – types (genetic, species and ecosystem diversity) –values of biodiversity – threats to biodiversity - endangered and endemic species – conservation of biodiversity (in-situ and ex-situ conservation) - India as a mega-diversity nation – hot-spots of biodiversity in India

UNIT IV	SOCIAL ISSUES AND THE ENVIRONMENT	8

Sustainable development – sustainable development goals - water conservation, rain water harvesting, watershed management – resettlement and rehabilitation - consumerism and waste products, value education.

Disaster management- floods, drought, earthquake, tsunami, cyclone and landslides - case studies.

Environmental ethics- issues and possible solutions – environment protection act – air (prevention and control of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act.

UNIT V	HUMAN POPULATION AND THE ENVIRONMENT	6

Introduction - population growth, variation among nations, population explosion, family welfare programme – women and child welfare - environment and human health – endemic/epidemic/pandemic, COVID – 19, HIV / AIDS– role of information technology in environment and human health –environmental impact assessment- case studies.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Illustrate the importance and conservation of natural resources.

CO2: Assess the impact of various pollutants and suggest appropriate pollution control methods.

CO3: Explain the basic structure of ecosystem and the conservation of biodiversity.

CO4: Analyze the social issues related to environment and recommend suitable solutions.

CO5: Investigate the trends in population explosion and assess its impact.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik, "Perspectives in environmental studies", New Age International, 6th edition, 2018.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2017.
3. Gilbert M. Masters, Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2015.

REFERENCES:

1. William P. Cunningham and Mary Ann Cunningham, "Environmental Science: A Global Concern", McGraw Hill, 14th edition, 2017.
2. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt. Ltd., Delhi, 14th edition, 2014.
3. Erach Bharucha, "Textbook of Environmental Studies", Universities Press Pvt. Ltd., Hyderabad, 2nd edition, 2015.

20ME103	COMPUTER AIDED ENGINEERING GRAPHICS	L	T	P	C
		2	0	4	4

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

UNIT I	INTRODUCTION TO CONVENTIONS IN ENGINEERING DRAWING AND CAD COMMANDS	18

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Introduction to CAD commands- CAD user interface- coordinate systems, object selection methods, selection of units and precession. Sketching – line, circle, arc, polygon, rectangle and ellipse. Working with object snaps, layers and object properties. Editing the objects – copy, move, trim, extend, working with arrays, mirror, scale, hatch, fillet and chamfer. Conversion of simple pictorial diagrams to orthographic view using CAD software.

UNIT II	PLANE CURVES	16

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of

cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT III	PROJECTION OF POINTS, LINES AND PLANE SURFACE	18

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT IV	PROJECTION OF SOLIDS AND PROJECTION OF SECTIONED SOLIDS	20

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method. Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.

UNIT V	DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTION	18

Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones-combination of two solid objects in simple vertical positions.

TOTAL: 90 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Illustrate the fundamentals and standards of engineering drawing and apply the concepts of orthographic projections using CAD software.
CO2: Interpret and construct various plane curves.
CO3: Develop orthographic projections of points, lines and plane surfaces.
CO4: Make use of concepts in projection to draw projections of solids and interpret the concept in section of solids.
CO5: Interpret and visualize development of surfaces.
CO6: Interpret and visualize isometric projection of simple solids.

TEXT BOOKS:

1. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 33rd Edition, 2020.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 15th Edition, 2019.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 2012.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2nd Edition, 2013.
3. Engineering Drawing Practice for Schools and Colleges SP: 46 , BIS, 2003.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy 11th Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 1993.
5. Parthasarathy N.S and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.

6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

20CS201	DATA STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of ADTs
- To learn linear data structures – lists, stacks, and queues
- To understand and apply Tree data structures
- To understand and apply Graph structures
- To analyze sorting, searching and hashing algorithms

UNIT I	LINEAR DATA STRUCTURES – LIST	9

Algorithm analysis-What to analyze-running time calculations-Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation —singly linked lists-circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT II	LINEAR DATA STRUCTURES – STACKS, QUEUES	9

Stack ADT – Stack Model - Implementations: Array and Linked list - Applications - Balancing symbols - Evaluating arithmetic expressions - Conversion of Infix to postfix expression- Queue ADT – Queue Model - Implementations: Array and Linked list - Circular Queue – Priority Queue - deQueue – applications of queues.

UNIT III	NON LINEAR DATA STRUCTURES – TREES	9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree – Priority Queues – Applications of priority queues.

UNIT IV	NON LINEAR DATA STRUCTURES - GRAPHS	9

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

UNIT V	SEARCHING, SORTING AND HASHING TECHNIQUES	9

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

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Implement abstract data types for linear data structures.

CO2: Apply the appropriate linear data structures to solve problems.

CO3: Identify and use appropriate tree data structures in problem solving.

CO4: Choose appropriate Graph representations and solve real-world applications.

CO5: Critically analyze the various sorting and searching algorithms.

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2016.
2. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2014.

REFERENCES:

1. Narasimha Karumanchi, "Data Structure and Algorithmic Thinking with Python: Data Structure and Algorithmic Puzzles", CareerMonk Publications, 2020.
2. Jean-Paul Tremblay and Paul Sorenson, "An Introduction to Data Structures with Application", McGraw-Hill, 2017.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in Java", Third Edition, Pearson Education, 2012.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.
5. Ellis Horowitz, Sartaj Sahni, Dinesh P Mehta, "Fundamentals of Data Structures in C++", Second Edition, Silicon Press, 2007.

20CS202	PYTHON PROGRAMMING	L	T	P	C
	(LAB INTEGRATED)	3	0	2	4

OBJECTIVES:

- To understand and write simple Python programs.
- To write Python programs using functions and understand recursion
- To solve problems using Python data structures –- lists, tuples, dictionaries.
- To understand files, modules and packages in Python.
- To use Exceptions, Standard Libraries and IDE for application development.

UNIT I	INTRODUCTION TO PYTHON	9+6

Introduction to Python programming – Arithmetic Operators - values and types - variables, expressions, statements – Functions – Conditionals and Recursion –Iteration.

UNIT II	FUNCTIONS	9+6

Fruitful functions: Return Values, Incremental Development, Composition, Boolean functions, Recursion, Example, Checking Types – Strings: len, Traversal with a for loop, String slices, Immutable, Searching, Looping and Counting, String Methods, in Operator, String Comparison – Case Study: Word Play.

UNIT III	LISTS, DICTIONARIES, TUPLES	9+6

Lists: Sequence, Mutable, Traversing, Operations, list slices, list methods, Map, Filter and Reduce, Deleting elements, Lists and Strings, Objects and Values, Aliasing, List Arguments.

Dictionaries: Mapping, Collection of Counters, Looping and Dictionaries, Reverse Lookup, Dictionaries and Lists, Memos, Global Variables.

Tuples: Immutable, Tuple Assignment, Tuple as Return Values, Variable-length Argument Tuples, Lists and Tuples, dictionaries and Tuples, Sequences of Sequences. Case Study: Data Structure Selection.

UNIT IV	FILES, MODULES, PACKAGES	9+6

Files: Persistence, Reading and Writing, Format Operator, Filenames and Paths, Catching Exceptions - Modules: Importing a module, Packages, Creating a module.

UNIT V	EXCEPTIONS, LIBRARIES	9+6

Exception Handling – Built-in Exceptions – Application Development with Python: Integrated Development Environment, Python Standard Library.

LIST OF EXPERIMENTS:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Operations on Tuples:
   a. finding repeated elements
   b. slice a tuple
   c. reverse a tuple
   d. replace last value of a tuple
5. String manipulation
   a. Get a string from a given string where all occurrences of its first char have been changed to '$', except the first char itself
   b. Python function that takes a list of words and returns the length of the longest one
   c. Python program to remove the characters which have odd index values of a given string
   d. Python program to count the occurrences of each word in a given sentence.
   e. Python program that accepts a comma separated sequence of words as input and prints the unique words in sorted form
   f. Python function to reverses a string if it's length is a multiple of 4
6. List operations
   a. Find the maximum of a list of numbers
   b. Python program to remove duplicates from a list.
   c. Python program to get the smallest number from a list.
   d. Python program to print a specified list after removing the 0th, 4th and 5th elements.
   e. Python program to print the numbers of a specified list after removing even numbers from it.
   f. Python program to find the second smallest number in a list.
7. Linear search and Binary search
8. Selection sort, Insertion sort
9. Merge sort
10. First n prime numbers
11. Multiply matrices
12. Programs that take command line arguments (word count)
13. Find the most frequent words in a text read from a file

| 14. Simulate elliptical orbits in Pygame |
| 15. Simulate bouncing ball using Pygame |

TOTAL: 45 +30 = 75 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

> **CO1:** Implement simple Python programs.
>
> **CO2:** Develop Python programs using functions.
>
> **CO3:** Represent and solve compound data using Python lists, tuples, dictionaries.
>
> **CO4:** Implement and perform operations on files, modules and packages.
>
> **CO5:** Apply Exceptions, Standard Libraries and IDE for application development.

TEXT BOOKS:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

2. Martin C. Brown, Python: The Complete Reference, Mc-Graw Hill,. (Unit 4 – Chapter 5 , Unit 5 – Chapter 7, 17)

REFERENCES:

1. David Beazley, Brian K. Jones, Python Cookbook, O'Reilly, Third Edition, 2013.

2. Reema Thareja, "Problem Solving and Programming with Python", 2nd Edition, Oxford University Press 2019.

3. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

4. John V Guttag, Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013

5. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

6. Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.

7. Kenneth A. Lambert, Fundamentals of Python: First Programsǁ, CENGAGE Learning, 2012.

8. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

9. Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python 3ǁ, Second edition, Pragmatic Programmers, LLC, 2013.

SOFTWARE REQUIREMENTS:

PythonIDLE

20EM111	**ENGINEERING PRACTICES LABORATORY**	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I   CIVIL ENGINEERING PRACTICE   15

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in house hold fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
   Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
   Wood work, joints by sawing, planning and cutting.

II   MECHANICAL ENGINEERING PRACTICE   15

Welding:

a. Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
b. Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming &Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III   ELECTRICAL ENGINEERING PRACTICE   15

1. Study of various safety measures in Electrical System
2. Draw and demonstrate the layout for a residential house wiring using energy meter, switches, fuse, indicator, LED lamp, fluorescent lamp with one of the lamps to be controlled by 2 different switches
3. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit (series and parallel circuit).
4. Measurement of energy using single phase energy meter for incandescent lamp and LED lamp.
5. Measurement of resistance to earth of an electrical equipment

IV   ELECTRONICS ENGINEERING PRACTICE   15

1. Study of Electronic components (fixed and Variable):
   i. Resistor – Measurement of resistance using colour coding and digital multimeter.
   ii. Capacitor – Measurement of capacitance using identification code, LCR meter
   iii. Inductor – Measurement of inductance using colour coding and LCR meter
2. Study of Electronic equipment:
   i. Signal generation using AFO (sine, square, triangle for various frequency and amplitude ranges)
   ii. Measurement of amplitude, frequency, peak-peak, RMS, period, DC level of sine, square and triangle waveform using CRO and DSO.
   iii. Measurement of DC voltage and current using analog and digital meters
3. Study of Electronic accessories:
   i. Circuit connection using Breadboard and wires.
   ii. Circuit connection using general purpose PCB by Soldering practice techniques.
4. Study of logic gates AND, OR, EX-OR and NOT by demonstration.
5. Generation of Clock Signal.
6. Measurement of ripple factor of HWR and FWR.
7. Study of Iron box, fan and regulator (resistive and electronics type), emergency lamp, Power Tools: (a) Range Finder (b) Digital Live-wire detector.

TOTAL: 60 PERIODS

(Part A :30 periods and Part B: 30 periods)

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Develop carpentry components and pipe connections including plumbing works.
CO2: Make use of welding equipments to join the structures
CO3: Analyse the basic machining operations
CO4: Develop the models using sheet metal works
CO5: Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
CO6: Fabricate carpentry components and pipe connections including plumbing works.
CO7: Carry out simple wiring as per the layout given

CO8: Measures various electrical parameters like Voltage, Current, Power factor, Energy, Earth resistance etc.

CO9: Calculate ripple factor of a given waveform, use logic gates for simple applications.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and Other fittings.	15Sets.
2. Carpentry vice (fitted to workbench)	15Nos.
3. Standard wood working tools	15Sets.
4. Models of industrial trusses, door joints, furniture joints	5each
5. Power Tools: (a)Rotary Hammer	2Nos
(b) Demolition Hammer	2Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2Nos
(f) Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5Nos.
2. Welding booth with exhaust facility	5Nos.
3. Welding accessories like welding shield, chipping hammer, Wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other Welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring (One Way Switch, Two Way Switch, Lamp Holder, Ceiling rose, LED lamp, fluorescent lamp etc) -15 Nos.
2. Electrical measuring instruments (Ammeter, Voltmeter, DRB, DIB etc) - 1 each
3. Earth Tester - 1 No.
4. Energy Meter, Ammeter, Voltmeter, Lamp load / Resistive load - 1 each

ELECTRONICS

1. Soldering guns - 10 No.
2. Assorted electronic components for making circuits (Resistor, Capacitor, Inductor, logic gates etc) - 50 Nos.
3. Small PCBs, Breadboard -10 Nos.
4. Multimeters - 10 Nos.
5. LCR Meter, DSO - 1No.
6. CRO, AFO - 5 Nos.
7. Study purpose items: Iron box, fan and regulator, emergency lamp, Range Finder, Digital Live-wire detector - 1 each

		L	T	P	C
20CS211	**DATA STRUCTURES LABORATORY**	0	0	4	2

OBJECTIVES:

- To implement the basic data structures for solving simple problems.
- To implement linear and non-linear data structures.
- To understand the different operations of search trees.
- To implement graph traversal algorithms.
- To get familiarized to sorting and searching algorithms.

LIST OF EXPERIMENTS:

1. Array Manipulation
   a. Find kth smallest element in an unsorted array
   b. Find the sub array with given sum
   c. Matrix manipulations – Addition, Subtraction, Multiplication
   d. Job Sequencing: Given an array of jobs where every job has a deadline and a profit. Profit can be earned only if the job is finished before the deadline. It is also given that every job takes a single unit of time, so the minimum possible deadline for any job is 1. How to maximize total profit if only one job can be scheduled at a time. Print the sequence of jobID order to maximize total profit.

2. String manipulations:
   a. Reversing a set of words and count the frequency of each letter in the string.
   b. Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents any number of zeroes (minimum requirement is one 0) there should not be any other character except 0 in the [0] sequence in a given binary string.
   c. Remove all the occurrences of string S2 in string S1 and print the remaining.

3. Pointers
   a. Manipulating two dimensional arrays using pointers.
   b. Print all permutations of a given string using pointers.

4. Dynamic Memory Allocation
   a. Find Largest Number.
   b. Print the list in reverse order.

5. Array implementation of List, Stack and Queue ADTs.

6. Linked list implementation of List, Stack and Queue ADTs.

7. Applications of List, Stack and Queue ADTs.

8. Implementation of Binary Trees and operations of Binary Trees.

9. Implementation of Binary Search Trees.

10. Implementation of AVL Trees.

11. Implementation of Heaps using Priority Queues.

12. Graph representation and Traversal algorithms.

13. Implement searching and sorting algorithms. Analyze and compare the time taken

for various algorithms with best, average and worst case inputs.

	TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the students will be able to:

CO1: Write functions to implement linear and non-linear data structure operations.

CO2: Suggest and use appropriate linear / non-linear data structure operations for solving a given problem.

CO3: Implement different operations of search trees.

CO4: Implement appropriate Graph representations and traversals to solve real-world applications.

CO5: Implement and analyze the various searching and sorting algorithms.

SOFTWARE REQUIREMENTS:

Turbo C/C++

20EL211	**ADVANCED READING & WRITING** (Common to All Branches)	**L**	**T**	**P**	**C**
		0	0	2	1

OBJECTIVES:

The Course will enable learners to:

- Strengthen their reading skills.
- Enhance writing skills with specific reference to technical writing.
- Apply their critical thinking skills.
- Demonstrate their project and proposal writing.

UNIT I		**6**

Reading - Strategies for effective reading - Writing - Descriptive essays- Predicting content using photos.

UNIT II		**6**

Reading - Use of graphic organizers to review and aid comprehension - Writing - Expository essays.

UNIT III		**6**

Reading - Speed reading techniques - Writing - Elements of a good essay - Analytical essays.

UNIT IV		**6**

Reading - Genre and organization of ideas – Writing - Email writing - Job applications.

UNIT V		6
Reading - Critical reading and thinking -Writing - Letter of recommendation - Vision statement.		

	TOTAL: 30 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

    CO1: Read and evaluate texts critically.

    CO2: Display critical thinking in various professional contexts.

    CO3: Apply various texts using speed reading techniques.

    CO4: Illustrate and write different types of Essays.

    CO5: Write effective emails, winning job applications and persuasive recommendations.

TEXT BOOKS:

1. Debra Daise, Charl Norloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011.
2. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011.

REFERENCES:

1. Elbow, Peter. Writing Without Teachers. London: Oxford University Press, 1973. Print.
2. Goatly, Andrew., and Hiradhar, Preet. Critical Reading and Writing. New York: Routledge, 2016.
3. Liss, Rhonda., and Davis, Jason. Effective Academic Writing (Level 3).Oxford: Oxford University Press, 2006.
4. Petelin, Roslyn., and Durham, Marsha. The Professional Writing Guide: Knowing Well and Knowing Why. Warriewood, NSW: Business & Professional Publishing, 2004.
5. Suresh Kumar, E., Sandhya, B. Savithri, J., and Sreehari, P. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012.
6. Withrow, Jeans., Brookes, Gay., and Cummings, Martha Clark. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge: Cambridge University Press, 2004.

SEMESTER III

		L	T	P	C
20MA302	**DISCRETE MATHEMATICS** **(Common to CSE and CSD)**	3	2	0	4

OBJECTIVES:

- Validate the arguments by using connectives and rules of inference.
- Develop the knowledge on the basics of counting, solving recurrence relations.
- Demonstrate the fundamentals of graphs.
- Illustrate the functions, relations and group theory.
- Familiarize the concepts of lattices and Boolean algebra.

UNIT I	LOGIC AND PROOFS	15

Propositional logic – Propositional equivalences – Predicates and quantifiers – Nested quantifiers – Rules of inference – Introduction to proofs – Proof methods and strategy.

UNIT II	COMBINATORICS	15

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

UNIT III	GRAPH THEORY	15

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

UNIT IV	ALGEBRAIC STRUCTURES	15

Algebraic systems – Semi groups and monoids – Groups – Subgroups – Homomorphisms – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V	LATTICES AND BOOLEAN ALGEBRA	15

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

TOTAL: 75 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Examine the validity of the arguments.
CO2: Demonstrate various proof techniques and application of principles.
CO3: Apply graph theory techniques to solve real life problems.
CO4: Identify algebraic techniques to formulate and solve group theoretic problems.
CO5: Utilize the significance of lattices and Boolean algebra in computer science and engineering.

TEXT BOOKS:

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

REFERENCES:

1. R.P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. S. Lipschutz, and M. Lipson, "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. T. Koshy. "Discrete Mathematics with Applications", Elsevier Publications, 1st Edition, 2006.

20AI301	DIGITAL PRINCIPLES AND COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Design Digital Circuits using simplified Boolean functions
- To Design Combinational Circuits and Sequential Circuits
- To Demonstrate the basic structure and operation of a computer, Instructions and Addressing mode.
- To Design a basic processor with pipeline.
- To Evaluate the memory hierarchical system including cache memory and virtual memory.
- To Discuss the different ways of communicating with I/O devices and I/O interfaces.

UNIT I	DIGITAL FUNDAMENTALS	10

Number Systems - Arithmetic Operations - Binary Codes- Boolean Algebra and Logic Gates - Theorems and Properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map - Logic Gates – NAND and NOR Implementations.

UNIT II	COMBINATIONAL AND SEQUENTIAL CIRCUITS	9

Combinational Circuits –Binary Adder - Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders – Encoders – Multiplexers. Sequential Circuits - Storage Elements: Latches, Flip-Flops - Registers and Counters.

UNIT III	COMPUTER FUNDAMENTALS	9

Basic Structure of Computers: Computer Types - Functional Units – Basic Operational Concepts - Number Representation and Arithmetic Operations - Character Representation - Performance - Historical Perspective. Instruction Set Architecture: Memory Locations and Addresses - Memory Operations - Instructions and Instruction Sequencing - Addressing Modes.

UNIT IV	BASIC PROCESSING UNIT AND PIPELINING	9

Basic Processing Unit: Some Fundamental Concepts - Instruction Execution - Hardware Components - Instruction Fetch and Execution Steps - Control Signals - Hardwired Control Pipelining - Basic Concept—The Ideal Case - Pipeline Organization - Pipelining Issues - Data Dependencies - Memory Delays - Branch Delays - Resource Limitations - Performance Evaluation - Superscalar Operation.

UNIT V	I/O AND MEMORY	8

Input/Output Organization: Bus Structure - Bus Operation - Arbitration - Interface Circuits - Interconnection Standards - USB, SATA. **The Memory System:** Basic Concepts - Semiconductor RAM Memories - Read-only Memories - Direct Memory Access - Memory Hierarchy - Cache Memories - Performance Considerations - Virtual Memory - Secondary Storage.

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Simplify complex Boolean functions.

CO2: Implement digital circuits using combinational logic ICs and PLDs

CO3: Understand and execute programs based on 8086 microprocessors

CO4: Design Multiprocessor circuits.

CO5: Design and interface I/O circuits

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design with an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018.
2. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2015.

REFERENCES:

1. Charles H. Roth Jr., "Fundamentals of Logic Design", Seventh Edition, Jaico Publishing House, 2013.
2. Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill, 2017.
3. A.K.Ray, K.M.Bhurchandi,"Advanced Microprocessors and Peripherals "3rd edition, Tata McGrawHill, 2019.
4. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 3rd Edition, 2017.

20IT403	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of Data modeling and Database Systems.
- To understand SQL and effective relational database design concepts.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To understand efficient data querying and updates, with needed configuration
- To learn how to efficiently design and implement various database objects and entities

UNIT I	DATABASE CONCEPTS	9

Concept of Database and Overview of DBMS - Characteristics of databases, Database Language, Types of DBMS architecture – Three-Schema Architecture -Introductions to data models' types- ER Model- ER Diagrams Extended ER Diagram reducing ER to table Applications: ER model of University Database Application. SQL fundamentals Views - Integrity Procedures, Functions, Cursor and Triggers Embedded SQL Dynamic SQL.

UNIT II	DATABASE DESIGN	9

Design a DB for Car Insurance Company - Draw ER diagram and convert ER model to relational schema. Evaluating data model quality - The relational Model Schema Keys Relational Algebra Domain Relational Calculus- Tuple Relational Calculus – Fundamental

operations. Relational Database Design and Querying Undesirable Properties of Relations Functional Dependency: Closures- Single Valued Dependency Single valued Normalization (1NF, 2NF 3NF and BCNF) - Desirable properties of
Decompositions 4NF - 5NF Denormalization

UNIT III	TRANSACTIONS	9

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery

UNIT IV	DATA STORAGE AND QUERYING	9

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 – Overview of physical storage structure- stable storage, failure classification -log based recovery, deferred database modification, check-pointing-File Structures:- Index structures-Primary, Secondary and clustering indices. Single and multilevel indexing. Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation

UNIT V	ADAVNCED TOPICS	9

Distributed database Implementation Concurrent transactions - Concurrency control Lock based Time Stamping-Validation based. NoSQL, NoSQL Categories - Designing an enterprise database system - Client Server database

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Implement SQL and effective relational database design concepts.

CO2: Map ER model to Relational model to perform database design effectively

CO3: Compare and contrast various indexing strategies in different database systems

CO4: Implement queries using normalization criteria and optimization techniques

CO5: Analyze how advanced databases differ from traditional databases.

CO6: Design and deploy an efficient and scalable data storage node for varied kind of application requirements

TEXT BOOKS:

1. Elmasri R. and S. Navathe, "Fundamentals of Database Systems", Pearson Education, 7th Edition, 2016.
2. Abraham Silberschatz, Henry F.Korth, "Database System Concepts", Tata McGraw Hill , 7th Edition, 2021.
3. Elmasri R. and S. Navathe, "Database Systems: Models, Languages, Design and Application Programming", Pearson Education, 2013.

REFERENCES:

1. Raghu Ramakrishnan, Gehrke "Database Management Systems", MCGraw Hill, 3rd Edition 2014.
2. Plunkett T., B. Macdonald, "Oracle Big Data Hand Book", McGraw Hill, First Edition, 2013
3. Gupta G K, "Database Management Systems" , Tata McGraw Hill Education Private Limited, New Delhi, 2011.

4. C. J. Date, A.Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2015.
5. Maqsood Alam, Aalok Muley, Chaitanya Kadaru, Ashok Joshi, Oracle NoSQL Database: Real- Time Big Data Management for the Enterprise, McGraw Hill Professional, 2013.
6. Thomas Connolly, Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", Pearson , 6th Edition, 2015.

20CS302	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To explain object-oriented programming concepts and fundamentals of Java
- To apply the principles of packages, inheritance, interfaces, and exceptions
- To develop a Java application with I/O streams, threads, and generics classes
- To use the functionalities of Strings and Collections
- To design and build simple Graphical User Interfaces.

UNIT I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	9

An Overview of Java - Data Types, Variables, and Arrays – Operators - Control Statements – Class Fundamentals – Declaring objects – Methods – Constructors – this keyword – Overloading methods - Overloading constructors - Access Control – Static – Final.

UNIT II	INHERITANCE, INTERFACES AND EXCEPTION HANDLING	9

Inheritance: Inheritance basics, Using super, Method Overriding, Using Abstract Classes, Using final with Inheritance – Package and Interfaces: Packages, Packages and member access, Importing Packages, Interfaces, Static Methods in an Interface – Exception Handling:

Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions.

UNIT III	MULTITHREADING, I/O AND GENERIC PROGRAMMING	9

Multithreaded Programming: Creating a Thread, Thread Priorities, Synchronization, Interthread Communication – I/O: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files – Generics: Introduction, Generic class, Bounded Types, Generic Methods, Generic Interfaces, Generic Restrictions.

UNIT IV	STRING HANDLING AND COLLECTIONS	9

Lambda Expressions - String Handling – Collections: The Collection Interfaces, The Collection Classes – Iterator – Map - Regular Expression Processing.

UNIT V	EVENT DRIVEN PROGRAMMING	9

Event Handling - Introducing the AWT: Working with Windows, Graphics, and Text – Using AWT Controls, Layout Managers, and Menus - Introducing Swing - Exploring Swing.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the object-oriented programming concepts and fundamentals of Java

CO2: Develop Java programs with the packages, inheritance, interfaces and exceptions

CO3: Build Java applications with I/O streams, threads and generics classes
CO4: Apply strings and collections in applications
CO5: Develop interactive Java applications using swings and event handling mechanism

TEXT BOOK:

1. Herbert Schildt, "Java:The complete reference", 11th Edition, McGraw Hill Education, 2019.

REFERENCES:

1. Cay S. Horstmann, Gary Cornell, "Core Java Volume–I Fundamentals", 11th Edition, Prentice Hall, 2019.

2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.

3. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
   Timothy Budd, Understanding Object-oriented programming with Java, Third Edition, Pearson Education, 2008.

		L	T	P	C
20CB505	**DESIGN THINKING**	**2**	**2**	**0**	**3**

OBJECTIVES:

- Familiarize design thinking and its phases.
- Perform immersion activity in empathize phase of design thinking.
- Create problem statements in the define phase of design thinking.
- Ideate and find solutions to the problem defined.
- Develop a prototype and perform testing.

UNIT I	**INTRODUCTION**	**6+6**

Introduction to design thinking - Importance of design thinking for business – Phases of design thinking – Experiential activity – Case study.

UNIT II	**EMPATHIZE PHASE**	**6+6**

Empathize phase - Steps involved - Immersion activity- Questionnaire – Empathy map for case study

UNIT III	**DEFINE PHASE**	**6+6**

Creation of personas in define phase – steps in problem statement creation - problem statement definition – Examples – Key problem statements.

UNIT IV	**IDEATION PHASE**	**6+6**

Ideation phase steps – Ideation games – Ideate to find solutions – Doodling – Storytelling in presenting ideas and prototypes.

UNIT V	**PROTOTYPE AND TESTING**	**6+6**

Importance of prototype in design thinking –Guidelines - Prototyping the idea – Value proposition statement – Testing in design thinking – Prototype testing – Documentation – Design thinking in functional work – Mapping design thinking to agile methodologies.

	TOTAL: 60 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the phases of design thinking process.
CO2: Conduct an immersion activity to create an empathy map
CO3: Define the key problems of the personas created.
CO4: Apply the ideation phase steps to present the prototype ideas

CO5: Create a prototype with value propositions and test the prototype

TEXT BOOKS:

1. Christian Müller-Roterberg, "Handbook of Design Thinking", Kindle Direct Publishing, November 2018.
2. Dan Senor and Saul Singer, "Start-Up Nation", Grand Central Publishing, Twelfth Edition, 2009.

REFERENCES:

1. Nir Eyal and Ryan Hoover, "Hooked: How to Build Habit-Forming Products", Library of Congress, 2014.
2. Corral, Luis & Fronza, Ilenia, "Design Thinking and Agile Practices for Software Engineering: An Opportunity for Innovation", 2018.

20GE301	**UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY**	**L**	**T**	**P**	**C**
		2	2	0	3

OBJECTIVES:

The objective of the course is fourfold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE TOPICS:

The course has 28 lectures (2 lecture hours) and 14 practice sessions (2 Tutorial hour) in 5 Units:

UNIT I	**COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION**

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- The basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: Understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

UNIT II	**UNDERSTANDING HARMONY IN THE HUMAN BEING – HARMONY IN MYSELF!**

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs dealing with disease

UNIT III	UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY-HARMONY IN HUMAN-HUMAN RELATIONSHIP

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect; Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, Fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided society, Universal order from family to world family.
- Include practice sessions to reflect on relationships in family, hostel and institutes extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT IV	UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE – WHOLE EXISTENCE AS COEXISTENCE

- Understanding the harmony in nature
- Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence.
- Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V	IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems.
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations Sum up.
- Include practice exercises and case studies will be taken up in practice (tutorial) sessions eg. To discuss the conduct as an engineer or scientist etc.

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Would become more aware of themselves, and their surroundings (family, society, nature).
CO2: Would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO3: Would have better critical ability.
CO4: Would become sensitive to their commitment towards what they have understood (human values, human relationship, and human society).
CO5: Would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

TEXT BOOK:
1. R R Gaur, R Sangal, G P Bagaria, "Human Values and Professional Ethics", Excel Books,
   New Delhi, Second Edition 2019.

REFERENCES:
1. A Nagaraj, "Jeevan Vidya: Ek Parichaya", Jeevan Vidya Prakashan, Amarkantak, 1999.
2. E. F Schumacher, "Small is Beautiful", Vintage classics, London, 1993.
3. A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, Third Edition 2020.
4. Maulana Abdul Kalam Azad, "India Wins Freedom", Oriental blackswan private limited, Hyderabad, 2020.
5. Mahatma Gandhi, "Hind Swaraj or Indian Home Rule", Maheswari Publications, Delhi 2020.

6. Romain Rolland, "The life of Vivekananda and the universal gospel", Publication house of Ramakrishna Math, Kolkata, Thirty second edition 2018.

7. Romain Rolland, "Mahatma Gandhi: The man who become one with the universal being
8. ", Srishti Publishers & Distributors, New Delhi, Sixth Edition 2013.
9. Heaton, Dennis P. "The story of stuff." (2010): 553-556.
10. Gandhi, Mohandas Karamchand, "The story of my experiments with truth: An autobiography", Om Books International, 2018.
11. Andrews, Cecile, "Slow is beautiful: new visions of community, leisure, and joie de vivre", New society publishers, 2006.
12. Kumarappa, Joseph Cornelius, "The economy of permanence. CP", All India Village Industries Assn., 1946.
13. Vivekananda-Romain Rolland (English) Gandhi-Romain Rolland (English)

20IT412	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:
- To understand data definitions and data manipulation commands
- To learn the use of nested and join queries
- To understand functions, procedures and procedural extensions of databases
- To be familiar with the use of a front-end tool
- To understand design and implementation of typical database applications

LIST OF EXPERIMENTS:
1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
3. Views, Sequences, Synonyms
4. Database Programming: Implicit and Explicit Cursors
5. Procedures and Functions
6. Triggers
7. Exception Handling
8. Database Design using ER modeling, normalization and Implementation for any application.
9. Database Connectivity with Front End Tools
10. Case Study using real life database applications anyone from the following list
    a) Inventory Management for a EMart Grocery Shop
    b) Society Financial Management
    c) Cop Friendly App – Eseva Property
    d) Management – eMall
    e) Star Small and Medium Banking and Finance
- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
- Apply Normalization rules in designing the tables in scope.

- Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
- Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
- Ability to showcase ACID Properties with sample queries with appropriate setting

TOTAL: 60 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:
    CO1: Apply typical data definitions and manipulation commands.
    CO2: Design applications to test Nested and Join Queries
    CO3: Implement simple applications that use Views
    CO4: Implement applications that require a Front-end Tool
    CO5: Critically analyze the use of Tables, Views, Functions and Procedures.

SOFTWARE REQUIREMENTS:

Java, SQL

20CS311	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:
- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, collections, exception handling, regular expressions and file processing.
- To develop applications using event handling.

LIST OF EXPERIMENTS:

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff

    If the type of the EB connection is domestic, calculate the amount to be paid as follows:
        First 100 units - Rs. 1 per unit
        101-200 units - Rs. 2.50 per unit
        201 -500 units - Rs. 4 per unit
        > 501 units - Rs. 6 per unit
    If the type of the EB connection is commercial, calculate the amount to be paid as follows:
        First 100 units - Rs. 2 per unit
        101-200 units - Rs. 4.50 per unit
        201 -500 units - Rs. 6 per unit
        > 501 units - Rs. 7 per unit
2. Arrays Manipulations:
    a. Find k^{th} smallest element in an unsorted array
    b. Find the sub array with given sum
    c. Matrix manipulations – Addition, Subtraction, Multiplication

d. Remove duplicate elements in an Array
e. Accept an integer value N and print the Nth digit in the integer sequence 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and so on till infinity.
Example: The 11th digit in the sequence 12345678910111213…. is 0.

3. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.

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

5. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains the methods print Area () that prints the area of the given shape and Numberofsides() that prints the number of sides of the given shape.

7. Write a Java program to apply built-in and user defined exceptions.

8. String Manipulation:
   a. Reversing a set of words and count the frequency of each letter in the string.
   b. Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents any number of zeroes (minimum requirement is one 0) there should not be any other character except 0 in the [0] sequence in a given binary string.
   c. Remove all the occurrences of string S2 in string S1 and print the remaining.
   d. Find the longest repeating sequence in a string.
   e. Print the number of unique string values that can be formed by rearranging the letters in the string S.

9. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.

10. Write a Java program to read and copy the content of one file to other by handling all file related exceptions.

11. Collections:
   a. Write a program to perform string operations using ArrayList. Write functions for the following
      i. Append - add at end
      ii. Insert – add at particular index
      iii. Search
      iv. List all string starts with given letter
   b. Find the frequency of words in a given text.

12. Write a java program to remove all non-alphanumeric characters from a string using regular expression.

13. Design a calculator using event-driven programming paradigm of Java with the following options.
   a. Decimal manipulations
   b. Scientific manipulations

14. Develop a mini project for any application using Java concepts.

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.

CO2: Develop and implement Java programs with collections, exception handling, regular expressions and multithreading.

CO3: Design applications using file processing and event handling

SOFTWARE REQUIREMENTS:

Eclipse IDE, Java

20CS313	APTITUDE AND CODING SKILLS - I	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop vocabulary for effective communication and reading skills.
- To build the logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.

LIST OF EXERCISES:

1. English – Phase I

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. Logical Reasoning – Phase I

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. Quantitative Ability - Phase I

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. Automata Fix – Phase I

Logical, Compilation and Code reuse

| | | | | | | | TOTAL: 30 PERIODS |

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Develop vocabulary for effective communication and reading skills.

CO2: Build the logical reasoning and quantitative skills.

CO3: Develop error correction and debugging skills in programming.

SEMESTER IV

20MA402	PROBABILITY AND STATISTICS	L	T	P	C

		3	2	0	4

OBJECTIVES:

The Course will enable learners to:

- Determine the probability value of one-dimensional random variables.
- Illustrate the concepts of covariance, correlation and regression.
- Discuss the concept of testing of hypothesis for small and large samples.
- Demonstrate the difference between the types of design to experiments.
- Identify and interpret the control charts for variables and attributes.

UNIT I	ONE DIMENSIONAL RANDOM VARIABLES	15

Random variable – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II	TWO DIMENSIONAL RANDOM VARIABLES	15

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables.

UNIT III	TESTING OF HYPOTHESIS	15

Sampling distributions – Estimation of parameters – Statistical hypothesis – Large sample tests based on Normal distribution for single mean and difference of means – Tests based on t, Chi- square and F distributions for mean, variance and proportion – Contingency table (test for independent) – Goodness of fit.

UNIT IV	DESIGN OF EXPERIMENTS	15

One way and Two-way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT V	STATISTICAL QUALITY CONTROL	15

Control charts for measurements ($\bar{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits.

TOTAL: 75 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the fundamental knowledge of modern probability theory and standard distributions.

CO2: Categorize the probability models and function of random variables based on one and two-dimensional random variables.

CO3: Employ the concept of testing the hypothesis in real life problems.

CO4: Implement the analysis of variance for real life problems.

CO5: Apply statistical quality control in engineering and management problems.

TEXT BOOKS:

1. R.A. Johnson, I. Miller and J. Freund, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. J.S. Milton and J.C. Arnold, "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCES:
1. J.L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. A.Papoulis, and S. Unni Krishna pillai, Probability, "Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. S.M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. R.E.Walpole, R.H.Myers, S.L. Myers and K.Ye, "Probability and Statistics for Engineers and Scientists".Pearson Education, Asia, 9th Edition, 2012.

20CS907	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To learn the fundamentals of Human Computer Interaction.
- To become familiar with different design software process
- To learn various interaction design model
- To be aware of mobile design and web interfaces in HCI
- To learn different communication and guidelines for interaction

UNIT I	FOUNDATIONS OF HCI	9

Input–output channels, Human memory, Thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems, Text entry devices, Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning.

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	INTERACTION DESIGN MODELS	9

GOMS - CMN-GOMS Analysis, Modeling Structure, State Transition Networks - Three-State Model, Glimpse Model, Physical Models – Shneideman's eight golden rules, Norman's Sever principles, Norman's model of interaction, Nielsen's ten heuristics, Heuristic evaluation, contextual evaluation, Cognitive walk-through.

UNIT IV	MOBILE HCI AND WEB INTERFACE DESIGN	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. Designing Web Interfaces – Drag Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies.

UNIT V	COLLABORATION AND COMMUNICATION	9

Face-to-face Communication, Conversation, Text-based Communication, Group working, Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design: Groupware, Meeting and decision support systems,

Shared applications and artifacts, Frameworks for groupware Implementing synchronous groupware, Mixed, Augmented and Virtual Reality.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Enumerate the basic concepts of human, computer interactions

CO2: Inspect software design process in human computer interaction

CO3: Examine various models and theories related to human computer interaction

CO4: Build meaningful user interface

CO5: Establish the different levels of communication across the application stakeholders.

TEXT BOOKS:

1. A Dix, Janet Finlay, G D Abowd, R Beale., Human-Computer Interaction, 3rd Edition, Pearson Publishers, 2008.
2. Brian Fling, Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009.
3. Bill Scott and Theresa Neil, —Designing Web Interfacesǁ, First Edition, O'Reilly, 2009.

REFERENCES:

1. Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies for Effective.
2. Human Computer Interaction, 5th Edition, Pearson Publishers, 2010. Hans-Jorg Bullinger," Human-Computer Interaction", Lawrence Erlbaum Associates, Publishers.
3. Jakob Nielsen," Advances in Human-computer Interaction",Ablex Publishing Corporation

20CS402	DESIGN AND ANALYSIS OF ALGORITHMS (Common to CSE, CSD, AI&DS and IT)	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To critically analyse the efficiency of alternative algorithmic solutions for the same problem
- To understand brute force and divide and conquer design techniques.
- To apply dynamic programming and greedy techniques for solving various problems.
- To use iterative improvement technique to solve optimization problems
- To examine the limitations of algorithmic power and handling it in different problems.

UNIT I	INTRODUCTION	8

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types –Fundamentals of the Analysis of Algorithmic Efficiency – Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms – Visualization.

UNIT II	BRUTE FORCE AND DIVIDE AND CONQUER	10

Brute Force – Computing a^n – String Matching - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort - Multiplication of Large Integers – Closest-Pair and Convex - Hull Problems -

Decrease and Conquer Method: Josephus Problem-Transform and Conquer Method: Presorting.

UNIT III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	11

Dynamic programming – Principle of optimality - Coin changing problem, Computing a Binomial Coefficient – Floyd's algorithm – Multi stage graph - Optimal Binary Search Trees - Longest common subsequence - Matrix-chain multiplication – Travelling Salesperson Problem – Knapsack Problem and Memory functions. Greedy Technique – Prim's algorithm and Kruskal's Algorithm – 0/1 Knapsack problem - Huffman Trees.

UNIT IV	ITERATIVE IMPROVEMENT	7

The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable marriage Problem.

UNIT V	COPING WITH THE LIMITATIONS OF ALGORITHM POWER	9

Lower - Bound Arguments - P, NP NP- Complete and NP Hard Problems. Backtracking – N-Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Travelling Salesman Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Analyse the efficiency of recursive and non-recursive algorithms mathematically

CO2: Explain brute force and divide and conquer design techniques.

CO3: Apply dynamic programming and greedy techniques for solving various problems.

CO4: Use iterative improvement technique to solve optimization problems

CO5: Examine the limitations of algorithmic power and handle it in different problems.

TEXT BOOKS:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.
3. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.

REFERENCES:

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, Reprint 2006.
2. Harsh Bhasin, —Algorithms Design and Analysis, Oxford university press, 2016.
3. S. Sridhar, —Design and Analysis of Algorithms, Oxford university press, 2014.

20CD401	DESIGN PROGRAMMING (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To provide an idea about Blender interface.
- To impart a good understanding of materials and textures.
- To gain clear knowledge on Nurbs and meta shapes.
- To attain insight on Unity Scripts.
- To understand decision making in games.

UNIT I	BLENDER INTERFACE AND NAVIGATION	9

3D Modeling-The blender Screen- The user preferences window-preset Interface arrangements- The 3D window-Window Modes-Layers-Moving in 3D space-Blender View menu, Controls, windows-Navigation- Creating and editing Objects

UNIT II	MATERIALS AND TEXTURES	9

Material settings-Material Buttons, Colors- Textures-Texture Mapping-Unwrapping with Seams-Texture Paint-World Settings-Lighting and Cameras-Rendering and Ray Tracing

UNIT III	NURBS AND META SHAPES	9

Introduction to 3D Text-Creating 3D Text in Blender-Converting Text to Mesh Object-Converting text to a curve-Modifiers-Modifiers for generating, deforming, Simulating

UNIT IV	UNITY SCRIPTS	9

Basic C# scripting- Introducing scripting in unity- Method instead of function - Introducing Classes -Passing values between the classes - Using objects and classes in game script-Understanding component property in scripts - Displaying public variables in inspector panel - Multi-word variable names- Common – built – in variable types - Variable scopes

UNIT V	DECISION MAKING IN GAMES	9

Condition testing using if statement - Usage of for each loop -Usage of while loop - Storing game objects in array -Storing game objects in list- Using dot syntax in unity script - Accessing components own variables and methods - Accessing another game objects and its components.

LIST OF EXERCISES:
1. Create and Navigate an object using Blender
2. Formulate 3D scene from primitives
3. Converting Text to Mesh Object using blender
4. With Blender, Convert text to a Curve
   UNITY BASED EXERCISES:
5. Integration of 3D Assets into Unity
6. Create Scripts to control the movement of game Assets
7. Creating and loading game prefabs at runtime in the game Engine
8. Construct a GUI in the Game Engine to interact with the Game Assets
9. Design and animate a game character in Unity
10. Deploy the game/app to Windows and other platforms

OUTCOMES:

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

CO1: Learn about Blender interface
CO2: Understand Texture Mapping and Rendering
CO3: Analyze Text to Mesh Object and Curve conversion
CO4: Know the scripting fundamentals

| **CO5:** Understand accessing game objects | | | | |

TEXT BOOKS:

1. John M.Blain ,"Complete guide to blender graphics",4th edition, Taylor & Francis publications, 2018.
2. Terry Norton, "Learning C# by Developing Games with Unity 3D Beginner's Guide", second edition, Packt Publishing Limited, 2013.

REFERENCES:

1. Lee ZhiEng, "Building a Game With Unity and Blender",1st Edition , Packt Publishing Limited , 2015
2. Michelle Menard, "Game development with unity", 2nd edition, Cengage Learning PTR,2015.
3. Vahé Karamian," Introduction to Game Programming: Using C# and Unity 3D", Noorcon Inc.2016
4. Michelle Menard, Bryan Wagstaff, "Game development with Unity", Cengage Learning, 2015

SOFTWARE REQUIREMENTS:

Blender, Unity

20CD402	**INFORMATION DESIGN AND VISUALIZATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:
- To understand the basic concepts of design
- To develop the knowledge on the basis of design controlling
- To Illustrate the role of python libraries for visualization
- To learn and organize different data visualization techniques
- To Discuss, analyze and evaluate visualization models

UNIT I	**INTRODUCTION TO DESIGN FUNDAMENTALS**	**9**

Exploration of Complex Information Spaces, Orientation in Complex Information Spaces, Fisheye Views: A Step Towards Abstraction, Applications of Fisheye Views, Fisheye Views for 3D Data, Enrichment and Reuse of Geometric Models, Requirement Analysis, Approach to Reuse and Enrich Models.

UNIT II	**DESIGN CONTROLLING**	**9**

Rendering line Drawings for Illustrative Purposes, An Analytic Rendering Pipeline, Hidden Line Elimination, Drawing the Lines – Shading, Illustrating with Lines, Measuring and Highlighting in Graphics, Approaches and Techniques in Paintings, Theoretical Background, Measuring Colour Contrasts, Animation Analysis, Colour Discontinuity, Discontinuity in Motion, Emphasizing Objects

UNIT III	**PYTHON LIBRARIES FOR VISUALIZATION**	**9**

Exploratory Data Analysis Fundamentals, The Significance of EDA, Launching the IPython Shell - Launching the Jupyter Notebook - IPython Magic Commands – Making Sense of data, The Basics of NumPy Arrays-Pandas, SciPy, Matplotlib.

UNIT IV	**DATA VISUALIZATION**	**9**

Overview-Visualization Design Principles - Univariate Data Visualization- Bivariate Data Visualization- Multivariate Data Visualization-Visualizing Groups-Dynamic Techniques-Overview Data Brushing, Nearness Selection, Sorting and Rearranging, Searching and Filtering

UNIT V	MODEL DEVELOPMENT AND EVALUATION	9

Hypothesis testing and regression- Hypothesis testing, p-hacking, understanding regression, Model development and evaluation, Understanding Supervised Learning, Understanding unsupervised Learning, Reinforcement Learning, Machine Learning workflow.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:
CO1: Identify the characteristics of Design Fundamentals
CO2: Understand the design controlling process.
CO3: Apply the python libraries for Visualization
CO4: Examine the data visualization process
CO5: Describe the methods of a visualization model

TEXT BOOKS:

1. Thomas Strothotte, Computational Visualization Graphics, Abstraction, and Interactivity, Springer-Verlag Berlin Heidelberg New York, 2011
2. Suresh Kumar Mukhiya and Usman Ahmed, "Hands-on Exploratory Data Analysis with Python",Packt publishing , March 2020.
3. Glenn J. Myatt, Wayne P. Johnson, Making sense of data II: A Practical Guide to Data Visualization, Advanced Data Mining Methods, and Applications,2008.

REFERENCES:

1. Chaomei Chan, "Information Visualization: Beyond the Horizon", 2nd edition, Springer Verlag, 2004.
2. Suresh Kumar Mukhiya and Usman Ahmed, "Hands-on Exploratory Data Analysis with Python",Packt publishing , March 2020.
3. Danyel Fisher & Miriah Meyer, "Making Data Visual: A Practical Guide To Using Visualization For Insight", O'reilly publications, 2018.

20CD403	OPERATING SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To understand and analyse, Processes, Threads and Scheduling algorithms.
- To understand the concept of Deadlocks and various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android

UNIT I	OPERATING SYSTEMS: OVERVIEW	9

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore

Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II	MEMORY MANAGEMENT IN OPERATING SYSTEM	9

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III	STORAGE MANAGEMENT	9

Main Memory - Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory - Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT IV	FILE SYSTEMS AND I/O SYSTEMS	9

Mass Storage system - Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space 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, Efficiency and Performance, Recovery; I/O Systems - I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

UNIT V	CASE STUDY	9

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students will be able to
CO1: Understand the basics of Operating Systems
CO2: Understand deadlock, prevention and avoidance algorithms.
CO3: Compare and contrast various memory management schemes.
CO4: Understand the functionality of file systems and perform administrative tasks on Linux Servers.
CO5: Compare iOS and Android Operating Systems.

TEXT BOOK:
1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons ,Inc., 9th Edition, 2012.

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, —Operating Systems – A Spiral Approachǁ, Tata McGraw Hill Edition, 2010. os Notes
2. Achyut S.Godbole, Atul Kahate, —Operating Systems, McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, —Modern Operating Systems, Second Edition, Pearson Education, 2004. CS8493 Notes Operating Systems
4. Gary Nutt, —Operating Systemsǁ, Third Edition, Pearson Education, 2004.
5. Harvey M. Deitel, —Operating Systems, Third Edition, Pearson Education, 2004.

20CD411	INFORMATION DESIGN AND VISUALIZATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To learn basic knowledge about Design techniques
- To understand transformation techniques of design
- To Study basic concepts of data visualization
- To build visualization skills in python libraries
- To learn machine learning based visualization techniques

LIST OF EXERCISES:

1. Installing and Creating Basic Shapes with Adobe Illustrator
2. Recreating Map Symbols and Creating Logo Designs
3. Apply 3D drawing and painting
4. 2D/3D Poster Design in illustrator
5. Drawing Compounding vector shapes & strokes / Pathfinder Tool
6. Applying color models, pallets, Transformation and pattern in gimp
7. Apply Filtering techniques in 2D/3D using gimp
8. Download, install and explore the features of R/Python for data analytics.
9. Basic plots using Matplotlib
10. Statistical and Probability measures
    a) Frequency distributions
    b) Mean, Mode, Standard Deviation
    c) Variability
    d) Normal curves
    e) Correlation and scatter plots
    f) Correlation coefficient
    g) Regression
11. Use the standard benchmark data set for performing the following:
    a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
    b) Bivariate Analysis: Linear and logistic regression modelling.
    c) Multiple Regression Analysis
    d) Compare the results of the above analysis for the two data sets

12. Implement the following algorithms on Real time stream data sets.
    a) Support Vector Machine
    b) Decision tree classifier
    c) Clustering Algorithms

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Apply adobe illustrator for image techniques
CO2: Implement transformation process in computer design
CO3: Apply fundamentals of data visualization with python libraries
CO4: Implement basic classification algorithms with visualization techniques
CO5: Apply Real time dataset using visualization tools.

SOFTWARE REQUIREMENTS:
Standalone desktops with Adobe Illustrator/Gimp, Jupiter notebook.

20CD412	OPERATING SYSTEM DESIGN LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To learn Unix commands and shell programming
- To implement various CPU Scheduling Algorithms
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance, Deadlock Detection Algorithms and Page Replacement Algorithms
- To implement File Organization and File Allocation Strategies

LIST OF EXERCISES:

1. Basics of UNIX commands
2. Shell Programming
3. Write C programs to implement the various CPU Scheduling Algorithms
4. Implementation of Semaphores
5. Implementation of Shared memory and IPC
6. Bankers Algorithm for Deadlock Avoidance
7. Implementation of Deadlock Detection Algorithm
8. Write C program to implement Threading and Synchronization Applications
9. Implementation of the following Memory Allocation Methods for fixed partition
   1. First Fit
   2. Worst Fit
   3. Best Fit
10. Implementation of Paging Technique of Memory Management
11. Implementation Page Replacement Algorithms FIFO, LRU & OPTIMAL
12. Implementation of the various File Organization Techniques
13. Implementation of the following File Allocation Strategies
    1. Sequential
    2. Indexed
    3. Linked

TOTAL: 30 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Compare the performance of various CPU Scheduling Algorithms

CO2: Implement Deadlock avoidance and Detection Algorithms
CO3: Implement Semaphores and Create processes and implement IPC
CO4: Analyze the performance of the various Page Replacement Algorithms
CO5: Implement File Organization and File Allocation Strategies.

SOFTWARE REQUIREMENTS:

Ubundu, C

20CS414	APTITUDE AND CODING SKILLS – II	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop advanced vocabulary for effective communication and reading skills.
- To build an enhanced level of logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.
- To apply data structures and algorithms in problem solving.

LIST OF EXERCISES:

1.English – Phase II

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. Logical Reasoning – Phase II

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. Quantitative Ability - Phase II

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. Automata Fix – Phase II

Logical, Compilation and Code reuse

5. Automata - Phase II

Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

TOTAL: 30   PERIODS

SEMESTER V

20CD501	WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

● To understand different internet technologies and to design website using HTML and CSS

● To build dynamic Webpages

● To create server-side programs using JSP and Servlets

● To construct simple web pages in PHP and to represent data in XML format.

● To demonstrate Java-specific web services

UNIT I	WEB BASICS, HTML 5, CSS 3	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 –Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II	CLIENT-SIDE PROGRAMMING	9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling-JSON introduction Function Files – Http Request – SQL.

UNIT III	SERVER-SIDE PROGRAMMING	9

Servlets: Java Servlet Architecture - Servlet Life Cycle - Parameter Data - Session Handling- Understanding Cookies - Installing and Configuring Apache Tomcat Web Server - Database Connectivity: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages - JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV	PHP and XML	9

An introduction to PHP: PHP- Using PHP- Variables- Built-in functions- Form Validation- Regular Expressions - File handling – Cookies - Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V	INTRODUCTION TO AJAX and WEB SERVICES	9

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

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Construct a basic website using HTML and Cascading Style Sheets.
CO2: Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
CO3: Develop server-side programs using Servlets and JSP.
CO4: Construct simple web pages in PHP and to represent data in XML format.
CO5: Apply AJAX and Web Services to develop interactive web applications

TEXT BOOKS:

1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Pearson, 5th Edition, 2018.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.

REFERENCES:

1. Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2nd Edition, 1999.
2. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
3. Gopalan N.P. and Akilandeswari J., "Web Technology", Second Edition, Prentice Hall of India, 2014.
4. UttamK.Roy, "Web Technologies", Oxford University Press, 2011.
5. Nicholas S. Williams, Professional Java for Web Applications, Wrox Publisher, First Edition, 2014.

20CD502	COMPUTER GRAPHICS AND ANIMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To grasp the fundamental knowledge of implementing Computer Graphics in 2D.
- To get familiar with 3D Graphics.
- To learn the process of implementation of Computer Graphics through Vulkan API.
- To get familiarity with basic to advanced rendering technique.
- To become familiar with Animation and Multimedia systems.

UNIT I	2D GRAPHICS PROCESSING	9

Video Display devices -Raster Scan System-Graphics Output Primitives-Open GL Point Functions-Open GL Line Functions-Open GL Curve Functions-Implementation Algorithm for Graphics Primitives & Attributes: Line Drawing Algorithm-Parallel Line Algorithm-Circle Generating Algorithm-Ellipse Generating Algorithm-Two-Dimensional Viewing Pipeline-Clipping Algorithm.

UNIT II	3D GRAPHICS PIPELINE	9

Three-Dimensional Geometric transformation: Translation- Rotation- Scaling-Composite Three-Dimensional Transformations-Other Three-dimensional Transformations-Three-dimensional viewing pipeline-Projection Transformations-Orthogonal Projections-Oblique Parallel Projections-Perspective Projections-OpenGL Three-dimensional Viewing Function.

UNIT III	VULKAN GRAPHICS API	9

Overview of Vulkan-Introduction-Instances, Devices and Queues-The Vulkan Instance-Vulkan Physical Devices-Physical Device Memory-Device Queues-Creating a Logical Device-Object Types and Function Conventions- Enhancing Vulkan: Layers – Extensions-Queues and Commands: Device Queue-Creating Command Buffers-Recording Buffer-Recycling Command Buffers -Moving Data: Managing Resource State.

UNIT IV	RENDERING	9

Lighting and Shading-Light Matter-Light Sources-The Phong Reflection Model-Texture Mapping-Texture Generation-Global Illumination-Ray Tracing- Radiosity-Parallel Rendering-Volume Rendering- Environment map- Bump mapping- isosurfaces and marching Cubes-Rasterization.

UNIT V	ANIMATION	9

Design of Animation Sequences-General Computer animation Function-Raster Animations-Computer Animation Languages-Key Frame System- Morphing-Simulating Acceleration-Motion Specification-Direct Motion Specifications-Goal Directed System-Kinematics & Dynamics.

	TOTAL: 45 PERIODS

OUTCOMES:

On Successful completion of the course, Students will be able to

CO1: Implement 2D transformations and algorithms for generating primitives and attributes**.**

CO2: Solve problems in 3D transformations and viewing**.**

CO3: Implement the process of open source Vulkan API.

CO4: Implement rendering techniques and use advanced based rendering.

CO5: Understand the multimedia systems and animation.

TEXT BOOKS:

1. Donald D. Hearn, M. Pauline Baker, Warren Carithers, "Computer Graphics with OpenGL", Pearson Education, Fourth Edition, 2014.
2. Graham Sellers, John Kessenich, "Vulkan Programming Guide", 1st Edition, Addison Wesley, 2016.
3. Edward Angel, Dave Shreiner," Interactive Computer Graphics. A Top-Down Approach with WebGL", 7th Edition, 2015

REFERENCES:
1. OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.5 with SPIR-V, 9th Edition, Addison Wesley, 2016.
2. https://vulkan-tutorial.com

20CD503	AUGMENTED AND VIRTUAL REALITY (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:

To impart knowledge on

- To get exposure on Augmented Reality.
- To introduce Virtual Reality and input and output devices.
- To acquire knowledge on computing architectures and modelling.
- To explore Virtual Reality programming and human factors.
- To learn various applications of Virtual Reality.

UNIT I	AUGMENTED REALITY(AR)	9+6

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices.

UNIT II	INTRODUCTION TO VIRTUAL REALITY(VR) AND INPUT AND OUTPUT DEVICES	9+6

Introduction: The three I's of Virtual Reality - A short history of early virtual reality - Early commercial VR technology - VR becomes an industry - The five classic components of a VR system. Input devices: Three-Dimensional position trackers - tracker performance parameters - ultrasonic trackers - optical trackers - navigation and manipulation interfaces - gesture interfaces. Output devices: graphics displays - large-volume displays - sound displays.

UNIT III	COMPUTING ARCHITECTURES AND MODELING OF A VR SYSTEM	9+6

Computing architectures for VR: The rendering pipeline - The graphics rendering pipeline - The haptics rendering pipeline - PC graphics architecture - PC graphics accelerators - Graphics benchmarks - Distributed VR architectures - Colocated rendering pipelines. Modeling: geometric modeling - kinematics modeling - physical and behavior modelling.

UNIT IV	VR PROGRAMMING AND HUMAN FACTORS	9+6

Toolkits and scene graphs - WorldToolKit - Model geometry and appearance - The WTK scene graph - Sensors and action functions - WTK networking - Java 3D - Model geometry and appearance - Java 3D scene graph - Sensors and behaviors - Java 3D networking - WTK and Java 3D performance comparison –Human factors in VR: Methodology and terminology - user performance studies - VR health and safety issues - VR and society.

UNIT V	APPLICATIONS OF VR	9+6

Medical Application of VR - Virtual anatomy-Triage and diagnostic - Surgery - VR in education - VR and the Arts - Entertainment applications of VR - military VR applications - Army use of VR - VR applications in the Navy - Air force use of VR - Applications of VR in

Robotics - Robot programming - Robot teleoperation.

<div align="right">TOTAL:45+30=75 PERIODS</div>

LIST OF EXERCISES:

1. Introduction to Unity Software.
2. Study of tools like Unity, Blender.
3. Download objects from asset store and apply various lighting and shading effects.
4. Use the primitive objects and apply various projection types by handling camera.
5. Experience VR AR MR and its production tools
6. Create your first 3D prototype for the Classroom, Library, Auditorium, Seminar Hall, Indoor Playground Environment.
7. Learning Real Time programming (C#).
8. Level Creation using Unity.
9. Project on the Selected AR or VR device.
10. Project can be selected from their generic use cases related to the concern department.

OUTCOMES:

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

CO1: Understand Augmented Reality.
CO2: Explore different input and output devices used in Virtual Reality system.
CO3: Model the VR system.
CO4: To learn about Google Toolkit's and Scene Graph.
CO5: Apply VR in various fields.

TEXTBOOK:

1. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016.
2. Grigore C. Burdea, Philippe Coiffet, "Virtual reality technology", Wiley, Second Edition, 2006.

REFERENCE BOOK:

1. "Handbook of Augmented Reality", Borko Furht, Springer, 2011.
2. Sherman, William R & Craig, Alan B, "Understanding Virtual reality", Elsevier India Private Limited, Noida, 2008.
3. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018.

SOFTWARE REQUIREMENTS:

Unity, Maya/3DS MAX/Blender.

20CD511	COMPUTER GRAPHICS & ANIMATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To grasp the fundamental knowledge of implementing Computer Graphics in 2D
- To get familiar with 3D Graphics
- To learn the process of implementation of Computer Graphics through Vulkan API
- To get familiarity with basic to advanced rendering techniques
- To become familiar with Animation & Multimedia systems

LIST OF EXERCISES:

1. Install vulkan sdk with c++ in Visual Studio and set up the work environment.
2. Understand vulkan environment for setting up graphics experiment: setup, presentation, graphics pipeline commands, window surface, swap chain, imageviews, buffers.
3. 2D primitives (points, lines, polygons, triangle fan, triangle strip etc.,)
4. Setting up the camera, lights and performing viewing transformations. Demonstrate aSimple projection transformation for a primitive.
5. Drawing 3D primitive "Cube" and show the cube from different camera angles andperspectives.
6. Place lights and Shade the cube using any shading language or simple flat shading, with different colors for different surfaces of the cube.
7. Apply basic transformations on the cube including Translation, Rotation, Scaling.
8. Understand different types of shaders in Vulkan
9. Using different Buffers (Depth Buffer, Stencil Buffer) to implement different effects on the 3D model
10. Applying textures on a Cube.
11. Perform the above steps on other geometric objects other than Cube.
12. Create and animate simple 3D scene with different objects and attributes.
13. Perform Rendering with Environment and Bump maps or using other rendering techniques.

TOTAL: 60 PERIODS

OUTCOMES:

On Successful completion of the course, Students will be able to

CO1: Implement 2D transformations and algorithms for generating primitives and attributes.
CO2: Solve problems in 3D transformations and viewing
CO3: Implement and Render graphics using open source Vulkan API
CO4: Implement rendering techniques and Use GPU based rendering
CO5: Create 2D animations.

SOFTWARE REQUIREMENTS:

Systems with Vulkan SDK, C++ compiler and IDE like Visual Studio.

20CD512	WEB TECHNOLOGY LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To create web pages using HTML/XML and style sheets.
- To design user interfaces using Java frames and applets.
- To develop dynamic web pages using server-side scripting and PHP programming.
- To build applications with AJAX.
- To develop mini-project using web applications.

LIST OF EXERCISES:

1. Create a web page with the following.
   - a. Cascading style sheets.
   - b. Embedded style sheets.
   - c. Inline style sheets.
2. Form Validation (Date, Email, User name, Password and Number validation) using JavaScript.
3. Write programs in Java using Servlets:
   - a. To invoke servlets from HTML forms
   - b. Session tracking.
4. Create a three-tier java application using JDBC with the following functionalities:
   Add Record, Modify Record, Delete Record, display one Record, Display All
   Get the input from the user through forms and display the results in the client browser.
5. Create a dynamic web application using Servlet/JSP with a facility to
   - a. Login to the application
   - b. Register a new user and
   - c. Change password for an existing user
6. Create an Ajax application to retrieve data from an XML file and display the data in an HTML.
7. i) Validate the form using PHP regular expression.
   ii) PHP stores a form data into database.
8. Write a web service for finding public review about a consumer product.
9. Mini Projects-Develop any one of the following web applications (not limited to one) using above technologies.
   - a. Online assessment system
   - b. Ticket reservation system
   - c. Online shopping
   - d. Student management system
   - e. Student result management system
   - f. Library management
   - g. Hospital management
   - h. Attendance management system
   - i. Examination automation system
   - j. Web based chat application

TOTAL: 60 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Create web pages using HTML/XML and style sheets.
CO2: Design user interfaces using Java frames and applets.

CO3: Develop dynamic web pages using server-side scripting and PHP programming.
CO4: Build applications with AJAX.
CO5: Develop mini-project using web application.

SOFTWARE REQUIREMENTS:
Systems with Eclipse, Mysql, Apach server, Net Beans, WAMP/XAMPP.

20CS512	ADVANCED APTITUDE AND CODING SKILLS - I	L	T	P	C
		0	0	2	1

OBJECTIVES:
- To develop vocabulary for effective communication and reading skills.
- To build the logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.

LIST OF EXERCISES:

1. English – Phase I Advanced
Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. Logical Reasoning – Phase I Advanced
Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. Quantitative Ability - Phase I Advanced
Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. Automata Fix – Phase I
1. Logical, Compilation and Code reuse

TOTAL: 30 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Develop vocabulary for effective communication and reading skills.
CO2: Build the logical reasoning and quantitative skills.
CO3: Develop error correction and debugging skills in programming.

SEMESTER VI

20CS601	COMPILER DESIGN	L	T	P	C
	(LAB INTEGRATED)	2	0	2	3

OBJECTIVES:
- To study the different phases of compiler
- To understand the techniques for tokenization and parsing
- To understand the conversion of source program into an intermediate representation
- To learn the different techniques used for assembly code generation
- To analyse various code optimization techniques

UNIT I	INTRODUCTION TO COMPILERS	6+ 6 = 15

Introduction–Structure of a Compiler–Role of the Lexical Analyzer - Input Buffering - Specification of Tokens - Recognition of Tokens–The Lexica Analyzer Generator LEX- Finite Automata - From Regular Expressions to Automata -conversion from NFA to DFA, Epsilon NFA to DFA - Minimization of Automata.

UNIT II	SYNTAX ANALYSIS	6+ 6 = 15

Role of the Parser - Context-free grammars – Derivation Trees – Ambiguity in Grammars and Languages- Writing a grammar – Top-Down Parsing –Bottom-Up Parsing -LR Parser-SLR, CLR -Introduction to LALR Parser -Parser Generators – Design of a parser generator – YACC.

UNIT III	INTERMEDIATE CODE GENERATION	6+ 6 = 15

Syntax Directed Definitions - Evaluation Orders for Syntax Directed Definitions–Application of Syntax Directed Translation - Intermediate Languages - Syntax Tree -Three address code – Types and Declarations - Translation of Expressions - Type Checking.

UNIT IV	RUN-TIME ENVIRONMENT AND CODE GENERATION	6+ 6 = 15

Run Time Environment: Storage Organization-Stack Allocation of space - Access to nonlocal data on stack – Heap management - Parameter Passing - Issues in Code Generation - Design of a simple Code Generator Code generator using DAG – Dynamic programming-based code generation.

UNIT V	CODE OPTIMIZATION	6+ 6 = 15

Principle sources of optimization –Peep hole Optimization – Register allocation and assignment - DAG -Basic blocks and flow graph - Optimization in Basic blocks – Data flow analysis.

LIST OF EXERCISES:

1. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.). Create a symbol table, while recognizing identifiers.

2. Design a lexical analyzer for the given language. The lexical analyzer should ignore redundant spaces, tabs and new lines, comments etc.

3. Implement a Lexical Analyzer using Lex Tool

4. Design Predictive Parser for the given language

5. Implement an Arithmetic Calculator using LEX and YACC

6. Generate three address code for a simple program using LEX and YACC.

7. Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation)

8. Implement back-end of the compiler for which the three-address code is given as input and the 8086-assembly language code is produced as output.

TOTAL: 30 +30 = 60 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the different phases of compiler
CO2: Perform tokenization and parsing for programs
CO3: Generate intermediate code representation for any source programs
CO4: Analyze the different techniques used for assembly code generation
CO5: Implement code optimization techniques with simple code generators

TEXT BOOK:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education Limited, 2014.

REFERENCES:

1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A
2. Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
3. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint, 2003.
4. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers, Elsevier Science, 2004.
5. V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010.
6. Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 1993.

SOFTWARE REQUIREMENTS:

Systems with UBUNTU 10.04, GNU compiler.

20CD601	COMPUTER NETWORKS (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:
- To study the fundamental concepts of computer networks and physical layer.
- To gain the knowledge of various protocols and techniques used in the data link layer.
- To learn the services of network layer and network layer protocols.
- To describe different protocols used in the transport layer.
- To understand the application layer protocols

UNIT I	INTRODUCTION AND PHYSICAL LAYER	9 + 6

Data Communications – Network Types – Protocol Layering – Network Models (OSI, TCP/IP) Networking Devices: Hubs, Bridges, Switches – Performance Metrics – Transmission media - Guided media -Unguided media- Switching-Circuit Switching - Packet Switching

UNIT II	DATA LINK LAYER	9 + 6

Introduction – Link-Layer Addressing- Error Detection and Correction - DLC Services – Data Link Layer Protocols – HDLC – PPP - Wired LANs: Ethernet - Wireless LANs – Introduction – IEEE 802.11, Bluetooth

UNIT III	NETWORK LAYER	9 + 6

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

UNIT IV	TRANSPORT LAYER	9 + 6

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol –Transmission Control Protocol – SCTP.

UNIT V	APPLICATION LAYER	9 + 6

Application layer-WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP

LIST OF EXERCISES:

1. Practice different network commands available in Windows and Linux Operating Systems and troubleshoot the network.

2. Network configuration commands using Linux.

3. Error detection and correction mechanisms.

4. Flow control mechanisms.

5. Multi-client chatting in TCP and UDP using Socket programming

6. Implementation of HTTP, Web Caching, FTP using socket programming.

7. Develop a DNS client server to resolve the given host name or IP address.

TOTAL: 45 +30 = 75 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the fundamental concepts of computer networks and physical layer.
CO2: Gain knowledge of various protocols and techniques used in the data link layer.
CO3: Learn the network layer services and network layer protocols.
CO4: Understand the various protocols used in the transport layer.
CO5: Analyze the various application layer protocols.

TEXT BOOK:

1. Data Communications and Networking, Behrouz A. Forouzan, McGraw Hill Education, 5th Ed., 2017.

REFERENCES:

1. Computer Networking- A Top-Down Approach, James F. Kurose, University of Massachusetts and Amherst Keith Ross, 8th Edition, 2021.

2. Computer Networks, Andrew S. Tanenbaum, Sixth Edition, Pearson, 2021.

3. Data Communications and Computer Networks, P.C. Gupta, Prentice-Hall of India, 2006.

4. Computer Networks: A Systems Approach, L. L. Peterson and B. S. Davie, Morgan Kaufmann, 3rd ed., 2003.

SOFTWARE REQUIREMENTS:

Systems with UBUNTU 18.04.01 LTS, NS2, gc++ editor.

20CS932	MOBILE COMPUTING	L	T	P	C
	(LAB INTEGRATED)	2	0	2	3

OBJECTIVES:
- To understand the basic concepts of mobile computing and multiplexing techniques.
- To learn the different mobile telecommunication systems.
- To get familiar with the mobile network layer protocols and Ad-Hoc networks.
- To know the various mobile transport and application layer protocols.
- To gain knowledge on different mobile platforms and applications.

UNIT I	INTRODUCTION	6+6

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA-TDMA-FDMA- CDMA.

UNIT II	MOBILE COMMUNICATION STANDARDS	6+6

Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Localization and calling – Radio Interface– Hand over – Security – GPRS- UMTS – Architecture – Handover - Wireless LAN - IEEE 802.11 – Bluetooth.

UNIT III	MOBILE NETWORK LAYER	6+6

Mobile IP – DHCP – AdHoc – Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security issues in MANET.

UNIT IV	MOBILE TRANSPORT AND APPLICATION LAYER	6+6

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.

UNIT V	MOBILE PLATFORMS AND APPLICATIONS	6+6

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

LIST OF EXERCISES:

1. Simulate Mobile Routing Protocols using Network simulators.
2. Develop an application that uses the following features:
   a. GUI components, Font and Colours
   b. Layout Managers and event listeners.
   c. Graphical primitives on the screen.
3. Develop an application that makes use of databases.
4. Develop an application that makes use of Notification Manager
5. Implement an application that uses Multi-threading.
6. Develop a native application that uses GPS location information
7. Implement an application that writes data to the SD card.
8. Implement an application that creates an alert upon receiving a message
9. Write a mobile application that makes use of RSS feed
10. Develop a mobile application to send an email.
Develop a simple Mobile application that uses data from sensors like GPS, proximity,

bluetooth, etc.
(Mini Project)

	TOTAL: 30+30 = 60 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the basics of mobile computing and multiplexing techniques.
CO2: Illustrate the generations of telecommunication systems in wireless networks.
CO3: Determine the functionality of MAC, network layer and identify a routing protocol for a given Adhoc network.
CO4: Explain the functionality of mobile Transport and Application layers.
CO5: Understand the usage of different mobile platforms and implement applications.

TEXT BOOK:

1. Jochen Schiller, - Mobile Communications, PHI, Second Edition, 2003.

2. Prasant Kumar Pattnaik, Rajib Mall, - Fundamentals of Mobile Computing, PHI Learning Pvt.Ltd, New Delhi – 2012

REFERENCES:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, - Principles of Mobile Computing, Springer, 2003.
3. William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital Systems, Second Edition, TataMcGraw Hill Edition ,2006.
4. C.K.Toh,- AdHoc Mobile Wireless Networksll, First Edition, Pearson Education, 2002.
5. Android Developers : http://developer.android.com/index.html
6. Apple Developer : https://developer.apple.com/
7. Windows Phone DevCenter: http://developer.windowsphone.com
8. BlackBerry Developer : http://developer.blackberry.com

SOFTWARE REQUIREMENTS:
iOS, Xcode

20CS614	ADVANCED APTITUDE AND CODING SKILLS - II	L	T	P	C
		0	0	2	1

OBJECTIVES:
- To develop advanced vocabulary for effective communication and reading skills.
- To build an enhanced level of logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.
- To apply data structures and algorithms in problem solving.

LIST OF EXERCISES:

1.**English – Phase II Advanced**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential

and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. **Logical Reasoning – Phase II Advanced**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. **Quantitative Ability - Phase II Advanced**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. **Automata Fix – Phase II**

Logical, Compilation and Code reuse

5. **Automata - Phase II**

Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

	TOTAL: 30 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Develop advanced vocabulary for effective communication and reading skills.
CO2: Build an enhanced level of logical reasoning and quantitative skills.
CO3: Develop error correction and debugging skills in programming.
CO4: Develop error correction and debugging skills in programming.

SEMESTER VII

20CD701	CLOUD COMPUTING (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:
- To understand the basic concept of cloud computing.
- To discuss the different types of cloud virtualization techniques.
- To understand the cloud platform architecture and its challenges.
- To discuss about cloud resource management and cloud security.
- To analyse the various cloud service providers and emerging cloud technologies

UNIT I	INTRODUCTION	9 + 6

Introduction to Cloud Computing – Definition of Cloud – The cloud computing reference

model – Characteristics and benefits – Challenges - Historical developments (evolution of the distributed computing technologies) - Principles of Parallel and Distributed Computing: Elements of parallel computing - Elements of distributed computing - Technologies for distributed computing.

UNIT II	VIRTUALIZATION	9 + 6

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

UNIT III	CLOUD PLATFORM ARCHITECTURE	9 + 6

Cloud Computing and Service Models - Data-Center Design and Interconnection Networks - Architectural Design of Compute and Storage Clouds: Layered Cloud Architectural Development - Virtualization Support and Disaster Recovery - Architectural Design Challenges, Public Cloud Platforms: GAE, AWS, and Azure.

UNIT IV	RESOURCE MANAGEMENT AND SECURITY IN CLOUD	9 + 6

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Virtual Machine Creation and Management - Global Exchange of Cloud Resources – Cloud Security and Trust Management: Cloud Security Defense Strategies - Distributed Intrusion/Anomaly Detection - Data and Software Protection Techniques - Reputation-Guided Protection of Data Centers.

UNIT V	CLOUD TECHNOLOGIES AND ADVANCEMENTS	9 + 6

MapReduce - Hadoop – Google App Engine – Programming Support of Google App Engine - Programming on Amazon AWS and Microsoft Azure – Emerging Cloud Software Environments: Open-Source Eucalyptus and Nimbus - Open Nebula, Sector/Sphere, and OpenStack - Manjra soft Aneka Cloud and Appliances.

LIST OF EXPERIMENTS:

1. Install Virtual box /VMware Workstation with different flavours of linux or windows OS on top of Windows.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple programs
3. Install Google App Engine. Create hello world app and other simple web applications using
Python/Java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

TOTAL: 45 +30 = 75 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the basic concepts and key technologies of cloud computing.
CO2: Apply the virtualization techniques for the development of cloud.
CO3: Understand and use the architecture of compute and storage cloud, service and delivery models.
CO4: Identify the core issues of cloud computing such as resource management and security
CO5: Analyze the various cloud service providers and other emerging cloud-based tools.

TEXT BOOK:

1. Raj kumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2017.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

REFERENCES:

1. Ritting house, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

SOFTWARE REQUIREMENTS:

Systems with internet connection.

SEMESTER V/VI – PROFESSIONAL ELECTIVES – I/II/III

20CD901	GAME ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To focus on basics of Game Artificial Intelligence.
- To learn about various artificial intelligence techniques for game design and development.
- To evaluate the various path finding algorithms.
- To learn about Decision making Algorithms
- To develop case studies for industries using artificial intelligence techniques in computer games.

UNIT I	INTRODUCTION TO GAME AI	9

What is AI- Academic AI -Game AI -Model of Games AI-Movement-Decision making -Strategy-Infrastructure-Agent Based AI-Algorithms and Data structures-The complexity Fallacy-The kind of AI in games-Hacks-Heuristics-Algorithms-AI Engine-Structure-Tools.

UNIT II	TECHNIQUES	9

The Basics of movement Algorithm- 2D-Statics-Kinematics Movement Algorithms-Seek-Wandering-Steering behaviours -Combining steering behaviours- Blending and Arbitration-

Weighted Blending- Priorities- Cooperative Arbitration-Steering Pipeline-Predicting-Jumping-Coordinated movement -Movement in 3D.

UNIT III	PATH FINDING ALGORITHMS	9

Path finding Graph- Graphs-Weighted Graphs-Directed Weighted Graphs-Dijkstra-A* and Heuristics-Hierarchical pathfinding-open Goal Pathfinding-Dynamic Pathfinding-Interruptible Pathfinding-Continuous time pathfinding-Movement planning -Animations-Movement Planning.

UNIT IV	DECISION MAKING	9

Decision trees-Performance-Balancing the Tree-Random Decision Trees- Behavior Trees-Fuzzy logic -Fuzzy State Machines-Markov systems-Markov Processes-Markov State Machines-Goal Oriented Systems-Rule based Systems.

UNIT V	MODERN TECHNIQUES -PROCEDURAL CONTENT GENERATION AND DESIGNING GAME AI	9

Pseudorandom Numbers-Lindenmayer Systems-Landscape Generation-Dungeons and Maze Generation-Shape Grammar - Game Theory-Designing Game AI—Design-Shooters-Driving-Real time Strategy-Sports-Turn Based Strategy Games.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the basics techniques used in computer games.
CO2: Apply the basic movement algorithms in modern and traditional systems.
CO3: Inspect the use of path finding algorithm in particular artificial intelligence techniques for solving game design problems.
CO4: Examine various Decision-making algorithms for game design.
CO5: Identify and examine state-of-the-art artificial intelligence techniques from the industry and academia to solve computer game design problems.

TEXT BOOKS:

1. Millington, Ian. Artificial Intelligence for Games (3rd Ed.). CRC Press, 2019
2. Programming Game AI by Example 1st (first) edition Text Only, Mat Buckland,2004

REFERENCES:

1. Game AI Pro 360: Guide to Architecture 1st Edition.
2. Game AI Pro 3: Collected Wisdom of Game AI Professionals, Steve Rabin, CRC Press, 2017.
3. Programming Game AI by Example, Mat Buckland, 2005.

20CD902	SOCIAL, TEXT AND MEDIA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Learn the fundamentals of Social Network Data Analysis.

- To Analyze and applying node classification in social networks.
- To Familiarize the models and algorithms in social networks.
- To Understand the principles for Text Mining and Visualization in Social Networks.
- To Learn about the multimedia information networks.

UNIT I	INTRODUCTION TO SOCIAL NETWORK DATA ANALYTICS	9

Introduction to Social Network Data Analytics, Statistical Properties of Social Networks-preliminary, Static Properties, Dynamic Properties. Random Walks in Social Networks and their Applications: A Survey-Background-Algorithms-Applications – Evaluation, Random Walk Community Discovery in Social Networks: Introduction – Core Methods.

UNIT II	NODE CLASSIFICATION IN SOCIAL NETWORKS	9

Introduction-Problem Formulation-Method using Local Classifiers-Random Walk based Methods: Label Propagation, Graph Regularization, Adsorption-Applying Node Classification to Large Social Networks-Related Approaches-Variation on Node classification.

UNIT III	MODELS AND ALGORITHMS	9

Influence Related Statistics-Social similarity and Influence-Viral marketing. Expert Location-Without Graph Constraint, Score Propagation, Team Formation, Other Approaches.

UNIT IV	TEXT MINING AND VISUALIZATION	9

Keyword search-Query semantics and Answer Ranking-Keyword search over XML and relational data-graph data-Classification Algorithms-Clustering Algorithms-Transfer learning in Heterogeneous Networks. Visualizing Social Networks- Introduction-A Taxonomy of Visualizations-The Convergence of Visualization, Interaction and Analytics.

UNIT V	MULTIMEDIA INFORMATION NETWORKS	9

Introduction -Ontology Based Learning- Community media- Retrieval Systems and Recommendation systems - personal photo albums- Actor – Centric, Quality Issues, Time and Location, Content Overlap in personal Collections- Network of Geographical Information- Inference Methods – Social Tagging and Applications.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Know the basics of Data Analysis in Social Network.
CO2: Understand node classification in Social Network.
CO3: Know various social network algorithms
CO4: Analyze and Visualize Social Networks.
CO5: Understand multimedia information networks and apply in real time problems

TEXT BOOKS:

1. Charu C. Aggarwal," Social Network Data Analytics", Springer, 2011.
2. Ajith Abraham, "Computational Social Network Analysis Trends, Tools and Research Advances", Springer, 2010.

REFERENCES:

1. Brian V. Carolan," Social Network Analysis and Education: Theory, Methods &

Applications", Kindle Edition, 2013.
2. Song Yang, Franziska B Keller," Social Network Analysis: Methods and Examples", Kindle Edition, 2016.
3. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Marshall Sponder, Mc Grawhill, 2012.

20CD903	MULTIMEDIA SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand different forms of media in systems.
- To acquire knowledge in multimedia components.
- To acquire knowledge in the development of multimedia applications.
- To acquire knowledge about multimedia tools and authoring.
- To learn about the latest trends and technologies in multimedia.

UNIT I	INTRODUCTION	9

Introduction to Multimedia – Characteristics of Multimedia Presentation – Multimedia Components – Promotion of Multimedia Based Components – Digital Representation – Media and Data Streams – Multimedia Architecture – Multimedia Documents – Visual Display System.

UNIT II	ELEMENTS OF MULTIMEDIA	9

Text: Types, Font, Unicode Standard, Text Compression, File Formats – Image: Types, Image Processing, Standards, Specification, Device Independent Color Models, Gamma Correction, File Formats – Video: Video Signal Transmission, Signal Formats, Broadcasting Standards, Digital Video Standards, PC Video, Video File Formats – Audio: Acoustics, Characteristics of Sound – Elements of Audio System: Microphone, Amplifier, Loudspeaker, Audio Mixer, Digital Audio, MIDI – Graphics: Components of Graphics System.

UNIT III	MULTIMEDIA COMPRESSION TYPES	9

Compression Types and Techniques: CODEC, GIF Coding Standards, JPEG, MPEG – Multimedia Database System – User Interfaces – OS Multimedia Support – Hardware Support – Real Time Protocols – Play Back Architectures – Synchronization – Document Architecture – Hypermedia Concepts: Hypermedia Design – Digital Copyrights.

UNIT IV	MULTIMEDIA TOOLS	9

Authoring Tools – Features and Types – Card and Page Based Tools – Icon and Object Based Tools – Time Based Tools – Cross Platform Authoring Tools – Editing Tools – Painting and Drawing Tools – 3D Modeling and Animation Tools – Image Editing Tools – Sound Editing Tools – Digital Movie Tools.

UNIT V	MULTIMEDIA APPLICATION DEVELOPMENT	9

Software Life Cycle – ADDIE Model – Conceptualization – Content Collection – Story Board –Script –Authoring Metaphors – Testing – Report Writing – Documentation.

| | **TOTAL: 45 PERIODS** |

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Articulate the concepts and techniques used in multimedia applications.
CO2: Handle the multimedia elements effectively.
CO3: Develop effective strategies to deliver Quality of Experience in multimedia applications.
CO4: Design and implement algorithms and techniques applied to multimedia objects.
CO5: Design and develop multimedia applications following software engineering models.

TEXTBOOKS:
1. Ranjan Parekh, "Principles of Multimedia", Second Edition, McGraw-Hill Education, 2017.
2. Tay Vaughan, "Multimedia: Making It Work", Ninth Edition, McGraw-Hill, 2014.

REFERENCES:
1. Ralf Steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Prentice Hall, 1995.
2. Paul Dietel, Harvey Dietel, Abbey Dietel, "Internet & World Wide Web How to Program", Fourth Edition, Prentice Hall, 2008.
3. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education, 2002.

20CD904	UI/UX DESIGN (LAB INTEGRATED)	L	T	P	C
		2	0	2	3

OBJECTIVES:
- To explain the principles of User Interface (UI) in order to do design with intention.
- To define the User eXperience (UX) and the psychology behind user decision making.
- To discuss about UX process and user Psychology.
- To apply technology for designing web applications with multimedia effects.
- To create a wireframe and prototype.

UNIT I	INTRODUCTION TO UI	6+6

Introduction to UI - Designing Behaviour: Designing with Intention - Conditioning and Addiction - Timing Matters - Gamification - Social/Viral Structure–Trust - Hidden versus Visible. Basic Visual Design Principles: Visual Weight - Contrast - Depth and Size – Color- Layout: Page Framework - Footers - Navigation -Images, and Headlines - Forms - Input Types - Labels and Instructions - Primary and Secondary Buttons - Adaptive and Responsive Design - Touch versus Mouse.

UNIT II	USER OBSERVATION AND EXPERIENCE	6+6

User Research - Subjective Research - Objective Research - Three Basic Types of Questions. Observe a user: Watch How They Choose - Interviews - Surveys - Card Sorting - Creating User Profiles - Bad profile - Useful profile.

UNIT III	INTRODUCTION TO UX	6+6

Introduction about UX - Five Main Ingredients of UX - Three "Whats" of user Perspective - Pyramid of UX Impact - UX Is a Process - UX - Not an Event or Task. Behaviour Basics: Psychology versus Culture - User Psychology - Experience - Conscious vs Subconscious Experience - Emotions - Gain and Loss – Motivations.

UNIT IV	WEB INTERFACE DESIGN	6+6

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Using Motion for UX - Design Pattern: Z-Pattern - F-Pattern - Visual Hierarchy - Lookup patterns – Feedback patterns.

UNIT V	WIREFRAMING, PROTOTYPING AND TESTING	6+6

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wire flows - Building a Prototype - Building High-Fidelity Mock-ups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

LIST OF EXERCISES:

1. Design UI for a Game website.
2. Design one-page UI for a website.
3. Design UI for a mobile.
4. Explore the Look and Feel of the new Project developed in Ex1.
5. Design a mascot for an imaginary brand.
6. Create a Sample Pattern Library for a product (Mood board, Fonts, Colors based on UI principles).
7. Design a mock-up website for a service sector company.
8. Create a brainstorming feature for proposed product.
9. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements.
10. Design a mobile mock-up website for an online store.

TOTAL: 30+30=60 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the principles of User Interface (UI) Design in order to design with intention.

CO2: Learn the effective User eXperience (UX) and the psychology behind user decision making.

CO3: Understand the importance of UX process and user Psychology.

CO4: Elucidate the implications for designing web application with multimedia effects.

CO5: Create Wireframe and Prototype.

TEXT BOOKS:

1. Joel Marsh, "UX for Beginners", O'Reilly Media, Inc., 1st Edition 2015.
2. Xia Jiajia, "UI UX Design", O'Reilly, Artpower International, 2016.
3. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3rd Edition, O'Reilly 2020

REFERENCES:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3rd Edition , O'Reilly 2020.
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018.
3. https://www.uxai.design/#:~:text=for%20designers,for%20AI%20products%20and%20services.

SOFTWARE REQUIREMENTS:

Javascript, Applets, Equivalent Frontend tools, MySQL, Figma or equivalent.

20CD905	PRODUCT CENTRIC AGILE DEVELOPMENT (LAB INTEGRATED)	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand agile software development practices
- To become familiar Product Centric Value Delivery
- To Implement Agile metrics and its working methods
- To apply Product Centric Agile Development and have a working knowledge of web services
- To obtain knowledge on DevOps and its related concepts.

UNIT I	AGILE SOFTWARE DEVELOPMENT PROCESS	6+6

Introduction to Agile Development- The Agile Mindset – Lean Agile mindset – Mindset awareness and openness to change – thinking lean with House of Lean – Embracing Agility with the Agile Manifesto – Principles of Agile Manifesto- Agile Methodologies – Scrum – Kanban – Scrumban – Spotify – SAFe- Agile engineering practices – Software development – TDD – BDD – Pair Programming – Refactoring – Extreme programming

UNIT II	PRODUCT CENTRIC VALUE DELIVERY	6+6

Introduction to Agile Product Centric Value Delivery – Overview of Agile Operating Model - Key Product management collaborations – Responsibilities – Exploring markets and users – Connecting with the customer – Defining Product strategy, vision & roadmaps – Managing and Prioritizing ART backlog – Delivering Value- Agile product delivery – Why Agile Product delivery? – Three dimensions of APD – Customer centricity & Design thinking – Develop on Cadence & Release on demand – DevOps and Continuous delivery pipeline- Product Centric Value Delivery Principles - Benefits of Product Centric Value Delivery - Delivering Value with Product Centric Agile Development

UNIT III	AGILE METRICS AND WAYS OF WORKING	6+6

An Introduction to Agile Metrics - Key Benefits of tracking Agile Metrics- Metrics Categories - Ways of Working – Embracing DevOps mindset, Culture & practices – Taking economic view – Systems thinking – Make value without interruptions – Synchronize with cross-domain planning – Organize around value – Decentralize decision making – Assume variability; preserve options

UNIT IV	APPLYING PRODUCT CENTRIC AGILE DEVELOPMENT	6+6

Application of Product centric agile development – Technology stacks - Introduction to Web Services – The definition of web services, basic operational model of web services,

tools and technologies enabling web services, benefits and challenges of using web services. – Cloud Services – Data – Digital - Security and NFRs- Digital Marketing use case – Data modernization use case

UNIT V	DevOps AND CI/CD	6+6

Understanding the DevOps Movement - Benefits of DevOps - The DevOps Lifecyle - Build Continuous automation, integration-Cloud computing-configuration management-continuous delivery, monitoring, feedback. Tools and technologies: Code repositories - Build tools-Maven-Continuous integration tools-Jenkins-Configuration management tools-Chef-Cloud service providers-Container technology-Docker-Monitoring tools-The DevOps Dashboard-An overview of a sample Java EE application

LIST OF EXERCISES:

1. Write down the problem statement for Student Result Management System. Do requirement analysis and develop Software Requirement Specification (SRS). Develop function- oriented Diagrams, User and Structural Diagram.
2. Develop Behavioral, implementation and Environmental view diagram for Student Result Management System.
3. Apply design thinking principles & establish product features, product back log as part of Discovery phase for Payment banking system
4. Apply design thinking principles & establish product features, product back log as part of Discovery phase for Retail solution
5. Apply design thinking principles & establish product features, product back log as part of Discovery phase for Health management system
6. Develop product backlog & create user stories – develop detailed sprint plan (Sprint 0 with 5 sprints)
7. Write a program to implement a) Web based service consumer b) Windows application based web service consumer.
8. Set up DevOps environment – Git – Install / Configure Git – Setting up project – pushing changes
9. Explore the environment by Jenkins installation and setup.
10. Develop a simple containerized application using Docker.

TOTAL: 30+30=60 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Apply agile development methods in software development practices.

CO2: Obtain knowledge on Product Centric Value Delivery.

CO3: Implement Agile metrics and its ways of working.

CO4: Apply Product Centric Agile Development and understand about web services.

CO5: Apply DevOps concepts and tools for Web Development.

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering: A Practitioner 's Approach", McGraw Hill International Edition, Nineth Edition, 2020
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India, 2003.

3. DevOps for Web Development, MiteshSoni, 2016

REFERENCES:

1. Craig Larman, Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004.
2. Kevin C. Desouza, Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.
3. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou, 2012.
4. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education, 2003.
5. https://v5.scaledagileframework.com/lean-agile-mindset/
6. https://scaledagileframework.com/product-management/
7. https://scaledagileframework.com/agile-product-delivery/

SOFTWARE REQUIREMENTS:

ArgoUML, Azure

20CD906	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To discuss on basics of 3D printing.
- To explain the principles of 3D printing technique.
- To explain and illustrate inkjet technology.
- To explain and illustrate laser technology.
- To discuss the applications of 3D printing.

UNIT I	INTRODUCTION	9

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats.

UNIT II	PRINCIPLE	9

Processes – Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations.

UNIT III	INKJET TECHNOLOGY	9

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continous jet, Mulitjet; Powder based fabrication – Colourjet.

UNIT IV	LASER TECHNOLOGY	9

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow – Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures.

UNIT V	INDUSTRIAL APPLICATIONS	9

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends;

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Outline and examine the basic concepts of 3D printing technology.
CO2: Outline 3D printing workflow`.
CO3: Explain and categorise the concepts and working principles of 3D printing using inkjet technique.
CO4: Explain and categorise the working principles of 3D printing using laser technique.
CO5: Explain various method for designing and modeling for industrial applications

TEXT BOOKS:

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

REFERENCES:

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010.
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007.
3. Joan Horvath, Mastering 3D Printing, APress, 2014.

		L	T	P	C
20AI401	**ARTIFICIAL INTELLIGENCE**	**3**	**0**	**0**	**3**

OBJECTIVES:
- To explain the foundations of AI and various intelligent agents
- To discuss problem solving search strategies and game playing
- To describe logical agents and first-order logic
- To illustrate problem solving strategies with knowledge representation mechanism for solving hard problems
- To explain the basics of learning and expert systems.

UNIT I	**ARTIFICIAL INTELLIGENCE AND INTELLIGENT AGENTS**	**9**

Introduction to AI – Foundations of Artificial Intelligence - Intelligent Agents – Agents and Environments - Concept of rationality – Nature of environments – Structure of agents – Problem solving agents – Example Problems-Search Algorithms –Uninformed Search Strategies

UNIT II	**PROBLEM SOLVING**	**9**

Heuristic search strategies – heuristic functions- Game Playing – Mini-max Algorithm – Optimal decisions in games – Alpha-beta search –Monte-Carlo search for Games - Constraint satisfaction problems – Constraint propagation – Backtracking search for CSP – Local search for CSP –Structure of CSP

UNIT III	**LOGICAL AGENTS**	**9**

Knowledge- based agents–Logic- Propositional logic– Propositional the or emproving–Propositional model checking– Agents based on propositional logic First-Order Logic – Syntax and semantics – Using First-Order Logic - Knowledge representation and engineering– Inferences in first-order logic– Propositional Vs First-Order Inference-Unification and First- Order Inference- Forward chaining –Backward chaining -Resolution

UNIT IV	KNOWLEDGE REPRESENTATION AND PLANNING	9

Ontological engineering–Categories and objects–Events–Mental objects and modallogic–Reasoning systems for categories – Reasoning with default information Classical planning–Algorithms for classical planning– Heuristics for planning–Hierarchical planning–Non- deterministic domains– Time, schedule, and resources -Analysis

UNIT V	LEARNING AND EXPERT SYSTEMS	9

Forms of Learning–Developing Machine Learning systems–Statistical Learning-Deep Learning: Simple feed-forward network - Neural Networks – Reinforcement Learning: Learning from rewards– Passive and active Reinforcement learning. Expert Systems: Functions–Main structure–if-then rules for representing knowledge–developing the shell–Dealing with uncertainty.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Explain the foundations of AI and various Intelligent agents.
CO2: Apply search strategies in problem solving and game playing.
CO3: Explain logical agents and first-order logic.
CO4: Apply problem-solving strategies with knowledge representation mechanism for solving hard problems.
CO5: Describe the basics of learning and expert systems.

TEXTBOOKS:
1. Peter Norvig and Stuart Russel, Artificial Intelligence: A Modern Approach, Pearson, 4th Edition, 2020.
2. Bratko, Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCES:
1. Elaine Rich, Kevin Knight and B.Nair, Artificial Intelligence 3rdEdition, McGraw Hill, 2017.
2. Melanie Mitchell, Artificial Intelligence: A Guide for Thinking Humans Series: Pelican Books, 2020
3. Ernest Friedman- Hill, Jessin Action, Rule-Based Systems in Java, Manning Publications, 2003
4. Nils J.Nilsson, the Quest for Artificial Intelligence, Cambridge University Press, 2009.
5. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition by Patterson, Pearson, India, 2015

20CS901	CYBER PHYSICAL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:
- The students will be able to Understand Cyber Physical System.
- To analyse Intelligent CPS.
- Apply modern tools to develop CPS applications
- To design a Cyber physical system for a given problem

	To test Cyber physical system			

- To test Cyber physical system

UNIT I	INTRODUCTION -SYNCHRONOUS MODEL	9

-reactive components - properties of components -composing components -synchronous designs

UNIT II	SAFETY REQUIREMENTS	9

Safety Specifications-Verifying Invariants-Enumerative Search-Symbolic Search

UNIT III	ASYNCHRONOUS MODEL	9

Asynchronous Processes-Asynchronous Design Primitives-Asynchronous Coordination Protocols

UNIT IV	LIVENESS REQUIREMENTS	9

Temporal Logic-Model Checking-Proving Liveness-Dynamical Systems-Continuous-Time Models-Linear Systems   - Designing Controllers-Analysis Techniques

UNIT V	TIMED MODEL	9

Timing-Based Protocols-Timed Automata-Real-Time Scheduling-EDF Scheduling-Fixed-Priority Scheduling-Hybrid Systems-Hybrid Dynamical Models-Designing Hybrid Systems-Linear Hybrid Automata

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

 CO1: The students will know basics of CPS
 CO2: The students will be able to identify research problems in CPS
 CO3: The students shall be able to design cyber physical systems
 CO4: The students shall be able to verify the designed cyber physical systems
 CO5: The students shall be able to deploy cyber physical systems in practical applications

TEXT BOOK:

1. R. Alur, "Principles of Cyber-Physical Systems," MIT Press, 2015.

REFERENCES:

1. Raj Rajkumar, Dionisio de Niz and Mark Klein, "Cyber-Physical Systems", Addison-Wesley, 2017
2. Andr´e Platzer. Logical Foundations of Cyber-Physical Systems. Springer, 2018

20CS902	WEB SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study and practice fundamental techniques in developing secure web-based applications
- To learn on web application technologies.

- To learn on the fundamental security controls to secure the web applications.
- To study the security principles in defending the resources.
- To identify and find the vulnerabilities of web-based applications and to protect those applications from attacks.

UNIT I	INTRODUCTION AND SECURITY FUNDAMENTALS	9

Introduction - Evolution of Web Applications - Web Application Security - Core Defence Mechanisms: Handling User Access - Handling User Input- Handling Attackers - Managing the Application - The OWASP Top Ten List – Security Fundamentals: Input Validation - Attack Surface Reduction - Classifying and Prioritizing Threats.

UNIT II	WEB APPLICATION TECHNOLOGIES	9

The HTTP Protocol - Web Functionality - Encoding Schemes - Mapping the Application: Enumerating Content and Functionality - Analyzing the Application - Bypassing Client-Side Controls: Transmitting Data via the Client - Capturing User Data: HTML Forms - Capturing User Data: Thick-Client Components - Handling Client-Side Data Securely.

UNIT III	WEB APPLICATION AUTHENTICATION AND AUTHORIZATION	9

Authentication: Access Control Overview - Authentication Fundamentals - Two-Factor and Three-Factor Authentication - Web Application Authentication - Securing Password-Based Authentication - Securing Web Authentication Mechanisms. Authorization: Access Control - Session Management Fundamentals - Securing Web Application Session Management.

UNIT IV	SECURITY PRINCIPLES	9

Browser Security Principles: Defining the Same-Origin Policy - Cross-Site Scripting - Cross-Site Request Forgery - Database Security Principles: Structured Query Language (SQL) Injection: SQL Injection Effects and Confidentiality-Integrity-Availability - Setting Database Permissions - Stored Procedure Security - Insecure Direct Object References.

UNIT V	VULNERABILITIES	9

Common Vulnerabilities - Attacking Access Controls - Securing Access Controls - Finding Vulnerabilities in Source Code: Approaches to Code Review - Signatures of Common Vulnerabilities - The Java Platform – PHP – JavaScript.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: To understand the core security problem affecting the web applications and the defence mechanisms.
CO2: To explore and probe the functionality of web-based applications examine the technologies in use.
CO3: To implement the fundamental security controls to secure the web applications.
CO4: To apply the security principles in defending the resources.
: **CO5:** To identify different category of vulnerabilities and security flaws in source code.

TEXT BOOKS:

1. Bryan Sullivan, Vincent Liu, "A Web Application Security - A Beginner's Guide",

McGraw-Hill Education, 2012.
2. Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws", Second Edition, John Wiley & Sons, Inc., 2011.

REFERENCES:
1. Hanqing and L. Zhao, Web Security: A Whitehat Perspective. United Kingdom: Auerbach Publishers, 2015. (ISBN No.: 978-1-46-659261-2).
2. M. Shema and J. B. Alcover, Hacking Web Apps: Detecting and Preventing Web Application Security Problems. Washington, DC, United States: Syngress Publishing, 2014. (ISBN No. 978-1-59-749951-4)

20AI702	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To learn the fundamentals of natural language processing
- To perform word level analysis.
- To understand the significance of Syntactic analysis.
- To understand the role of semantics and pragmatics.
- To learn discourse algorithms and various lexical resources

UNIT I	INTRODUCTION	9

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II	WORD LEVEL ANALYSIS	9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III	SYNTACTIC ANALYSIS	9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT IV	SEMANTICS AND PRAGMATICS	10

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods. .

UNIT V	DISCOURSE ANALYSIS AND LEXICAL RESOURCES	8

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Apply the fundamentals of natural language processing.
CO2: Perform word level analysis.
CO3: Analyze the syntax using various methods.
CO4: Understand the role of semantics and pragmatics.
CO5: Use discourse algorithms and various lexical resource.

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2019.
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", First Edition, O'Reilly Media, 2009.
3. Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015.

REFERENCES:

1. Richard M Reese, "Natural Language Processing with Java", O'Reilly Media, 2015.
2. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", Second Edition, Chapman and Hall/CRC Press, 2010.
3. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

20CS904	IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To deliver the fundamental concepts of image processing and pattern recognition
- To understand various image processing steps and their applications in real time.
- To acquire knowledge on Image Restoration and Reconstruction
- To learn on the concepts of color image processing
- To assist the students to incorporate pattern recognition in image processing and its importance in real time applications.

UNIT I	Digital Image Fundamentals	9

Introduction-Digital Image Processing-origins-Examples-Fundamental steps in DIP-Components of an Image Processing System-Digital Image Fundamentals-Image Sensing and Acquisition-Image Sampling and Quantization-Introduction to the Basic Mathematical

	Tools Used in Digital Image	

UNIT II	**Intensity Transformations and Spatial Filtering**	**9**

Some Basic Intensity Transformation Functions-Histogram Processing-Fundamentals of Spatial Filtering-Smoothing (Lowpass) Spatial Filters-Sharpening (High pass) Spatial Filters-High pass, Band reject, and Bandpass Filters from Lowpass Filters-Combining Spatial Enhancement Methods-Filtering in the Frequency Domain-The Discrete Fourier Transform of One Variable - Extensions to Functions of Two Variables

UNIT III	**Image Restoration and Reconstruction**	**9**

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 Degradations -Estimating the Degradation Function -Inverse Filtering-Minimum Mean Square Error (Wiener) Filtering-Constrained Least Squares Filtering -Geometric Mean Filter -Image Reconstruction from Projections

UNIT IV	**Color Image Processing**	**9**

Color Fundamentals-Color Models-Pseudocolor Image Processing-Basics of Full-Color Image Processing-Color Transformations-Color Image Smoothing and Sharpening-Using Color in Image Segmentation -Noise in Color Images-Color Image Compression

UNIT V	**Image Segmentation**	**9**

Fundamentals-Point, Line, and Edge Detection-Thresholding-Segmentation by Region Growing and by Region Splitting and Merging-Region Segmentation Using Clustering and Super pixels- Region Segmentation Using Graph Cuts -Segmentation Using Morphological Watersheds - The Use of Motion in Segmentation. Image Pattern Classification- Patterns and Pattern Classes - Pattern Classification by Prototype Matching -Optimum (Bayes) Statistical Classifiers-Neural Networks and Deep Learning -Deep Convolutional Neural Networks

	TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Describe the basic concepts of image processing with mathematical interpretation.
CO2: Apply the knowledge of different image enhancement, and image registration techniques.
CO3: Demonstrate the various image segmentation and morphological operations for partition of objects.
CO4: Acquire the concepts of color image processing.
CO5: Describe the fundamental concepts of various feature extraction techniques and recognize the image scene from image feature.
CO6: Analyze and implement image processing techniques for various real-time applications such as industry, medicine and defense.

TEXT BOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 4th Edition, Pearson, 2018.

2. William K. Pratt, Digital Image Processing, 4th Edition, John Wiley, 2007.

REFERENCES:

1. Maria Petrou and Panagiota Bosdogianni, "Image Processing: The Fundamentals", 2nd edition, JohnWiley, 2010
2. Kenneth R. Castleman, "Digital Image Processing", 2nd Edition, Pearson, 2010

20CS905	COMPUTER VISION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To understand the fundamental concepts related to Model Fitting and Deep Learning.
- To understand the fundamental concepts related to Recognition and Feature Detection.
- To understand the fundamental concepts related to Image Alignment and Motion Estimation.
- To understand the fundamental concepts related to 3D Reconstruction and Image-based rendering.

UNIT I	Introduction to Image formation and processing	9

What is computer vision? - Geometric primitives and transformations - Photometric image formation - The digital camera - Geometric primitives and transformations - Photometric image formation - The digital camera

UNIT II	Model Fitting and Deep Learning	9

Scattered data interpolation - Variational methods and regularization - Markov random fields - Supervised learning - Unsupervised learning - Deep neural networks - Convolutional networks - More complex models

UNIT III	Recognition and Feature Detection	9

Instance recognition - Image classification - Object detection - Semantic segmentation - Video understanding - Vision and language - Points and patches - Edges and contours - Contour tracking - Lines and vanishing points - Segmentation

UNIT IV	Image Alignment &Motion Estimation	9

Pairwise alignment - Image stitching - Global alignment - Compositing - Translational alignment - Parametric motion - Optical flow - Layered motion

UNIT V	3D reconstruction and Image-based rendering	9

Shape from X - 3D scanning - Surface representations - Point-based representations - Volumetric representations - Model-based reconstruction - Recovering texture maps and albedos - View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering - Neural rendering

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the fundamental concepts related to Image formation and processing.
CO2: Understand the fundamental concepts related to Model Fitting and Deep Learning.
CO3: Understand the fundamental concepts related to Recognition and Feature Detection.
CO4: Understand the fundamental concepts related to Image Alignment and Motion Estimation.
CO5: Understand the fundamental concepts related to 3D Reconstruction and Image-based rendering.

TEXT BOOKS:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.
4. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.

20CS906	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management. To deliver successful software projects that support organization 's strategic goals.

UNIT I	PROJECT EVALUATION AND PROJECT PLANNING	9

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II	PROJECT LIFE CYCLE AND EFFORT ESTIMATION	9

Software process and Process Models – Choice of Process models – Rapid Application

development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model

UNIT III	ACTIVITY PLANNING AND RISK MANAGEMENT	9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules

UNIT IV	PROJECT MANAGEMENT AND CONTROL	9

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

UNIT V	STAFFING IN SOFTWARE PROJECTS	9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand Project Management principles while developing software
CO2: Obtain adequate knowledge about software process models and software effort estimation techniques
CO3: Estimate the risks involved in various project activities.
CO4: Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
CO5: Learn staff selection process and the issues related to people man.

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Sixth Edition, Tata McGraw Hill, 2017.

REFERENCES:

1. Roger S. Pressman Bruce R. Maxin - Software Engineering A Practitioner's Approach-Mc Graw-Hill Education (2014)-8th edition

2. Robert K. Wysocki - Effective Software Project Management – Wiley Publication, 2011.

3. Walker Royce: - Software Project Management- Addison-Wesley, 1998

20CS911	HIGH PERFORMANCE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Modern processors.
- To analyze the various optimization techniques for writing parallel high-performance applications.
- To discuss the basics of Parallel computers.
- To learn shared memory parallel programming using OpenMP.
- To understand the distributed memory parallel programming with MPI.

UNIT I	MODERN PROCESSORS	9

Stored Program Computer Architecture - General purpose cache- based microprocessor- Performance based metrics and benchmarks- Moore's Law- Pipelining- Super scalarity - SIMD- Memory Hierarchies - Cache- mapping- prefetch- Multicore processors- Multithreaded processors- Vector Processors- Design Principles- Maximum performance estimates- Programming for vector architecture.

UNIT II	OPTIMIZATION TECHNIQUES	9

Basic optimization techniques for serial code: scalar profiling - function and line based runtime profiling- hardware performance counters- common sense optimizations- elimination of common subexpressions- avoiding branches - using SIMD instruction sets- the role of compilers - C++ optimizations - data access optimization: balance analysis and light speed estimates- storage order- Case study: Jacobi algorithm and dense matrix transpose

UNIT III	PARALLEL COMPUTERS	9

Taxonomy of parallel computing paradigms - Shared memory computers - Distributed- memory computers- Hierarchical systems- Networks - Basics of parallelization – Need to parallelize - Parallelism - Parallel Scalability- Factors that limit parallel execution- Scalability metrics- Simple scalability laws- parallel efficiency - serial performance Vs Strong scalability- Load balance.

UNIT IV	SHARED MEMORY PARALLEL PROGRAMMING WITH OpenMp	9

Introduction to OpenMp - parallel execution - data scoping- OpenMp work sharing for loops- synchronization - reductions - loop scheduling - tasking - case study: OpenMp- parallel jacobi algorithm - Efficient OpenMP programming: Profiling OpenMP programs - Performance pitfalls.

UNIT V	DISTRIBUTED MEMORY PARALLEL PROGRAMMING WITH MPI	9

Message passing - introduction to MPI – example - messages and point-topoint communication - collective communication – nonblocking point-to-point communication- virtual topologies - MPI parallelization of Jacobi solver- MPI implementation - performance properties - Basic MPI/OpenMP programming models.

TOTAL:45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the basics of Modern processors.
CO2: Analyze the various optimization techniques for writing parallel high-performance applications.
CO3: Discuss the basics of Parallel computers.
CO4: Learn shared memory parallel programming using OpenMP.
CO5: Understand the distributed memory parallel programming with MPI.

TEXT BOOKS:

1. Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, Chapman & Hall / CRC Computational Science series, 2011.

REFERENCES:

1. Robert Robey and Yuliana Zamora, Parallel and High-Performance Computing, Manning Publications, 2021.
2. Thomas Sterling, Matthew Anderson, Maciej Brodowicz, High Performance Computing: Modern Systems and Practices, Morgan Kaufmann Publishers, 2018.

20CS913	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of Internet of Things.
- To discuss the IoT topologies and types.
- To learn about the basics of IOT protocols.
- To build a small low-cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real-world scenario.

UNIT I	INTRODUCTION TO IoT	9

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M

UNIT II	EVOLUTION OF IoT	9

Emergence of IoT – IoT versus M2M, IoT versus CPS, IoT versus WoT, IoT Sensing and Actuation –sensor characteristics, sensing types, actuator characteristics, types, IoT Processing Topologies and Types

UNIT III	IoT PROTOCOLS	9

IoT Connectivity Technologies –IEEE 802.15.4, Zigbee, Thread, Z-wave, wireless HART, IoT Communication Technologies: Introduction – Infrastructure protocols – IPv6, RPL, QUIC, Micro internet protocol, Discovery protocols – Data protocols -MQTT, AMQP, XMPP, Identification protocols – Device management – Semantic protocols

UNIT IV	BUILDING IoT WITH RASPBERRY PI & ARDUINO	9

Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -

Programming Raspberry Pi with Python - Other IoT Devices - Arduino.	
UNIT V **IoT AND FUTURE TRENDS**	**9**
Agricultural IoT - Vehicular IoT - Healthcare IoT – Paradigms, challenges and future.	

<div align="right">

TOTAL: 45 PERIODS

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OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the fundamentals of Internet of Things.
CO2: Understand the significance of evolution of IoT topologies and types.
CO3: Analyze various protocols for IoT.
CO4: Design a portable IoT using Raspberry Pi.
CO5: Analyze applications of IoT in real time scenario.

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.

2. Sudip Misra, Anandarup Mukherjee, Arjit Roy, "Introduction to IoT", Cambridge University Press, 2021.

REFERENCES:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", CISCO Press, 2017.

2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.

3. Srinivasa K.G., Siddesh G.M., Hanumantha Raju R., "Internet of Things", Cengage Learning India Pvt Ltd, First Edition, 2018.

4. Mohammed A. Matin, "Wireless Sensor Networks: Technology and Protocols", InTech, 2012.

5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.

6. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.

7. Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

		L	T	P	C
20CB404	**INTRODUCTION TO INNOVATION IP MANAGEMENT & ENTREPRENEURSHIP**				
		3	0	0	3

OBJECTIVES:
 To impart knowledge on
- Develop mindsets to pursue entrepreneurship.
- Understand the basics of Innovation and Entrepreneurship
- Create, protect, assetize and commercialize intellectual property
- Identify and discover market needs

	• Manage an innovation program • Understand opportunities and challenges for entrepreneurs through StartupModels	
UNIT I	**INNOVATION**	**9**
Innovation Types of Innovation Incremental, disruptive, Lifecycle of Innovation (idea, literature survey, PoT, PoC, etc.) , Challenges in Innovation (time, cost, data, infrastructure, etc.		
UNIT II	**IPR**	**9**
Types of IPR (patents, copyrights, trademarks, GI, etc.) Lifecycle of IP (creation, protection, assetization, commercialization), Balancing IP Risks and Rewards (Right Access and Right Use of Open Source and 3rd party products, technology transfer and licensing)		
UNIT III	**ENTREPRENEURSHIP**	**9**
Opportunity Identification in Technology Entrepreneurship (customer pain points,competitive context) Market Research, Segmentation and Sizing Product Positioning,Pricing, and Go-To-Market Strategy IP Valuation (methods, examples, limitations)		
UNIT IV	**TYPES OF STARTUP BUSINESS MODEL**	**9**
Startup Business Models (fund raising, market segments, channels, etc.) Co- innovation and Open Innovation (academia, startups, corporates) Technology Innovation: Two Case Studies		
UNIT V	**PROCESSES IN STARTUP BUSINESS MODEL**	**9**
Innovation, Incubation and Entrepreneurship in Corporate Context Technology- driven Social Innovation and Entrepreneurship Manage Innovation, IP and Entrepreneurship Programs — Processes, Governance and Tools		
	TOTAL: 45 PERIODS	

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Understand the basics of Innovation and Entrepreneurship.
CO2: Manage an innovation program.
CO3: Create, protect, assetize and commercialize intellectual property
CO4: Understand opportunities and challenges for entrepreneurs
CO5: Developing mindsets to pursue entrepreneurship.
CO6: Identify and discover market needs

TEXT BOOK:
1. Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough Growth Navi Radjou, Jaideep Prabhu, Simone Ahuja , John Wiley & Sons.

REFERENCES:
1. Identifying Entrepreneurial Opportunities: Cognition and Categorization in Nascent Entrepreneurs, Matthew J. Karlesky.
2. http://www.businessdictionary.com/definition/entrepreneurship.
3. https://www.infoentrepreneurs.org/en/guides/use-innovation-to-growyourbusiness/
4. http://sourcesofinsight.com/innovation-life-cycle/
5. https://www.investottawa.ca/
6. https://www.Lead-innovation.com

20CE917	PROFESSIONAL ETHICS IN ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize with Human Values.
- To familiarize with Engineering Ethics.
- To learn on the Engineering as Social Experimentation.
- To impart knowledge on codes of ethics, safety, responsibilities and rights of engineers.
- To create awareness on global issues related to environmental ethics, computer ethics weapons development and corporate social responsibility

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

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	ENGINEERING AS SOCIAL EXPERIMENTATION	9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law - The Challenger Case Study.

UNIT IV	SAFETY, RESPONSIBILITIES AND RIGHTS	10

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Case Studies: Chernobyl and Bhopal Disasters - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V	GLOBAL ISSUES	8

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: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Summarize the importance of human values in work place.
CO2: Discuss the senses of engineering ethics, moral dilemmas, moral autonomy and uses of ethical theories.

CO3: Describe the role of engineers as responsible experimenters and necessity of codes of ethics in engineering.

CO4: Explain safety, risk, responsibilities and rights in the society.

CO5: Analyze the global issues related to environmental ethics, computer ethics, weapons development and the role of engineers as expert witnesses and advisors.

CO6: Apply ethics in society and discuss the ethical issues related to engineering.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, ―Ethics in Engineering‖, Tata McGraw Hill, New Delhi, 2014.

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, ―Engineering Ethics‖, Prentice Hall of India, New Delhi, 2013.

REFERENCES:

1. Charles B. Fleddermann, ―Engineering Ethics‖, Pearson Prentice Hall, New Jersey, 2012.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, ―Engineering Ethics – Concepts and Cases, Cengage Learning, 2018.
3. John R Boatright, ―Ethics and the Conduct of Business, Pearson Education, New Delhi, 2012.
4. Edmund G Seebauer and Robert L Barry, ―Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.

20ME926	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the roles of Management and the principles of an organization.
- Discuss the functions and responsibilities of managers.
- Demonstrate the tools and techniques to be used in the performance of the managerial job.
- To analyze and understand the environment of the organization.
- Develop the cognizance of the importance of management principles

UNIT I	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	9

Definition of Management – Science or Art– Manager Vs Entrepreneur - types of managers managerial roles and skills– Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization -Sole proprietorship, partnership, company-public and private sector enterprises-Organization culture and Environment– Current trends and issues in Management. Fundamentals of Entrepreneurship, Circular flow of income.

UNIT II	PLANNING	9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies –Planning premises – Strategic Management –Planning Tools and Techniques–Decision making steps and process - strategic technology planning

UNIT III	ORGANISING	9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority–departmentalization–delegation of authority–centralization and decentralization–Job Design-Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management. Managing personnel records

UNIT IV	DIRECTING	9

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction–job enrichment–leadership–types and theories of leadership–communication–process of communication–barrier in communication–effective communication– communication and IT. Organizational behaviour

UNIT V	CONTROLLING	9

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting .SQC techniques

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the management thoughts and various challenges of managerial activities in a global business environment.

CO2: Demonstrate the various strategies in Decision making at various levels management in the Organizations.

CO3: Discuss the various types of Organization structure.

CO4: Describe the steps in Staffing process and stages in Career development.

CO5: Explain the elements in Direction.

CO6: Summarize the various Controlling techniques to maintain standards in Organizations

TEXT BOOKS:

1. Koontz, H, & Weihrich, H (2016). Essentials of Management: An International Perspective (8th ed.), Tata McGraw Hills, New Delhi.

2. Ghuman, K & Aswathapa, K, (2017). Management concepts and cases (10th ed.), Tata McGraw Hills, New Delhi.

3. Telsan, M.T. (2016). Industrial and Business Management, (4th ed.), S. Chand, New Delhi.

REFERENCES:

1. Robbins, S. (2017). Management, (13th ed.), Pearson Education, New Delhi.

2. Saxena, P.K., Principles of Management: A Modern Approach, Global India publicaions.(2016)

20IT917	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- To learn the concept of protection of traditional knowledge.
- To study the legal framework and traditional knowledge.
- To interpret the concept of traditional knowledge and intellectual property.
- Make the students understand the traditional knowledge and analyze it and apply it to their day-to-day life.

UNIT I	INTRODUCTION TO TRADITIONAL KNOWLEDGE	9

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

UNIT II	PROTECTION OF TRADITIONAL KNOWLEDGE	9

The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT III	LEGAL FRAMEWORK AND TK	9

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFRAct); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

UNIT IV	TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY	9

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

UNIT V	TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS	9

Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Illustrate the concepts of Indian traditional knowledge.

CO2: Apply the concept of protection of traditional knowledge.

CO3: Analyze the legal framework and traditional knowledge.

CO4: Interpret the concept of traditional knowledge and intellectual property.

CO5: Analyze and apply traditional knowledge to their day-to-day life.

TEXT BOOKS:
1. Amit Jha, Traditional Knowledge System in India, Atlantic publishers, 2002

REFERENCE:
1. Kapil Kapoor, Michel Danino, Knowledge Traditions and Practices of India, Central Board of Secondary Education, 2012.

20CS909	SOFTWARE QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic tenets of software quality and quality factors.
- To learn about project life cycle and SQA tools.
- To be familiar with the software quality infrastructure.
- To understand software quality metrics and software process control.
- To be exposed to the management components of software quality.

UNIT I	INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE	9

Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall's quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.

UNIT II	SQA COMPONENTS IN PROJECT LIFE CYCLE	9

Software Development methodologies – Quality assurance activities in the development process-Verification & Validation – Reviews – Software Testing – Software Testing implementations –Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.

UNIT III	SOFTWARE QUALITY INFRASTRUCTURE	9

Procedures and work instructions - Templates - Checklists – 3S developmenting - Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.

UNIT IV	SOFTWARE QUALITY MANAGEMENT & METRICS	9

Project process control – Computerized tools - Software quality metrics – Objectives of

quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model.

UNIT V	STANDARDS, CERTIFICATIONS & ASSESSMENTS	9

Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE st 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Obtain adequate knowledge about software quality.
CO2: Understand SQA components in project life cycle**.**
CO3: Develop a software with suitable infrastructure.
CO4: Assess the quality of software products.
CO5: Demonstrate their capability to adopt quality standards in preparing the quality plan & documents.

TEXT BOOKS:

1. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2014.

REFERENCES:

1. Stephan Goericke, "The Future of Software Quality Assurance", Springer Nature 2020.
2. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.
3. Mordechai Ben-Menachem "Software Quality: Producing Practical Consistent Software",
   International Thompson Computer Press, 2014. .

20AI911	SEMANTIC WEB	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of semantic web and to conceptualize and depict Ontology for semantic web.
- To understand the languages for semantic web.
- To learn about the ontology learning algorithms and to utilize in the development of an application.
- To know the fundamental concepts of ontology management.
- To learn the applications related to semantic web.

UNIT I	THE QUEST FOR SEMANTICS	9

Building Models – Calculating with Knowledge – Exchanging Information – Semantic Web Technologies – Layers – Architecture – Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background – Sample Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation.

UNIT II	LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES	9

Web Documents in XML – RDF – Schema – Web Resource Description using RDF – RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics – Traditional Ontology Languages – LOOM – OKBC – OCML – Flogic Ontology Markup Languages – SHOE – OIL – DAML+OIL – OWL.

UNIT III	ONTOLOGY LEARNING FOR SEMANTIC WEB	9

Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms – Methods for evaluating Ontologies.

UNIT IV	ONTOLOGY LEARNING FOR SEMANTIC WEB	9

Overview – Need for management – Development process – Target Ontology – Ontology mapping – Skills management system – Ontological class – Constraints – Issues – Evolution –Development of Tools and Tool Suites – Ontology Merge Tools – Ontology based Annotation Tools.

UNIT V	APPLICATIONS	9

Web Services – Semantic Web Services – Case Study for specific domain – Security issues – Web Data Exchange and Syndication – Semantic Wikis – Semantic Portals – Semantic Metadata in Data Formats – Semantic Web in Life Sciences – Ontologies for Standardizations – Rule Interchange Format.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Create ontology for a given domain.
CO2: Develop an application using ontology languages and tools.
CO3: Understand the concepts of semantic Web.
CO4: Use ontology related tools and technologies for application creation.
CO5: Design and develop applications using semantic web.
CO6: Understand the standards related to semantic web.

TEXT BOOKS:

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", Chapman & Hall/CRC, 2009.
2. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez, "Ontological Engineering: with Examples from the Areas of Knowledge Management, e-Commerce and the Semantic Web", Springer, 2010.

REFERENCES:

1. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", MIT Press, 2008.
2. Alexander Maedche, "Ontology Learning for the Semantic Web", First Edition, Springer. 2002.
3. John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the Semantic Web: Ontology Driven Knowledge Management", John Wiley, 2003.
4. John Davies, Rudi Studer, Paul Warren, "Semantic Web Technologies: Trends and Research in Ontology-Based Systems", Wiley, 2006.

20CS920	BLOCK CHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand block chain system's fundamental components, how they fit together and examine a decentralization using block chain.
- To explain how Crypto currency works.
- To explain the components of Ethereum and Programming Languages for Ethere
- To study the basics of Web3 and Hyper ledger.
- To give an insight of alternative block chains and its emerging trends.

UNIT I	INTRODUCTION TO BLOCKCHAIN	9

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization – Symmetric Cryptography - Mathematics – Asymmetric Cryptography – public and private keys – Elliptic curve cryptography – Discrete logarithm problem in ECC.

UNIT II	INTRODUCTION TO CRYPTOCURRENCY	9

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments Wallets – innovation in Bitcoin – Alternative Coins – Theoretical Foundations – Bitcoin.

UNIT III	ETHEREUM	9

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code – Blocks and Blockchain – Fee Schedule – Supporting Protocols – Solidity Language.

UNIT IV	WEB3 AND HYPERLEDGER	9

Introduction to Web3 – Contract Deployment – POST Requests – Development frameworks Hyperledger as a protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.

UNIT V	ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS	9

Kadena – Ripple- Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the technology components of Blockchain and how it works behind the scenes.
CO2: Understand the Bitcoin and its limitations by comparing with other alternative coins.
CO3: Develop deep understanding of the Ethereum model, its consensus model, code execution.
CO4: Understand the architectural components of a Hyperledger and its development framework.
CO5: Explore the alternative blockchains and its emerging trends.

TEXT BOOKS:

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.
2. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", VPT, 2017.

REFERENCES:

1. Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", O'Reilly Publishing, 2014.
2. Roger Wattenhofer, "The Science of the Blockchain" CreateSpace Independent Publishing Platform, 2016.
3. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
4. Alex Leverington, "Ethereum Programming", Packt Publishing, 2017.
5. Antony Lewis "The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them", Mango Publishing 2018.
6. Andreas M. Antonopoulos, "Mastering Bitcoin: Programming the Open Block chain", O'Reilly Publishing, 2017.
7. Massimo Ragnedda, Giuseppe Destefanis, "Blockchain and Web 3.0: Social, Economic, and Technological Challenges", Routledge, 2019.

SEMESTER VII – PROFESSIONAL ELECTIVE – IV/V/VI

		L	T	P	C
20CD907	**LARGE SCALE INFORMATION STORAGE AND RETRIEVAL**	3	0	0	3

OBJECTIVES:

- To introduce the basics of multimedia and large-scale storage technology.
- To understand the fundamentals of text retrieval and music center.
- To outline the structure of Image retrieval techniques.
- To learn the video retrieval systems with an example.
- To understand the retrieval metrics and modern IR.

UNIT I	INTRODUCTION TO MEDIA AND LARGE-SCALE STORAGE NETWORKS	9

Introduction – Media Types – Media Understanding – Description of Audio, Visual spectral and Video - Storage networks, storage medium.

UNIT II	TEXT RETRIEVAL AND MUSIC GENRE	9

Text Information retrieval: Information retrieval system- catalog and indexing – automatic indexing – term clustering – User search Techniques- Information Visualization- Fundamentals - Instantaneous Features - Intensity - Tonal Analysis - Musical Genre, Similarity and Mood.

UNIT III	IMAGE RETRIEVAL	9

Content-based image retrieval; techniques; feature extraction; integration; similarity; feature in INDEXING; interactive retrieval; MPEG-7 standard

UNIT IV	VIDEO RETRIEVAL	9

Content Based Video Retrieval - Video Parsing – Video abstraction and Summarization– Video Content Representation, Indexing and retrieval –Video Browsing Schemes– Example of Video Retrieval Systems

UNIT V	RETRIEVAL METRICS AND MODERN IR	9

Average recall and average precision - Harmonic mean - Evaluation of a search engine – Relevance Issue – Kappa Measure – Quality versus Quantity, possible factors which influence outcome of a search – Grandfield Experimental Study. Introduction- parallel IR – Distributed IR – trends and research Issue.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: The students can able to apply the basics of media and large-scale storage on Networks.
CO2: To analyze various techniques in text retrieval and music genre.
CO3: To analyze various image retrieval techniques.
CO4: To know the video browsing schemes of video retrieval systems.
CO5: Critically evaluate Multimedia retrieval system effectiveness and improvement Techniques.

TEXT BOOKS:

1. Brusilovsky, Peter et.al. The Adaptive Web: Methods and Strategies of Web Personalization. Berlin: Springer, 2021.
2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze," Introduction to

Information Retrieval", Cambridge University Press, 2018.

3. Ricci, F.; Rokach, L.; Shapira, B.; Kantor, P.B. (Eds.), Recommender Systems Handbook. 1 st Edition., 2011.Jesse Schell, "The Art of Game Design, A Book of Lenses", Third Edition, CRC Press, 2019.

REFERENCES:

1. Gerald J.Kowalski ,Mark T.Maybury "Information Storage and Retrieval Systems theory and implementation" , Kluwer academic publishers, second edition 2006.
2. Chile-Hung wei,Yue Li,Chih-Ying Gwo "Multimedia Storage and Retrieval Innovations for Digital Library Systems,2012.
3. Philip K.C Tse, "Multimedia Information Storage and Retrieval: Techniques and Technologies, University of Hong Kong, 2008.

20CD908	GPU COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basics of GPU architectures.
- To write programs for massively parallel processors.
- To understand the OpenCL basics and interpret different GPU programming models.
- To familiarize various algorithms for GPU programming.
- To learn the basics of CUDA Programming and Applications.

UNIT I	GPU ARCHITECTURE	9

Evolution of GPU architectures – Understanding Parallelism with GPU –Types of Parallelism – Parallel Patterns-CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Block Scheduling – Memory Handling with CUDA: Shared Memory, Constant Memory, Global Memory, and Texture Memory.

UNIT II	PROGRAMMING ISSUES	9

Common Problems: CUDA Error Handling– Parallel Programming Issues– Synchronization, Algorithmic Issues– Finding and Avoiding Errors– Developing for future GPUs

UNIT III	OPENCL BASICS	9

OpenCL Standard – OpenCL Platform Model and Execution Model – Kernels and the OpenCL Programming Model – Memory Model – Basic OpenCL Examples.

UNIT IV	ALGORITTHMS ON GPU	9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster.

UNIT V	CUDA PROGRAMMING	9

Using CUDA – Multi CPU and Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the GPU architecture.
CO2: Identify efficient parallel programming patterns to solve problems.
CO3: Develop simple programs using OpenCL.
CO4: Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication.
CO5: Implement programs using CUDA, identify issues and debug them.

TEXT BOOKS:

1. Shane Cook, CUDA Programming: —A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.

2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, —Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015

REFERENCES:

1. Nicholas Wilt, —CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison – Wesley, 2013.
2. Jason Sanders, Edward Kandrot, —CUDA by Example: An Introduction to General Purpose GPU Programming, Addison – Wesley, 2010.
3. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors – A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.
4. http://www.nvidia.com/object/cuda_home_new.html

20CD909	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

OBJECTIVES:
*   To learn the role of digital marketing in overall marketing strategy.
*   To understand website designing and optimization methods in digital marketing.
*   To learn about Search Engine Marketing Platforms.
*   To understand various Social Media Marketing strategies.
*   To understand the concepts of Web Analytics and various types of report generation.

UNIT I	INTRODUCTION TO DIGITAL MARKETING	9

Digital marketing - Importance of digital marketing-Difference between traditional and digital marketing- Digital marketing platforms- recent trends and current scenario of the industry - digital marketing as a tool for students, professionals and businesses-Tools.

UNIT II	WEBSITE DESIGNING AND OPTIMIZATION	9

On Page Optimisation (OPO)- HTML and CSS basics- Meta tags usage- Using Javascript - Contextual interlinking - Microformats & schemas - Off-Page Optimization - Linking Strategies - Competitor Analysis-Sculpting-Link baiting - Social Book Marking and Promotions- Directory submissions -Search Engine Optimization (SEO)- Growth of SEO- Ecosystem of a search engine SEO Tools.

UNIT III	SEARCH ENGINE MARKETING	9

SEM platforms- Google Adwords – Ad creation process- Keyword grouping-Bidding techniques – Site targeting & keyword targeting -Ad approval process – Ad extensions- Site, Demographic targeting, CPC-based, CPA-based & CPM-based accounts

UNIT IV	SOCIAL MEDIA MARKETING	9

Social Media Marketing- Email Marketing- Mobile Marketing - Adsense, Blogging and Affiliate Marketing.

UNIT V	WEB ANALYTICS	9

Introduction to Web Analytics- GA Terminology (Dimensions & Metrics)- Introduction to Reports - Audience Reports, Traffic Sources and Content Reports- Campaign Tagging & Reporting - Dashboard- Linking and Using Data from Google Adwords- Case studies on digital marketing strategies.

		TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Explain the role and importance of digital marketing in a rapidly changing business landscape
CO2: Examine website designing and optimization.
CO3: Analyze the various SEM platforms for digital marketing.
CO4: Discuss the marketing strategies used in social media.
CO5: Analyze the web and generate various types of reports for real time application.

TEXT BOOKS:
1. Seema Gupta, Digital Marketing, McGraw Hill, 2nd Edition, 2020.
2. Subhankar Das, Search Engine Optimization and Marketing a Recipe for Success in Digital Marketing, CRC Press, 2021.
3. Chuck Hemann, Ken Burbary, Digital Marketing Analytics, Pearson, Second Edition, 2019

REFERENCES:
1. Dave Chaffey, Fiona Ellis-Chadwick, Digital Marketing: Strategy, Implementation and Practice 7th Edition, Pearson, 2019.
2. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaign, Wiley, 2016.
3. Rob Stokes, eMarketing The Essential Guide to Marketing in a digital world, Quirk eMarketing.
4. Shivani Karwal, Digital Marketing Handbook: A Guide to Search Engine Optimization, 2015.
5. Jacobson, Howie, McDonald, Joel and McDonald, Kristie, Google AdWords for Dummies, 3rd Edition, O'Reilly, 2011.
6. http://www.gbv.de/dms/zbw/865712123.pdf

7. https://www.redandyellow.co.za/content/uploads/woocommerce_uploads/2017/10/emarketing textbook_download.pdf

20CD910	3D MODELLING AND DESIGN (LAB INTEGRATED)	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the basic concepts of modeling.
- To gain basic understanding of Lighting and Procedural Textures.
- To Understand the concepts of Curves and Nurbs.
- To develop 3D Animated Movies.
- To acquire knowledge on game engines.

UNIT I	MODELING	6+6

Modeling- Mesh- Origin Point- Vertices- Edges- Faces- Edit Mode- Some Mesh-Editing Tools- Background Images- Topology- Example Modeling Through Mesh Editing-Sculpt Mode.

UNIT II	UV MAPPING	6+6

Lighting and Procedural Textures- Setting Up a Basic Scene- The Scene Camera- Procedural Materials and Textures- Creating a UV Map- Texture Painting.

UNIT III	CURVES AND NURBS	6+6

Metaballs- Curves- Spin- NURBS- Basic Rigging and Animation- Keyframing with the Timeline- The Dopesheet- Pivot Point: The Center of Rotation- Basic Tracking: Eyes That Follow- Rigging with Bones- Rigging a Simple Character.

UNIT IV	MAKING MOVIES	6+6

Forward Kinematics vs. Inverse Kinetics- Blender 2.5 Rigs- Walk Cycles- Shape Keys- Lip Syncing- Making Movies- The Compositing Node Editor- Lighting Adjustments- A Practical Example of Compositing- The Video Sequence Editor.

UNIT V	THE GAME ENGINE	6+6

Making Particles- Making Hair- Fluid Dynamics- Smoke- Soft Body Physics- The Game Engine- Game Engine Physics- Creating Your Own Droid- Silly Soccer Game- A Change of Scene- Shooting Things.

LIST OF EXERCISES:

1. Practice the short cut commands in blender.
2. Creation of Making a robot.
3. The Ten-Cube Challenge.
4. Cube Painting
5. Painting a Boxlike Model
6. NURBS Modeling Example: A Simple Shark
7. How to model a motorbike's fairing using NURBS / HD.
8. Creating Robotic Arm Rig in blender.

9.	Make a simple 3D Animated Movies in Blender.
10.	Implement the creation of hair with an object in blender.
11.	Making of a Football/Soccer Goal in Blender.

TOTAL: 30+30=60 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Implement the concepts of modeling.
CO2: Implement the Lighting and Procedural Textures.
CO3: Implement the concepts of curves and nurbs.
CO4: Implement 3D Animated Movies.
CO5: Implement on game engines.

TEXT BOOKS:

1. Lance Flavell, "Beginning Blender: Open-Source 3D Modelling, Animation, and Game Design" Publisher, Apress, 2010.
2. Arijan Belac, Blender 3D Incredible Models, A Comprehensive guide to hard surface modelling, procedural texturing, and rendering, Packt Publishing 2022.

REFERENCES:

1. Michael E.Mortenson "3D Modeling, Animation, and Rendering": An Illustrated Lexicon, Black and White Edition 2010.
2. Boris Kulagin, "3ds Max 8 from Modelling to Animation", Bpb Publishers, ISBN-10 : 1931769532, Edition 2006.
3. Michael G, "3D Modelling and Animation: Synthesis and Analysis Techniques for the Human Body", Igi Publishing, 2004.

SOFTWARE REQUIREMENTS:

Systems with Blender.

20CD911	OPTIMIZATION ALGORITHMS BASED DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To understand the basic concepts of unconstrained optimization techniques.
- To understand the basic concepts of constrained optimization techniques.
- To provide the mathematical foundation of artificial neural networks and swarm intelligence for design problems.
- To implement optimization approaches and to select appropriates solution for design application.
- To demonstrate selected optimization algorithms commonly used in static and dynamic applications.

UNIT I	UNCONSTRAINED OPTIMIZATION TECHNIQUES	9

Introduction to optimum design - General principles of optimization – Problem formulation & their classifications- Single variable and multivariable optimization, Techniques of

unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods.

UNIT II	CONSTRAINED OPTIMIZATION TECHNIQUES	9

Optimization with equality and inequality constraints-Direct methods–Indirect methods using penalty functions, Lagrange multipliers-Geometric programming.

UNIT III	ARTIFICIAL NEURAL NETWORKS AND SWARM INTELLIGENCE	9

Introduction–Activation functions, types of activation functions, neural network architectures, Single layer feed forward network, multilayer feed forward network, Neural network applications. Swarm intelligence-Various animal behaviours, Ant Colony optimization, Particle Swarm optimization.

UNIT IV	ADVANCED OPTIMIZATION TECHNIQUES	9

Multistage optimization–dynamic programming, stochastic programming Multi objective optimization Genetic algorithms and Simulated Annealing technique.

UNIT V	STATIC AND DYNAMIC APPLICATIONS	9

Structural applications – Design of simple truss members – Design of simple axial, transverse loaded members for minimum cost, weight – Design of shafts and torsionally loaded members –Design of springs. Dynamic Applications – Optimum design of single, two degree of freedom systems, vibration absorbers. Application in Mechanisms–Optimum design of simple linkage mechanisms.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Formulate unconstrained optimization techniques in engineering design application.
CO2: Formulate constrained optimization techniques for various applications.
CO3: Implement neural network technique to real world design problems.
CO4: Apply genetic algorithms to combinatorial optimization problems.
CO5: Evaluate solutions by various optimization approaches for a design problem

TEXT BOOKS:

1. Goldberg, David. E, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson, 2009.
2. Jang, J. S.R, Sun, C. T and Mizutani E., "Neuro-Fuzzy and Soft Computing", Pearson Education.2015,
3. JohnsonRay,C.,V "Optimum Design Of Mechanical Elements",Wiley,2nd Edition1980.

REFERENCES:

1. Kalyanmoy Deb, "Optimization for Engineering Design: Algorithms and Examples", PHI Learning Private Limited, 2nd Edition, 202.
2. Rao Singiresu S., "Engineering Optimization – Theory and Practice", New Age International Limited, New Delhi, 3rd Edition, 2013.
3. Rajasekaran S and Vijayalakshmi Pai, G.A, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2011 Ralf Steinmetz, Klara Nahrstedt, "Multimedia,

computing, communications and applications", Prentice Hall, 1995.

20CD912	DESIGN PATTERNS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the concept of Design patterns and its importance.
- Understand the case study to design a problem and solutions.
- Relate the Creational, Structural, behavioral Design patterns.
- Identify the structural patterns to solve the problem.
- Apply the suitable design patterns to refine the basic design for given context.

UNIT I	INTRODUCTION	9

Introduction: What Is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

UNIT II	A CASE STUDY	9

A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation.

UNIT III	CREATIONAL PATTERNS	9

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton.

UNIT IV	STRUCTURAL PATTERNS	9

Structural Patterns: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy.

UNIT V	BEHAVIORAL PATTERNS	9

Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, Strategy, Template Method, Visitor. Conclusion: What to Expect from Design Patterns, The Pattern Community.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Construct the appropriate design patterns to solve object-oriented design problems.
CO2: Construct design solutions by using behavioral patterns.
CO3: Develop design solutions using creational patterns.
CO4: Apply structural patterns to solve design problems.
CO5: Construct design solutions by using behavioral patterns.

	TEXT BOOKS:			

TEXT BOOKS:
1. Design Patterns, "Erich Gamma", Pearson Education 2015.
2. Design Patterns, "Alan Shalloway", Pearson Education 2004.
3. Meta Patterns designed, "Wolf gang ", Pearson 2008.

REFERENCES:
1. Head First Design Patterns," Eric Freeman-Oreilly-spd" Edition 2004.
2. JAVA Enterprise Design Patterns Vol-III By Mark Grand, Wiley DreamTech Edition 2002.
3. Pattern"s in JAVA Vol-I," Mark Grand, Wiley DreamTech ",Edition 2002.
4. Pattern"s in JAVA Vol-II ," Mark Grand ,Wiley DreamTech", Edition 2002.

20CD913	GAME DESIGN (LAB INTEGRATED)	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To Understand the Fundamental principles of Game Design and Development.
- To know the importance and application of Game AI.
- To learn the detailed processes of typical Game Engine.
- To implement simple 2D games using the design and development process learnt.
- To implement simple 3D games using the design and development process learnt.

UNIT I	GAME DESIGN FUNDAMENTALS	6+6

Role of Game Designer, Structure of Games, major genres, game concepts, game worlds, working with formal elements, dramatic elements and system dynamics, storytelling, game play, core mechanics, game balancing, principles of Level Design, Conceptualization, prototyping, playtesting.

UNIT II	GAME AI	6+6

Game AI, AI model, algorithms for Movement, Path finding, Decision making, Tactical and Strategic AI, Procedural Content Generation, Board Games

UNIT III	GAME ENGINE	6+6

Rendering engine and pipeline, Scene Graph, Level of Detail, sorting, Animation Systems, Collision and Rigid Body dynamics.

UNIT IV	2D GAME DESIGN AND IMPLEMENTATION	6+6

GoDot game engine Designing and Prototyping a simple 2D Game, including character design, storytelling, levels. Implementing the Game in pygame or Godot engine or equivalent.

UNIT V	3D GAME DESIGN AND IMPLEMENTATION	6+6

Designing and Prototyping a simple 3D Game, including character design, storytelling, levels. Implementing the Game in pygame or Godot engine or Blender or equivalent.

TOTAL: 30+30 PERIODS

LIST OF EXERCISES:

(Note: Students can work in small teams of 2 or 3 for the experiments)

1. Install any Game Engine (Ex: Godot engine / equivalent) and understand the features and functions.

2. Install Blender and learn some basic 3D graphics including rendering pipeline, textures, coordinate systems, lighting, simple animation

3. Experiment with creating and importing simple 2D / 3D characters, into the work environment

4. Design and document a simple 2D game, following the principles of game design, including genre, characters, game world, characters, game mechanics, levels.

5. Implement the 2D game using pygame / equivalent tools.

6. Implement any simple path finding algorithm and incorporate the same in the 2D game.

7. Implement any other simple AI techniques, to the game

8. Design and document a simple 3D game, following the principles of game design, including genre, characters, game world, characters, game mechanics, levels.

9. Implement the 3D game using Blender / equivalent tools.

10. Evaluate the design and the implementation of the games.

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Use the Fundamental principles of Game Design and Development in context
CO2: Able to apply AI techniques in Game Design and Development ·
CO3: Thoroughly understand the detailed processes of the Game Engine ·
CO4: Design and Implement simple 2D games using the design and development process learnt.
CO5: Design and Implement simple 3D games using the design and development process learnt.

TEXT BOOKS:

1. Ernest Adams, "Fundamentals of Game Design", 3rd Edition, Pearson Education, 2015.
2. Ian Millington, "AI for Games", CRC Press, 3 rd edition, 2019.
3. Jung Hyun Han, "3D Graphics for Game Programming", Delmar Cengage Learning, 2011.

REFERENCES:

1. Tracy Fullerton: Game Design Workshop, A Play centric Approach to Creating Innovative Games, 4 th Edition, CRC Press, 2018.
2. Jason Gregory, "Game Engine Architecture", CRC Press, Third Edition, 2018.
3. Ernest Adams and Joris Dormans, "Game Mechanics: Advanced Game Design", New Riders Press, 2012.

4. Jesse Schell, "The Art of Game Design, A Book of Lenses", Third Edition, CRC Press, 2019.
5. Sanjay Madhav, "Game Programming in C++: Creating 3D Games", Addison-Wesley Professional; 1st edition

SOFTWARE REQUIREMENTS:

Blender, Unity, Unreal Engine/Equivalent

20CD914	DESIGN OF EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge on the basics, building blocks of Embedded System.
- To discuss Input/output Interfacing & Bus Communication with processors.
- To teach automation using scheduling algorithms and Real time operating system.
- To discuss on different Phases & Modeling of a new embedded product.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I	INTRODUCTION TO EMBEDDED SYSTEMS	9

Introduction to Embedded Systems –built in features for embedded Target Architecture - selection of Embedded processor – DMA- memory devices – Memory management methods-memory mapping, cache replacement policies- Timer and Counting devices, Watchdog Timer, Real Time Clock - Software Development tools-IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging-Overview of functional safety standards for embedded systems.

UNIT II	EMBEDDED NETWORKING BY PROCESSORS	9

Embedded Networking: Introduction, I/O Device Ports & Buses- multiple interrupts and interrupt service mechanism – Serial Bus communication protocols -RS232 standard–RS485–USB–Inter Integrated Circuits (I2C)- CAN Bus –Wireless protocol based on Wifi , Bluetooth, Zigbee – Introduction to Device Drivers.

UNIT III	RTOS BASED EMBEDDED SYSTEM DESIGN	9

Introduction to basic concepts of RTOS- Need, Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication context switching, interrupt latency and deadline shared memory, message passing - Interprocess Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: VxWorks, uC/OS-II, RT Linux.

UNIT IV	MODELLING WITH HARDWARE / SOFTWARE DESIGN APPROACHES	9

Modelling embedded systems- embedded software development approach --Overview of UML modeling with UML, UML Diagrams-- Hardware/Software Partitioning, Co-Design Approaches for System Specification and modeling- CoSynthesis- features comparing Single-processor Architectures & Multi-Processor Architectures--design

approach on parallelism in uniprocessors & Multiprocessors.

UNIT V	EMBEDDED SYSTEM APPLICATION DEVELOPMENT	9

Objective, Need, different Phases & Modelling of the EDLC. choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems-Case studies on Digital Camera, Adaptive Cruise control in a Car, Mobile Phone software for key inputs.

	TOTAL : 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Demonstrate the functionalities of processor internal blocks, with their requirement.
CO2: Analyze that Bus standards are chosen based on interface overheads without sacrificing processor performance.
CO3: Explain the role and features of RT operating system, that makes multitask execution possible by processors. ·
CO4: Illustrate that using multiple CPU based on either hardcore or softcore helps data overhead management with processing- speed reduction for uC execution.
CO5: Recommend Embedded consumer product design based on phases of product development.

TEXT BOOKS:
1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.
2. Peckol, "Embedded system Design", JohnWiley&Sons,2010.
3. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson 2013.

REFERENCES:
1. EliciaWhite, "Making Embedded Systems", O'Reilly Series,SPD,2011
2. Bruce Powel Douglass, "Real-Time UML Workshop for Embedded Systems, Elsevier, 2011
3. Advanced Computer architecture, By Rajiv Chopra, S Chand , 2010
4. Jorgen Staunstrup, Wayne Wolf, Hardware / Software Co- Design Principles and Practice,
Springer, 2009.
5. Shibu.K.V, "Introduction to Embedded Systems", TataMcgraw Hill,2009
6. Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006
7. Giovanni De Micheli, Mariagiovanna Sami, Hardware / Software Co- Design, Kluwer Academic Publishers, 2002

20CD915	WEB DEVELOPMENT FRAMEWORKS	L	T	P	C
		2	0	2	3

OBJECTIVES:
- To understand web semantics and related tools and framework.
- Able to get hands on latest JS based web frameworks.
- To develop a scalable and responsive web application.

- To develop an industry ready application web enterprise feature.

UNIT I	ADVANCED JAVASCRIPT	6+6

Introduction to HTML5 and CSS3, Media Queries, JS, DOM, BootStrap, Variables, Loops, Operators, Scope, Hoisting, Arrays, Spread, REST, DeStructuring.

List of Exercise/Experiments:

1) Create a JS Object for Bank Account (w attributes like à customer name, account type, balance, data of creation, bank name, branch name, pan card number). Using JS Object keyword, try to perform following activities
- List down all the entries of the bank object
- Check the existence of a key
- If key found, get the value for the key

2) Spread Operator
- Merge Customer and Account Arrays
- Update the Customer Object with the new values
- Develop a function that takes a Spread Argument and calculates total balance.

UNIT II	INTRODUCTION TO REACTJS	6+6

Class - Inheritance, Methods, Extended Class-Map, filter and Reduce Functions, Functions – Arrow Functions, Lambda Expressions, REST - Introduction, Why JSX, Hello World Apps, Project Structure.

List of Exercise/Experiments

1) Create a list of Bank Objects (same kind of object you used in above lab, but in a array format)
- Display the banks where balance is greater than 200
- deduct 10% of the Bank account balance, as part of monthly service fees
- Display the banks where balance is greater than 200 and branch code is "Chennai"
- Add a new Bank to the given array
- Delete a bank from the array (use splice operator)
- Calculate the total balance of all bank accounts

2) Develop a Scientific calculator that does following operations
- Rounded Value
- Area of Circle
- Calculating of Sin, Cos and Tan functions
- Permiter of an Rectangle
- Employ Arrow functions
- Employ HOC

UNIT III	REACT COMPONENTS AND HOOKS	6+6

Class vs Functional Components, React Class Based Components - componentDidMount, WillUpdate, shouldupate, didcatch etc - State - UseState, UseRef, USeEffect, UseHistory Usage and Props(difference, when to use what, mutable or immutabilty, direction of flow), PropTypes, Auxillary Components, Controlled and Uncontrolled Components, Component Interaction (Parent to Child and Child to Parent), Iteration & Conditional Response.

List of Exercise/Experiments:

1) Create a collection of Customer by using
- Weak Map and Map Collection in JS
- Show Case the different feature set of the same.

2) Add Login Page, Dash Board Page, Admin Page

- Enable React Routing
- Add React Protected Route, for authorization

UNIT IV	REACT LIBRARY - I	6+6

Event Bubbleup - Component Wrapper - Integration of CSS Modules - Forms Validations(YUP, Formik, Standard), Events Handling, Data Binding.

List of Exercise/Experiments:

1) Develop a React application that has User Registration Form w field level validations, data submission to a rest api end point, boot strap for responsive.
- Use YUP or Formik to implement the same

UNIT V	REACT LIBRARY - II	6+6

Custom Hooks, HTTP - Fetch, Axios, Services, Behaviour Subjects - StateLess, StateFulll and Container Components, Error Handling - Build, Env, CORS, Unit Testing w React Testing Library - Introduction to react-native - Introduction to StoryBook.

List of Exercise/Experiments:

1) Employ back end api for Login Page functionality (authentication). Post login, store the user context (received from the back-end server) in browser's session storage as objects. And use the same as creds during protected route verification
- On the dashboard page, have a grid of Students. The data has to be bought from back end api
- Employ useref, useeffect & usestate, and useHistory

1) Enable Exception Handling
2) Enable HOC and Aux Components
3) Implement React-Testing Library

Business Use Case Implementations

1) Student Management System
2) Retail Bank System
3) eCommerce System
4) Student LMS Management System

	TOTAL: 30+30=60 PERIODS

OUTCOMES:
CO1: Personalize web pages using text formatting, graphics, audio, and video.
CO2: Hands on knowledge on Rest API, propTypes.
CO3: Able to develop a web application using latest React Framework
CO4: Apply various React features including functions, components, and services.
CO5: Able to develop application using ReactJs hooks.

TEXT BOOKS:
1. JAVASCRIPT THE DEFINITIVE GUIDE 7/ED Paperback – 15 June 2020.
2. Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL Paperback – Import, 18 December 2020
3. Advanced Web Development with React Paperback – 1 January 2020

REFERENCES:
1. PARENTAL WEBSITE - https://reactjs.org/
2. The Road to Learn React: Your journey to master plain yet pragmatic
3. React.js by Robin Wieruch
4. Learning React: Functional Web Development with React and Redux by
5. Alex Banks and Eve Porcello
6. Learning React by Kirupa Chinnathambi
7. "React Up & Running" by Stoyan Stefanov
8. https://www.edureka.co/reactjs-redux-certification-training

ONLINE LEARNING PLATFORMS:

•	CodePen,				
•	CodeSandbox (ß Preferred)				
•	Stackblitz.				

LIST OF EQUIPMENTS:
- NodeJS (v9.11.2)
- Github as code repository
- Visual studio code as IDE
- RTL as unit testing framework
- Responsive design w bootstrap
- React JS installation (v17)
- Chrome / FIreFox Browsers (latest)
- Responsive using Media Queries & Bootstrap Material & Antdesign
- Design based Apps

		L	**T**	**P**	**C**
20AI918	**INTELLIGENT ROBOTS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To understand the basics of Intelligent Robots.
- To discuss the Autonomous capabilities and Software architecture.
- To explain the Reactive Functionality of intelligent Robots.
- To use the various sensors in building Intelligent Robots.
- To explain the Deliberative Functionality of intelligent Robots.

UNIT I	INTRODUCTION	9

Overview- Definition – Components -Three Modalities – Need for Intelligent Robots – History of AI Robotics – Industrial Manipulators – Mobile Robots – Drones – Cognitive Systems.

UNIT II	AUTOMATION AND AUTONOMY	9

Autonomous Capabilities – Bounded Rationality – Automation and Autonomy – Programming Style – Hardware Design – Types of Functional Failures – Autonomous Capabilities. Types of Software Architectures – Operational Architectures – Components of a Telesystem – Human Supervisory Control.

UNIT III	REACTIVE FUNCTIONALITY	9

Behaviours : Agency and Marr's Computational Theory – Animal Behaviours – Schema Theory. Perception: Action-Perception cycle – Functions. Behaviour Coordination – Function – Cooperating Methods – Competing Methods – Sequences.

UNIT IV	SENSORS AND SENSING	9

Locomotion: Mechanical, Biomimetic, Legged Locomotion – Action Selection – Sensors and Sensing Model – Choosing – Range Sensing: Stereo – Depth from X – Sonar or Ultrasonics.

UNIT V	DELIBERATIVE FUNCTIONALITY	9

Deliberation – Strips – Navigation – Spatial Memory – Types of Path Planning – Configuration Space – Metric Path Planning – Motion Planning – Localization – Feature based Localization – Iconic Localization – Static vs Dynamic Environments – Simultaneous Localization and Mapping - Terrain Identification and Mapping – Scale and Traversability - Exploration – Mutlirobot Systems and AI – Human-Robot Interaction and areas of AI.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Understand the basics of Intelligent Robots.
CO2: Discuss the Autonomous capabilities and Software architecture.
CO3: Explain the Reactive Functionality of intelligent Robots.
CO4: Use the various sensors in building Intelligent Robots.
CO5: Explain the Deliberative Functionality of intelligent Robots.

TEXT BOOKS:

1. Robin R. Murphy, "Introduction to AI Robotics", MIT Press, Second Edition, 2019.

REFERENCES:

1. Francis X. Govers, "Artificial Intelligence for Robotics: Build Intelligent Robots that Perform Human Tasks Using AI Techniques", Packt Publishing, 2018.
2. Sebastian Thrun, Wolfram Burgard, and Dieter Fox, "Probabilistic Robotics", MIT Press, 2005.
3. Yoon Seok Pyo, Han Cheol Cho, Ryu Woon Jung, and Tae Hoon Lim, "ROS Robot Programming", ROBOTIS Co., Ltd, 2017.

20AI909	BIGDATA AND CLOUD DATABASES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of big data and real time analytics.
- To use big data infrastructure and platforms.
- To explore the various cloud data platforms.
- To perform real-time real-time data processing and management.
- To understand the cloud data access and data security features.

UNIT I	BIG DATA	9

Big Data – Big Data Analytics and Cloud Computing - Hadoop, HDFS, MapReduce, Spark, and Flink - Real-Time Analytics – Computing Abstractions – Characteristics - Real-Time Processing for Big Data - Data Stream Processing Platforms - Data Stream Analytics Platforms.

UNIT II	BIG DATA INFRASTRUCTURES AND PLATFORMS	9

Database Techniques for Big Data – Navigational, Relational Data Models - NoSQL Movement - NoSQL Solutions for Big Data Management - NoSQL Data Models - Types of Resource Management - Big Data Processing Systems and Platforms.

UNIT III	CLOUD DATA PLATFORM	9

Cloud data platform layered architecture – Mapping cloud data platform layers to specific tools – AWS, Google Cloud – Azure – Open source – Getting Data into the Platform – Databases, files, APIs and Streams – Ingesting data from Relational databases, files, streams, SaaS applications – Network and Security considerations

UNIT IV	REAL-TIME DATA PROCESSING AND MANAGEMENT	9

Real-time ingestion vs real-time processing – Organizing data for real-time use - Data transformations – Cloud Services for real-time data processing – Metadata – pipeline metadata – Metadata model - Schema management – Approaches – Schema Registry – Schema management features of cloud data warehouses.

UNIT V	DATA ACCESS AND SECURITY	9

Different types of data consumers – Cloud data warehouses – Application data access – Machine Learning on the data platform – Business intelligence and reporting tools – Data Security.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the basic concepts of big data and real time analytics.
CO2: Use big data infrastructure and platforms.
CO3: Explore the various cloud data platforms.
CO4: Perform real-time real-time data processing and management.
CO5: Understand the cloud data access and data security features.

TEXT BOOKS:

1. Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi, "Big Data - Principles and Paradigms", Morgan Kaufmann publications, 2016.

2. Danil Zburivsky, Lynda Partner, "Designing Cloud Data Platforms", Manning Publications, 2021.

REFERENCES:

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analyticsll, Wiley and SAS Business Series, 2012.

 2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009

20AI913	PATTERN RECOGNITION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn various classification and pattern classifier algorithms.
- To learn various unsupervised algorithms for pattern recognition.
- To study the grammars and its applications.
- To analyze feature selection and feature generation strategies.
- To use neural networks and genetic algorithms for pattern recognition.

UNIT I	CLASSIFICATION & PATTERN CLASSIFIER	9

Overview of pattern recognition-Discriminant functions - Supervised learning - Parametric estimation - Maximum likelihood estimation. Bayesian parameter estimation-perceptron algorithm LMSE algorithm-problems with Bayes Approach-Pattern classification by distance functions Minimum distance pattern classifier.

UNIT II	UNSUPERVISED CLASSIFICATION	9

Clustering for unsupervised learning and classification-Clustering concept - C-means algorithm Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solution.

UNIT III	STRUCTURAL PATTERN RECOGNITION	9

Elements of formal grammars-String generation as pattern description - Recognition of Syntactic description - Parsing-Stochastic grammars and applications – Graph structural based representation.

UNIT IV	FEATURE SELECTION & FEATURE GENERATION	9

Pre-processing, Feature Selection Based on Statistical Hypothesis Testing, The Receiver Operating Characteristics (ROC) Curve, Class Separability Measures, Feature Subset selection, Optimal Feature Generation, Neural Networks and Feature Generation / Selection, The Bayesian Information Criterion. Linear Transforms, Regional Features, Features for Shape and Size Characterization, Typical Features for Speech and Audio Classification Template Matching: Introduction, Similarity Measures Based on Optimal Path Searching Techniques, Measures Based on Correlations, Deformable Template Models

UNIT V	NEURAL NETWORKS AND GENETIC ALGORITHM FOR PATTERN CLASSIFICATION	9

Neural network structures for pattern recognition-Neural network -based pattern associators– Self organizing networks. Pattern Classification and Optimization using Genetic Algorithm – Recent Trends

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Understand various classification and pattern classifier algorithms.
CO2: Elaborate various unsupervised algorithms for pattern recognition.
CO3: Discuss the grammars and its applications.
CO4: Analyse Feature selection and Feature generation techniques.

CO5: Use neural networks algorithms and genetic algorithms for pattern recognition.

TEXT BOOKS:

1. Duda R.O., and Hart.P.E.,Pattern Classification and Scene Analysis, second edition, Wiley, 131 2001.

2. Robert J.Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley& Sons Inc., New York, 2007.

3. Trevor H, Robert T,Jerome Friedman, The Elements of Statistical Learning, Springer Series,2017.

4. Christopher M Bishop, Pattern Recognition and Machine Learning. Springer. 2011

REFERENCES:

1. Tou and Gonzales, "Pattern Recognition Principles", Wesley Publication Company, London, 1974.

2. Morton Nadier and Eric Smith P., "Pattern Recognition Engineering", John Wiley & Sons, NewYork, 1993.

3. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press, 2009.

4. E. Alpaydin, "Introduction to Machine Learning", Prentice-Hall of India, 2010.

5. G. James, D. Witten, T. Hastie and R. Tibshirani, "Introduction to Statistical Learning", Springer, 2013.

20AI919	COMPUTATIONAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Study about the introduction of Computational Intelligence.
- To Explore the various Evolutionary Algorithms
- To learn about the fundamental of Neural network •
- To learn about the Fuzzy systems
- To study about the Computational Intelligence

UNIT I	INTRODUCTION	9

Neural Networks-Fuzzy Logic-Computational Intelligence- Application areas- Adaptation Adaptation VS Learning- Types-Spaces-Self Organization and Evolution-Adaptation and Self Organization-Comparison

UNIT II	EVOLUTION OF COMPUTATION CONCEPTS	9

History of Evolutionary Computation- Evolutionary Computation Overview-Genetic Algorithms Evolutionary Programming-Evolution Strategies-Genetic Programming-Particle Swarm Optimization-Genetic Algorithm Implementation-Particle Swarm Optimization Implementation.

UNIT III	NEURAL NETWORKS	9

Neural Network History-Neural Network Terminology-Neural Network Topologies-Neural Network Adaptation-Comparing Neural networks and other classification models-Pre-Processing-Post Processing.

UNIT IV	FUZZY SYSTEM CONCEPTS	9

Fuzzy sets and Fuzzy Logic –Theory of Fuzzy Sets-Approximate Reasoning- Developing a Fuzzy Controller-Fuzzy System Implementation

UNIT V	COMPUTATIONAL INTELLIGENCE IMPLEMENTATIONS	9

Implementation Issues-Fuzzy Evolutionary Fuzzy Rule System Implementation – Choosing Best Tools-An Example Data Mining Systems-Performance Metrics

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Able to Understand the need of Computational Intelligence and its components.
CO2: Analyse the implementation of different algorithms.
CO3: Able to Understand the Neural Network Classification Models.
CO4: To be familiar with Fuzzy sets and its implementation.
CO5: To design and implement the Computational intelligence.

TEXT BOOKS:

1. Dr.Russell Eberhart and Dr.Yuhui Shi, "Computational Intelligence: Concepts to Implementations", Morgan Kaufmann Publishers, 2007.

2. Konar A, "Computational Intelligence: Principles, Techniques and Applications", Springer Verlag, 2005.

REFERENCES:

1. Andries P. Engelbrecht, "Computational Intelligence: An Introduction", Wiley Publishing, 2007.

2. Leszek Rutkowski, "Computational Intelligence: Methods and Techniques", Springer, 2005.

20AI917	INTELLIGENT AGENT TECHNOLOGY	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: 135 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	IMPLEMENTING AGENT SYSTEMS	9

Agent Platforms – JACK – Agents – Capabilities -Data – Message/Events – Plans – Automatic Generation of Skeleton Code.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Brief on Agents, Multi agents and Intelligent agents
CO2: Elaborate on Multi agent systems
CO3: Understand the various search algorithms for agents
CO4: Understand Rational Decision Making and Learning in multi agent systems

CO5: Implement an Intelligent agent systems				

TEXT BOOKS:

1. Gerhard Weiss, "Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence", MIT Press, 2001.

2. Lin Padgham, Michael Winikoff, "Developing Intelligent Agent Systems – A practical Guide", Wiley, 2004.

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

		L	T	P	C
20CS922	**SERVICE ORIENTED ARCHITECTURE**	3	0	0	3

OBJECTIVES:

- Learn XML fundamental
- Be exposed to build applications based on XML.
- Understand the key principles behind SOA.
- Be familiar with the web services technology elements for realizing SOAP.
- Learn the various web service standards.

UNIT I	INTRODUCTION TO XML	9

Fundamentals of XML : document structure – Well-formed and valid documents – Namespaces – Validating XML with DTD - Creating XML Schema – X-Files

UNIT II	BUILDING XML- BASED APPLICATION	9

Parsing XML: Using DOM, Using SAX – Transforming XML with XSL – XSL Formatting – Modeling Databases in XML

UNIT III	ARCHITECTING WEB SERVICES	9

Web Services - Business Motivation For Web Services - CORBA and DCOM - Service Oriented Architecture (SOA): Key Functional Components, Semantic Issues and Taxonomies - Implementation Architectural View.

UNIT IV	WEB SERVICES BUILDING BLOCKS: SOAP	9

Introduction to SOAP - Syntax - Messages - Implementation - Future of SOAP. Web Services Building Blocks: WSDL and UDDI

UNIT V	APPLIED XML	9

Understanding XML Standards: Standard Organization - Standard Stack Layer - Standard Stack Aspects. Implementing XML in E-Business.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Build applications based on XML.
CO2: Develop web services using technology elements.
CO3: Build SOA-based applications.

TEXT BOOKS:

1. Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2002.

REFERENCES:

1. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005.
2. Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002.
3. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Pearson Education, 2005.
4. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004.
5. James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, "Java Web Services Architecture", Morgan Kaufmann Publishers, 2003.

20AI915	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of image processing techniques for computer vision and video analysis.
- To learn the techniques used for image pre-processing.
- To discuss the various image Segmentation techniques.
- To understand the various Object recognition mechanisms.
- To elaborate on the motion analysis techniques for video analytics

UNIT I	INTRODUCTION	9

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

UNIT II	IMAGE PRE-PROCESSING	9

Pixel brightness transformations - Geometric transformations - Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-spectral images - Local preprocessing in the frequency domain - - Line detection by local pre-processing operators - Detection of corners (interest points) - Detection of maximally stable extremal regions - Image restoration

UNIT III	SEGMENTATION	9

Thresholding - Edge-based segmentation - Region-based segmentation – Matching - Evaluation issues in segmentation - Mean shift segmentation - Active contour models.

UNIT IV	OBJECT RECOGNITION	9

Knowledge representation - Statistical pattern recognition - Neural nets - Syntactic pattern recognition - Recognition as graph matching - Optimization techniques in recognition - Fuzzy systems - Boosting in pattern recognition - Random forests - Image understanding control strategies.

UNIT V	MOTION ANALYSIS	9

Differential motion analysis methods - Optical flow - Analysis based on correspondence of interest points - Detection of specific motion patterns - Video tracking - Motion models to aid tracking.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Understand the basics of image processing techniques for computer vision and video analysis.
CO2: Explain the techniques used for image pre-processing.
CO3: Learn the various image Segmentation techniques.
CO4: Understand the various Object recognition mechanisms.
CO5: Elaborate on the motion analysis techniques for video analytics.

TEXT BOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013.

REFERENCES:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, 2011.

2. Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.

3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.

4. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press,2012.

20AI902	NATURE INSPIRED COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of nature inspired techniques which influence computing
- To learn the computing inspired by nature
- To study the Swarm Intelligence
- To know about Immuno computing techniques
- To familiarize with DNA Computing

UNIT I	INTRODUCTION	9

From Nature to Natural Computing – Philosophy - Three Branches: Overview - Conceptualization - Individuals, Entities and agents - Parallelism and Distributivity - Interactivity, Adaptation- Feedback Self-Organization-Complexity, Emergence and Reductionism - Bottom-up Vs Top-Down Determination, Chaos and Fractals.

UNIT II	COMPUTING INSPIRED BY NATURE	9

Evolutionary Computing - Hill Climbing and Simulated Annealing - Darwin's Dangerous Idea - Genetics Principles - Standard Evolutionary Algorithm -Genetic Algorithms – Crossover – Mutation - Evolutionary Programming - Genetic Programming.

UNIT III	SWARM INTELLIGENCE	9

Introduction - Ant Colonies - Ant Foraging Behavior - Ant Colony Optimization, S-ACO Algorithm - Scope of ACO algorithms - Ant Clustering Algorithm (ACA) - Swarm Robotics - Foraging for food - Social Adaptation of Knowledge - Particle Swarm and Particle Swarm 102 Optimization (PSO)

UNIT IV	IMMUNOCOMPUTING	9

Introduction- Immune System - Physiology and main components - Pattern Recognition and Binding - The Immune Network Theory- Danger Theory - Evaluation Interactions - Immune algorithms - Bone Marrow Models - Forrest's Algorithm - Artificial Immune Networks.

UNIT V	COMPUTING WITH NEW NATURAL MATERIALS	9

DNA Computing: Introduction - The DNA Molecule – Manipulating DNA - Adleman's experiment - Test tube programming language - Universal DNA Computers - PAM Model - Splicing Systems - Lipton's Solution to SAT Problem - Scope of DNA Computing - From Classical to DNA Computing.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the basics Natural systems.
CO2: Analyze the concepts of Natural systems and its applications.
CO3: Learn Ant Colony Optimization and Swarm Robotics.
CO4: Articulate immune algorithms and Artificial immune networks.

CO5: Learn DNA Molecule and Scope of DNA computing.

TEXT BOOKS:
1. Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007.

REFERENCES:
1. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008. 2. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006. 3. Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI,2005.

20CS924	GAME THEORY & PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain game programming fundamentals.
- To learn about the processes, mechanics, issues in game design.
- To gain knowledge of the game design and Artificial intelligence.
- To understand the design and scripting languages of game programming.
- To know about networked games and analyze code for sample games.

UNIT I	INTRODUCTION	9

Evolution of video game programming-The Game Loop-Time and games-Game objects-2D rendering Foundations-Sprites-Scrolling-Tile Maps-Vectors –Matrices

UNIT II	3D GRAPHICS FOR GAMES	9

3D graphics-Basics-Coordinate-spaces-Lighting and Shading-visibility-Input Devices-Event based input system-Mobile Input-Basic sound-3D sound-Digital Signal Processing-Physics-Planes, Rays, and line segments-Collision Geometry-Collision Detection-Physics base movement-Physics middleware.

UNIT III	GAME DESIGN AND AI	9

Cameras-Types of cameras-Perspective projection-Camera implementation-Camera support algorithm- Real AI versus Game AI-Path finding-State based behaviors-Strategy and planning.

UNIT IV	USER INTERFACE AND SCRIPTING LANGUAGES	9

Menu system-HUD elements-Radar-other UI considerations-Scripting Languages-Implementing a scripting language-Tokenization-Syntax Analysis-Code Execution or Generation-Data Formats-Case study UI mods in world of war craft.

UNIT V	NETWORKED GAMES	9

Protocols-Network Topology-Server/Client-Peer-to-Peer-Cheating-Sample game -Side scroller for iOS, Tower defense for PC/Mac-Code Analysis.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the essential 2D graphical and mathematical techniques for game programming.

CO2: Illustrate 3D graphics like coordinate spaces, lighting and shading, z-buffering, and quaternions

CO3: Apply artificial intelligence techniques in game design.

CO4: Construct a basic game engine using UI and scripting languages.

CO5: Develop code for sample games.

TEXT BOOKS:

1. Sanjay Madhav, Game Programming Algorithms and Techniques: A platform - Agnostic Approach-Game Design,1st Edition, Addison-Wesley Professional, 2013.

REFERENCES:

1. JouniSmed, HarriHakonen, Algorithms and Networking for Computer Games, 2nd Edition, Wiley Publications, 2017.
2. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", Prentice Hall 3rd Edition, 2014.
3. JungHyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 1st Edition, 2011.

20CS930	LEAN SIX SIGMA	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain insights about the importance of lean six sigma practices.
- To predict, prevent and control defects in a process.
- To understanding the methods of Lean six sigma
- To analyze the challenges through process improvement.
- To evaluate the manufacturing values.

UNIT I	INTRODUCTION TO LEAN CONCEPTS	9

History- Statistical aspects - Six-sigma: Concepts, methodology-Objectives of lean manufacturing- key principles and implications of lean manufacturing traditional Vs lean manufacturing.

UNIT II	LEAN MANUFACTURING CONCEPTS	9

Value creation and waste elimination-main kinds of waste-pull production-different models of pull production-continuous flow-continuous improvement / Kaizen-worker involvement - cellular layout administrative lean.

UNIT III	LEAN MANUFACTURING TOOLS AND METHODOLOGY	9

Standard work -communication of standard work to employees -standard work and flexibility -visual controls-quality at the source-5S principles -preventative maintenance total quality management-total productive maintenance -changeover/setup time -batch size reduction -production leveling-Value stream mapping-Procedure and principles.

UNIT IV	SIX SIGMA CONCEPTS	9

History and development of Six Sigma – requirements of reliability – Definition – Common principles - failure rate – Fundamentals - FMEA - Roles & Responsibilities – Deliverables - challenges of six sigma - Defining a Six Sigma Project –Benefits and Application.

UNIT V	APPLICATIONS OF SIX SIGMA CONCEPTS	9

Lean concept – Seven muda – 5S – JIT – Basic 6σ Concept – Standard Deviation - Pareto principle – voice of customer – 5why"s – SIPOC Process - Building a 6σ team – DMAIC and DMADV – Case study.

	TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: understand the concept of lean manufacturing.
CO2: understand the various tools and methods of lean manufacturing.
CO3: explain the various tools for lean manufacturing.
CO4: study the various concepts in six sigma.
CO5: describe the above tools to implement LM system in an organization.

TEXT BOOKS:

1. Askin R G and Goldberg J B, "Design and Analysis of Lean Production Systems", John Wiley and Sons Inc., 2007.

2. Oakland J S, "TQM - Text with Cases", Butterworth - Heinemann Ltd., Oxford, 3rd Edition, 2012.

3. Dale H Besterfiled, "Total Quality Management", Pearson Education Asia, 3rd Edition, Indian Reprint 2012.

REFERENCES:

1. Janakiraman B and Gopal R K, "Total Quality Management -Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
2. James R Evans and William M Lindsay, "The Management and Control of Quality", 6 th Edition, South-Western (Thomson Learning), 2019.
3. Oakland J S, "TQM -Text with Cases", Butterworth-Heinemann Ltd., Oxford, 3rd Edition, 2003.
4. Suganthi L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

20IT927	INDIAN CONSTITUTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have some knowledge about Indian Constitution.
- To understand the concept of fundamental rights
- To learn about Lok Sabha and Rajya Sabha
- To have some knowledge about Legislative Assembly and Legislative Council
- To learn about Local Self Government

UNIT I	INTRODUCTION	9

Meaning and Importance of Constitution - Preamble and Salient Features of the Constitution.

UNIT II	FUNDAMENTAL RIGHTS	9

Fundamental Rights, Right to Equality, Right to Freedom, Right against exploitation, Right to freedom of religion, Cultural and Educational Rights, Right to Constitutional Remedies and Duties, Directive Principles of State Policy

UNIT III	LOK SABHA AND RAJYA SABHA	9

Union Government – Lok Sabha and Rajya Sabha Composition, Powers and functions: The President, The Prime Minister and Supreme Court: Role Position and Powers/ functions.

UNIT IV	LEGISLATIVE ASSEMBLY AND LEGISLATIVE COUNCIL	9

State Government - Legislative Assembly and Legislative Council: Composition, Powers and functions: The Governor, Chief Minister and High Court: Role, Position and Powers/ functions.

UNIT V	LOCAL SELF GOVERNMENT	9

Local self-Government, Panchayat Raj System in India; Election Commission; Public Service Commissions, Role, powers and function

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Interpret the knowledge on Indian Constitution.
CO2: Demonstrate the knowledge gained through fundamental rights concept.
CO3: Relate the concept of Lok Sabha and Rajya Sabha.
CO4: Illustrate the concept of Legislative Assembly and Legislative Council.
CO5: Analyze the concept of Local Self Government.

TEXT BOOKS:

1. M V Pylee, An Introduction to The Constitution of India, Vikas Publishing House Pvt. Ltd., 5th Edition.

REFERENCES:

1. Durga Das Basu, Introduction to the Constitution of India, 19th Edition Reprint 2009.

2. Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, 7th Edition, 2015.

20AI502	MACHINE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To discuss the basics of Machine Learning and Supervised Algorithms.
- To understand the various classification algorithms.
- To study dimensionality reduction techniques.
- To elaborate on unsupervised learning techniques.
- To discuss various Graphical models and understand the basics of reinforcement learning.

UNIT I	INTRODUCTION	9

Machine Learning – Types – Applications – Preparing to Model – Activities – Data – Exploring structure of Data – Data Quality and Remediation – Data Pre-processing – Modelling and Evaluation: Selecting a Model -Training a Model – Model representation and Interpretability – Evaluating Performance of a Model – Improving Performance.

UNIT II	FEATURE ENGINEERING AND DIMENSIONALITY REDUCTION	9

Feature Engineering – Feature Transformation – Feature Subset Selection - Principle Component Analysis – Feature Embedding – Factor Analysis – Singular value decomposition and Matrix Factorization – Multidimensional scaling – Linear Discriminant Analysis – Canonical Correlation Analysis – Isomap – Locally linear Embedding – Laplacian Eigenmaps.

UNIT III	SUPERVISED LEARNING	9

Linear Regression -Relation between two variables – Steps – Evaluation – Logistic Regression – Decision Tree – Algorithms – Construction – Classification using Decision Tree – Issues – Rulebased Classification – Pruning the Rule Set – Support Vector Machines – Linear SVM – Optimal 83 Hyperplane – Radial Basis Functions – Naïve Bayes Classifier – Bayesian Belief Networks.

UNIT IV	UNSUPERVISED LEARNING	9

Clustering – Types – Applications - Partitioning Methods – K-means Algorithm – K-Medoids – Hierarchical methods – Density based methods DBSCAN – Finding patterns using Association Rules – Hidden Markov Model.

UNIT V	NEURAL NETWORKS AND TYPES OF LEARNING	9

Biological Neuron – Artificial Neuron – Types of Activation function – Implementations of ANN – Architectures of Neural Networks – Learning Process in ANN – Back propagation – Deep Learning – Representation Learning – Active Learning – Instance based Learning – Association Rule Learning – Ensemble Learning Algorithm – Regularization Algorithm- Reinforcement Learning – Elements- Model-based- Temporal Difference Learning.

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the basics of Machine Learning and Supervised Algorithms.
CO2: Understand the various classification algorithms.
CO3: Study dimensionality reduction techniques.
CO4: Elaborate on unsupervised learning techniques.
CO5: Understand various Graphical models and understand the basics of reinforcement learning.

TEXT BOOK:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning", Pearson, 2019. (Unit 1 – chap 1,2,3/ Unit 2 – Chap 4 / Unit 4 – 9 / Unit 5 – Chap 10, 11)
2. Ethem Alpaydin, "Introduction to Machine Learning, Adaptive Computation and Machine Learning Series", Third Edition, MIT Press, 2014. (Unit 2 – Chap 6 / Unit 4 – chap 8.2.3 / Unit 5 – Chap 18)

REFERENCES:

1. Anuradha Srinivasaraghavan, Vincy Joseph, "Machine Learning", First Edition, Wiley, 2019. (Unit 3 – Chap 7,8,9,10,11 / Unit 4 – 13, 11.4, 11.5,12)
2. Peter Harrington, "Machine Learning in Action", Manning Publications, 2012.
3. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
4. Tom M Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2013.
5. Christoph Molnar, "Interpretable Machine Learning - A Guide for Making Black Box Models Explainable", Creative Commons License, 2020.

20IT928	PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP	L	T	P	C
		0	0	6	3

OBJECTIVES:

- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skills of the students.

This course is a four months immersive program to keep up with the industry demand and to have critical thinking, team based project experience and timely delivery of modules in a project that solves world problems using emerging technologies.

To prepare the students with digital skills for the future, the Experiential Project Based

Learning is introduced to give them hands-on experience using digital technologies on open-source platforms with an end-to-end journey to solve a problem. By the end of this course, the student understands the approach to solve a problem with team collaboration with mentoring from Industry and faculties. This is an EEC category course offered as an elective, under the type, "Experiential Project Based Learning".

Highlights of this course:
- Students undergo training on emerging technologies
- Students develop solutions for real-world use cases
- Students work with mentors to learn and use industry best practices
- Students access and use Self-Learning courses on various technologies, approaches, and methodologies.
- Collaborate in teams with other students working on the same topic
- Have a dedicated mentor to guide

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Upskill in emerging technologies and apply to real industry-level use cases
CO2: Understand agile development process
CO3: Develop career readiness competencies, Team Skills / Leadership qualities
CO4: Develop Time management, Project management skills and Communication Skills
CO5: Use Critical Thinking for Innovative Problem Solving
CO6: Develop entrepreneurship skills to independently work on products

The course will involve 40-50 hours of technical training, and 40-50 hours of project development. The activities involved in the project along with duration are given in Table 1.

TABLE 1 ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies and business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed	6

	in agile mode. The status of the project shall be updated to the mentors via appropriate platform	
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud based repository such as GitHub.	3
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
TOTAL		**16 WEEKS**

OPEN ELECTIVES OFFERED TO OTHER DEPARTMENTS								
SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20CD001	Computer Graphics and Animation	OE	3	3	0	0	3
2.	20CD002	UI/UX Design	OE	3	3	0	0	3
3.	20CD003	Multimedia Security	OE	3	3	0	0	3
4.	20CD004	Digital Marketing	OE	3	3	0	0	3

OPEN ELECTIVES OFFERED(OE) TO OTHER DEPARTMENTS

20CD001	COMPUTER GRAPHICS AND ANIMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To grasp the fundamental knowledge of implementing Computer Graphics in 2D.
- To get familiar with 3D Graphics.
- To learn the process of implementation of Computer Graphics through Vulkan API.
- To get familiarity with basic to advanced rendering technique.
- To become familiar with Animation and Multimedia systems.

UNIT I	2D GRAPHICS PROCESSING	9

Video Display devices -Raster Scan System-Graphics Output Primitives-Open GL Point Functions-Open GL Line Functions-Open GL Curve Functions-Implementation Algorithm for Graphics Primitives & Attributes: Line Drawing Algorithm-Parallel Line Algorithm-Circle Generating Algorithm-Ellipse Generating Algorithm-Two-Dimensional Viewing Pipeline-Clipping Algorithm.

UNIT II	3D GRAPHICS PIPELINE	9

Three-Dimensional Geometric transformation: Translation- Rotation- Scaling-Composite Three-Dimensional Transformations-Other Three-dimensional Transformations-Three-dimensional viewing pipeline-Projection Transformations-Orthogonal Projections-Oblique Parallel Projections-Perspective Projections-OpenGL Three-dimensional Viewing Function.

UNIT III	VULKAN GRAPHICS API	9

Overview of Vulkan-Introduction-Instances, Devices and Queues-The Vulkan Instance-Vulkan Physical Devices-Physical Device Memory-Device Queues-Creating a Logical Device-Object Types and Function Conventions- Enhancing Vulkan: Layers – Extensions-Queues and Commands: Device Queue-Creating Command Buffers-Recording Buffer-Recycling Command Buffers -Moving Data: Managing Resource State.

UNIT IV	RENDERING	9

Lighting and Shading-Light Matter-Light Sources-The Phong Reflection Model-Texture Mapping-Texture Generation-Global Illumination-Ray Tracing- Radiosity-Parallel Rendering-Volume Rendering- Environment map- Bump mapping- isosurfaces and marching Cubes-Rasterization.

UNIT V	ANIMATION	9

Design of Animation Sequences-General Computer animation Function-Raster Animations-Computer Animation Languages-Key Frame System- Morphing-Simulating Acceleration-Motion Specification-Direct Motion Specifications-Goal Directed System-Kinematics & Dynamics.

TOTAL: 45 PERIODS

OUTCOMES:

On Successful completion of the course, Students will be able to

CO1: Implement 2D transformations and algorithms for generating primitives and attributes**.**

CO2: Solve problems in 3D transformations and viewing**.**

CO3: Implement the process of open source Vulkan API.

CO4: Implement rendering techniques and use advanced based rendering.

CO5: Understand the multimedia systems and animation.

TEXT BOOKS:
1. Donald D. Hearn, M. Pauline Baker, Warren Carithers, "Computer Graphics with OpenGL", Pearson Education, Fourth Edition, 2014.
2. Graham Sellers, John Kessenich, "Vulkan Programming Guide", 1st Edition, Addison Wesley, 2016.
3. Edward Angel, Dave Shreiner," Interactive Computer Graphics. A Top-Down Approach with WebGL", 7th Edition, 2015

REFERENCES:
1. OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.5 with SPIR-V, 9th Edition, Addison Wesley, 2016.
2. https://vulkan-tutorial.com

20CD002	UI/UX DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

● To explain the principles of User Interface (UI) in order to do design with intention.
● To define the User eXperience (UX) and the psychology behind user decision making.
● To discuss about UX process and user Psychology.
● To apply technology for designing web applications with multimedia effects.
● To create a wireframe and prototype.

UNIT I	INTRODUCTION TO UI	9

Introduction to UI - Designing Behaviour: Designing with Intention - Conditioning and Addiction - Timing Matters - Gamification - Social/Viral Structure–Trust - Hidden versus Visible. Basic Visual Design Principles: Visual Weight - Contrast - Depth and Size – Color- Layout: Page Framework - Footers - Navigation -Images, and Headlines - Forms - Input Types - Labels and Instructions - Primary and Secondary Buttons - Adaptive and Responsive Design - Touch versus Mouse.

UNIT II	USER OBSERVATION AND EXPERIENCE	9

User Research - Subjective Research - Objective Research - Three Basic Types of Questions. Observe a user: Watch How They Choose - Interviews - Surveys - Card Sorting - Creating User Profiles - Bad profile - Useful profile.

UNIT III	INTRODUCTION TO UX	9

Introduction about UX - Five Main Ingredients of UX - Three "Whats" of user Perspective - Pyramid of UX Impact - UX Is a Process - UX - Not an Event or Task. Behaviour Basics: Psychology versus Culture - User Psychology - Experience - Conscious vs Subconscious Experience - Emotions - Gain and Loss – Motivations.

UNIT IV	WEB INTERFACE DESIGN	9

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Using Motion for UX - Design Pattern: Z-

Pattern - F-Pattern - Visual Hierarchy - Lookup patterns – Feedback patterns.

UNIT V	WIREFRAMING, PROTOTYPING AND TESTING	9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wire flows - Building a Prototype - Building High-Fidelity Mock-ups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the principles of User Interface (UI) Design in order to design with intention

CO2: Learn the effective User eXperience (UX) and the psychology behind user decision making.

CO3: Understand the importance of UX process and user Psychology.

CO4: Elucidate the implications for designing web application with multimedia effects.

CO5: Create Wireframe and Prototype.

TEXT BOOKS:

1. Joel Marsh, "UX for Beginners", O'Reilly Media, Inc., 1st Edition 2015.
2. Xia Jiajia, "UI UX Design", O'Reilly, Artpower International, 2016.
3. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3rd Edition, O'Reilly 2020

REFERENCES:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3rd Edition , O'Reilly 2020.

2. Steve Schoger, Adam Wathan "Refactoring UI", 2018.

3. https://www.uxai.design/#:~:text=for%20designers,for%20AI%20products%20and%20services.

20CD003	MULTIMEDIA SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand different forms of media in systems.
- To acquire knowledge in multimedia components.
- To acquire knowledge in the development of multimedia applications.
- To acquire knowledge about multimedia tools and authoring.
- To learn about the latest trends and technologies in multimedia.

UNIT I	INTRODUCTION	9

Introduction to Multimedia – Characteristics of Multimedia Presentation – Multimedia Components – Promotion of Multimedia Based Components – Digital Representation – Media and Data Streams – Multimedia Architecture – Multimedia Documents – Visual

Display System.		
UNIT II	**ELEMENTS OF MULTIMEDIA**	**9**

Text: Types, Font, Unicode Standard, Text Compression, File Formats – Image: Types, Image Processing, Standards, Specification, Device Independent Color Models, Gamma Correction, File Formats – Video: Video Signal Transmission, Signal Formats, Broadcasting Standards, Digital Video Standards, PC Video, Video File Formats – Audio: Acoustics, Characteristics of Sound – Elements of Audio System: Microphone, Amplifier, Loudspeaker, Audio Mixer, Digital Audio, MIDI – Graphics: Components of Graphics System.

UNIT III	**MULTIMEDIA COMPRESSION TYPES**	**9**

Compression Types and Techniques: CODEC, GIF Coding Standards, JPEG, MPEG – Multimedia Database System – User Interfaces – OS Multimedia Support – Hardware Support – Real Time Protocols – Play Back Architectures – Synchronization – Document Architecture – Hypermedia Concepts: Hypermedia Design – Digital Copyrights.

UNIT IV	**MULTIMEDIA TOOLS**	**9**

Authoring Tools – Features and Types – Card and Page Based Tools – Icon and Object Based Tools – Time Based Tools – Cross Platform Authoring Tools – Editing Tools – Painting and Drawing Tools – 3D Modeling and Animation Tools – Image Editing Tools – Sound Editing Tools – Digital Movie Tools.

UNIT V	**MULTIMEDIA APPLICATION DEVELOPMENT**	**9**

Software Life Cycle – ADDIE Model – Conceptualization – Content Collection – Story Board –Script –Authoring Metaphors – Testing – Report Writing – Documentation.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Articulate the concepts and techniques used in multimedia applications.
CO2: Handle the multimedia elements effectively.
CO3: Develop effective strategies to deliver Quality of Experience in multimedia applications.
CO4: Design and implement algorithms and techniques applied to multimedia objects.
CO5: Design and develop multimedia applications following software engineering models.

TEXTBOOKS:
1. Ranjan Parekh, "Principles of Multimedia", Second Edition, McGraw-Hill Education, 2017.
2. Tay Vaughan, "Multimedia: Making It Work", Ninth Edition, McGraw-Hill, 2014.

REFERENCES:
1. Ralf Steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Prentice Hall, 1995.
2. Paul Dietel, Harvey Dietel, Abbey Dietel, "Internet & World Wide Web How to

Program", Fourth Edition, Prentice Hall, 2008.
3. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education, 2002.

20CD004	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the role of digital marketing in overall marketing strategy.
- To understand website designing and optimization methods in digital marketing.
- To learn about Search Engine Marketing Platforms.
- To understand various Social Media Marketing strategies.
- To understand the concepts of Web Analytics and various types of report generation.

UNIT I	INTRODUCTION TO DIGITAL MARKETING	9

Digital marketing - Importance of digital marketing-Difference between traditional and digital marketing- Digital marketing platforms- recent trends and current scenario of the industry - digital marketing as a tool for students, professionals and businesses-Tools.

UNIT II	WEBSITE DESIGNING AND OPTIMIZATION	9

On Page Optimisation (OPO)- HTML and CSS basics- Meta tags usage- Using Javascript - Contextual interlinking - Microformats & schemas - Off-Page Optimization - Linking Strategies - Competitor Analysis-Sculpting-Link baiting - Social Book Marking and Promotions- Directory submissions -Search Engine Optimization (SEO)- Growth of SEO-Ecosystem of a search engine SEO Tools.

UNIT III	SEARCH ENGINE MARKETING	9

SEM platforms- Google Adwords – Ad creation process- Keyword grouping-Bidding techniques – Site targeting & keyword targeting -Ad approval process – Ad extensions-Site, Demographic targeting, CPC-based, CPA-based & CPM-based accounts

UNIT IV	SOCIAL MEDIA MARKETING	9

Social Media Marketing- Email Marketing- Mobile Marketing - Adsense, Blogging and Affiliate Marketing.

UNIT V	WEB ANALYTICS	9

Introduction to Web Analytics- GA Terminology (Dimensions & Metrics)- Introduction to Reports - Audience Reports, Traffic Sources and Content Reports- Campaign Tagging & Reporting - Dashboard- Linking and Using Data from Google Adwords- Case studies on digital marketing strategies.

	TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Explain the role and importance of digital marketing in a rapidly changing business landscape
CO2: Examine website designing and optimization.
CO3: Analyze the various SEM platforms for digital marketing.
CO4: Discuss the marketing strategies used in social media.
CO5: Analyze the web and generate various types of reports for real time application.

TEXT BOOKS:

1. Seema Gupta, Digital Marketing, McGraw Hill, 2nd Edition, 2020.
2. Subhankar Das, Search Engine Optimization and Marketing a Recipe for Success in Digital Marketing, CRC Press, 2021.
3. Chuck Hemann, Ken Burbary, Digital Marketing Analytics, Pearson, Second Edition, 2019

REFERENCES:

1. Dave Chaffey, Fiona Ellis-Chadwick, Digital Marketing: Strategy, Implementation and Practice 7th Edition, Pearson, 2019.
2. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaign, Wiley, 2016.
3. Rob Stokes, eMarketing The Essential Guide to Marketing in a digital world, Quirk eMarketing.
4. Shivani Karwal, Digital Marketing Handbook: A Guide to Search Engine Optimization, 2015.
5. Jacobson, Howie, McDonald, Joel and McDonald, Kristie, Google AdWords For Dummies, 3rd Edition, O'Reilly, 2011.
6. http://www.gbv.de/dms/zbw/865712123.pdf
7. https://www.redandyellow.co.za/content/uploads/woocommerce_uploads/2017/10/emarketi ng_textbook_download.pdf

HONOURS DEGREE- CREATIVE MEDIA DESIGN

20CD916	DIGITAL AUDIO AND VIDEO DESIGN(LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To introduce the fundamental principles of Audio processing.
- To provide an overview of Midi and Synthetic Audio Control.
- To review latest trends and future technologies Stereo and Surround Sound.
- To introduce the fundamental concepts of Video processing.
- To learn on Digital Video Processing Techniques and Applications.

UNIT I	BASICS OF DIGITAL AUDIO	9+6

Basics of Digital Audio - Auditory Perception - Noise Reduction. Digital and analogue recording contrasted, A/D and D/A Converter, Pitch Shifting and Time Stretching, Audio Data Reduction.

UNIT II	MIDI AND SYNTHETIC AUDIO CONTROL	9+6

MIDI principles- MIDI and digital audio contrasted - Interfacing a computer to a MIDI system- MIDI control of sound generators- Scalable polyphonic MIDI (SPMIDI)- MIDI and synchronisation- MIDI over USB.

UNIT III	STEREO AND SURROUND SOUND	9+6

Two-Channel Stereo - Principles of Loudspeaker Stereo - Two-Channel Signal Formats and Microphone techniques, Binaural Recording and Dummy Head Techniques,

Surround Sound - Three Channel Stereo, Four Channel Surround, 5.1 Channel Surround, and other Multichannel Configurations. Surround Sound Systems, Matrix Surround Sound Systems, Dolby Digital, DTS, Ambisonics.

UNIT IV	DIGITAL VIDEO FUNDAMENTALS	9+6

Basic concepts and Terminology- Analog video standards – Digital video basics – Analog-to Digital conversion – Color representation and chroma subsampling – Digital video formats and standards

UNIT V	DIGITAL VIDEO PROCESSING TECHNIQUES AND APPLICATIONS	9+6

Fundamentals of Motion Estimation and Motion Compensation- General Methodologies in Motion Estimation- Motion Estimation Algorithms- Video Enhancement and Noise Reduction- Noise Reduction in Video- Interframe Filtering Techniques.

LIST OF EXERCISES:

1. Image Enhancement operations like manipulating Brightness and Contrast.
2. Video noise and editing.
3. Designing MATLAB or OpenCV programs for Feature Extraction and Classification.
4. Music composition in MATLAB/OpenCV.
5. MATLAB/OpenCV audio Processing.
6. Filter and Mask effects in audio.
7. Reading and Writing of Video.
8. Video Object Tracking.
9. Extraction of Frames and manipulation.
10. Learning Processing for Visual Arts and animation.

TOTAL: 45+30=75 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Introduction of fundamental principles of Audio processing.
CO2: Provide an overview of Midi and Synthetic Audio Control.
CO3: Review latest trends and future technologies Stereo and Surround Sound.
CO4: Introduce the fundamental concepts of Video processing.
CO5: Learn on Digital Video Processing Techniques and Applications.

TEXT BOOKS:

1. Francis Rumsey & Tim McCormick "Sound and Recording ", Sixth Edition, 2014, Focal Press, Elsevier Ltd.

2. Oges Marques, Practical Image and Video Processing Using MATLAB, Wiley-IEEE Press, 2011.

REFERENCES:

1. Ian Mcloughlin "Applied Speech and Audio Processing with MATLAB Examples" Cambridge University Press, Cambridge, New York, 2009.

SOFTWARE REQUIREMENTS:

Audacity, Lightworks, VideoPad, HitFilm Express, DaVinci Resolve, VSDC Free Video

Editor, OpenShot, Shotcut.

20CD917	FILM MAKING(LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To understand the fundamentals of short film Making.
- To know the working of pre-production
- To acquire knowledge about the pre-production and kit.
- To know the working of post-production and distribution.
- To inculcate the working of scrips and insider

UNIT I	INTRODUCTION	9+6

Introduction –The Writer- Characters- Storytelling- Writer's Craft- Software Focus-Screenwriting- The Producer- Small Fish-Cutting Diamonds- The Director.

UNIT II	PRE-PRODUCTION	9+6

Scheduling and Budgeting-Insurance-Trade unions-United Kingdom-Crown funding-Starting a company-Actors Agencies-Screen Agencies-Location Libraries-Finance-Crewing-Casting-Locations.

UNIT III	PRODUCTION AND KIT	9+6

Camera – Lights- Fill Light- Back Light- Lighting equipment- Common lighting terms and accessories- Sounds.

UNIT IV	POST PRODUCTION AND DISTRIBUTION	9+6

Editor – Music – Marketing - Festivals and Distributors - Hybrid Distribution.

UNIT V	SCRIPTS AND INSIDER	9+6

Making an Oscar nominated short- Secrets of high-production values on a low budget - Noise Control- Storyboarding a silent film.

TOTAL: 45+30=75 PERIODS

LIST OF EXPERIMENTS:

1. Create a Power point presentation on Current public issues topics.
2. Implement Song mixing using sound Editing tool.
3. Creating new sound effects and voice over for the short film using sound editing tool.
4. Creating graphics for titles using drawing tool.
5. Implementing various transition animation using Unity.
6. Editing short film using editing tool
7. Creating Lighting effects using special effects tools.
8. Working on color correction and color exposure using Image editing tool.
9. Preparing shooting script and Editing Script.

10. Develop a short film based on current public issues as mini project.
OUTCOMES: At the end of this course, the students will be able to: **CO1:** Understand the fundamentals of short film Making. **CO2:** Know the working of pre-production **CO3:** Acquire knowledge about the pre-production and kit. **CO4:** Understand the working of post-production and distribution. **CO5:** Inculcate the working of scrips and insider.
TEXT BOOKS: 1. Max Thurlow & Clifford Thurlow, "Making Short Films – The Complete Guide from Script to Screen", Bloomsbury, 2013.
REFERENCE: 1. James R. Matin, "Create Documentary Films, telling Techniques Videos and Multimedia: A Comprehensive Guide to Using Documentary Storytelling Techniques for Film Video, The internet and Digital Media Nonfiction project", Real Deal Press, 2010. 2. Michael Rabiger, "Directing the Documentary", Focal Press, 2004. 3. Daniel Faltesek, "Selling Social Media the Political Economy of Social Networking", Bloomsbury Academic, 2018.
SOFTWARE REQUIREMENTS: Lightworks, VideoPad, VSDC Free Video Editor, HitFilm Express or equivalent.

20CD918	MULTIMEDIA DATA COMPRESSION AND STORAGE (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To understand the basics of compression techniques.
- To understand the categories of compression for text, image and video.
- To explore the modalities of text, image and video compression algorithms.
- To know about basics of consistency of data availability in storage devices.
- To understand the concepts of data streaming services.

UNIT I	BASICS OF DATA COMPRESSION	9+6

Introduction – Lossless and Lossy Compression – Basics of Huffmann coding-Arithmetic coding - Dictionary techniques- Context based compression – Applications.

UNIT II	IMAGE COMPRESSION	9+6

Lossless Image compression – JPEG - CALIC - JPEG LS - Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimile encoding.

UNIT III	VIDEO COMPRESSION	9+6

Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1-MPEG-2- H.263.

UNIT IV	DATA PLACEMENT ON DISKS	9+6

Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system.

UNIT V	DISK SCHEDULING METHODS	9+6

Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams.

TOTAL:45+30=75 PERIODS

LIST OF EXPERIMENTS:

1. Construct Huffman codes for given symbol probabilities.
2. Encode run lengths with fixed-length code.
3. Lempel-Ziv algorithm for adaptive variable-length encoding
4. Compress the given word using arithmetic coding based on the frequency of the letters.
5. Write a shell script, which converts all images in the current directory in JPEG.
6. Write a program to split images from a video without using any primitives.
7. Create a photo album of a trip by applying appropriate image dimensions and format.
8. Write the code for identifying the popularity of content retrieval from media server.
9. Write the code for ensuring data availability in disks using strip-based method.
10. Program for scheduling requests for data streams.

OUTCOMES:

At the end of this course, the students will be able to:
CO1: Understand the basics of text, Image and Video compression.
CO2: Understand the various compression algorithms for multimedia content.
CO3: Explore the applications of various compression techniques.
CO4: Explore knowledge on multimedia storage on disks.
CO5: Understand scheduling methods for request streams.

TEXT BOOKS:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.

2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008.

REFERENCES:

9. David Salomon, A concise introduction to data compression, 2008.
10. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series,
    2017.
11. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis,2019.
12. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition,
    2009.

SOFTWARE REQUIREMENTS:

Shell/Equivalent

HONOURS DEGREE- ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

20AI302	INTRODUCTION TO DATA SCIENCE (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To explain the fundamentals of data science.
- To experiment and implement python libraries for data science.
- To apply and implement basic classification algorithms.
- To apply clustering and outlier detection approaches.
- To present and interpret data using visualization tools in Python.

UNIT I	INTRODUCTION	9+6

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data.

UNIT II	PYTHON LIBRARIES FOR DATA SCIENCE	9+6

Launching the IPython Shell - Launching the Jupyter Notebook - IPython Magic Commands - The Basics of NumPy Arrays-Universal Functions – Aggregations – Computation on Arrays – Fancy Indexing – Sorting arrays – Structured data – Data manipulation with Pandas – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – String operations – Working with time series – High performance Pandas.

UNIT III	CLASSIFICATION	9+6

Basic Concepts – Decision Tree Induction – Bayes Classification Methods – Rule-Based Classification – Model Evaluation and Selection. Bayesian Belief Networks – Classification by Backpropagation – Support Vector Machines – Associative Classification – K-Nearest-Neighbor Classifiers – Fuzzy Set Approaches - Multiclass Classification - Semi-Supervised Classification.

UNIT IV	CLUSTERING AND OUTLIER DETECTION	9+6

Cluster Analysis – Partitioning Methods – Evaluation of Clusters – Probabilistic Model-Based Clustering – Outliers and Outlier Analysis – Outlier Detection Methods – Statistical Approaches – Clustering and Classification-Based Approaches.

UNIT V	DATA VISUALIZATION	9+6

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

	TOTAL:45+30=75 PERIODS

LIST OF EXPERIMENTS:

1. Download, install and explore the features of R/Python for data analytics.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Basic plots using Matplotlib
5. Statistical and Probability measures
   a) Frequency distributions

b) Mean, Mode, Standard Deviation
c) Variability
d) Normal curves
e) Correlation and scatter plots
f) Correlation coefficient
g) Regression
6. Use the standard benchmark data set for performing the following:
    a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard
        Deviation, Skewness and Kurtosis.
    b) Bivariate Analysis: Linear and logistic regression modelling.
    c) Multiple Regression Analysis
    d) Compare the results of the above analysis for the two data sets.
7. Apply supervised learning algorithms and unsupervised learning algorithms on any data set.
8. Apply and explore various plotting functions on any data set.

Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

Mini Projects
a) Recommendation system
b) Credit Card Fraud Detection
c) Fake News Detection
d) Customer Segmentation
e) Sentiment Analysis
f) Recommender Systems
g) Emotion Recognition
h) Stock Market Prediction
i) Email classification
j) Tweets classification
k) Uber Data Analysis
l) Social Network Analysis

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the fundamentals of data science.
CO2: Experiment python libraries for data science.
CO3: Apply and implement basic classification algorithms.
CO4: Implement clustering and outlier detection approaches.
CO5: Present and interpret data using visualization tools in Python.

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann, 2012.
3. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Kindle Edition, 2017.

REFERENCES:

1. Roger D. Peng, R Programming for Data Science, Lulu.com, 2016.

2. Laura Igual, Santi Seguí, "Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications", 1st Edition, Springer, 2017.

3. Peter Bruce, Andrew Bruce, "Practical Statistics for Data Scientists: 50 Essential Concepts", 3rd Edition, O'Reilly, 2017.

4. Avrim Blum, John Hopcroft, Ravi Kannan, "Foundations of Data Science", 1st Edition, Cambridge University Press, 2020.

SOFTWARE REQUIREMENTS:

Python, Jupiter Notebook.

20AI501	DATA EXPLORATION AND VISUALIZATION (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To outline an overview of exploratory data analysis and phases involved in data analytics.
- To acquire an in-depth knowledge in EDA techniques.
- To experiment the data visualization.
- To describe the methods of time series analysis.
- To explain the basics of tree and hierarchical representation of big data.

UNIT I	EXPLORATORY DATA ANALYSIS	9+6

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA.

UNIT II	EDA TECHNIQUES	9+6

Visual Aids For EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques -Descriptive Statistics-types of kurtosis, quartiles, Grouping Datasetsdata aggregation, group wise transformation.

UNIT III	VISUALIZING DATA	9+6

The Seven Stages of Visualizing Data, Processing-load and displaying data – functions, sketching and scripting, Mapping-Location, Data, two sided data ranges, smooth interpolation of values over time.

UNIT IV	TIME SERIES ANALYSIS	9+6

Overview of time series analysis-showing data as an area, drawing tabs, handling mouse input, Connections and Correlations – Preprocessing-introducing regular expression, sophisticated sorting, Scatterplot Maps-deployment issues.

UNIT V	TREES, HIERARCHIES, AND RECURSION	9+6

Treemaps - treemap library, directory structure, maintaining context, file item, folder item, Networks and Graphs-approaching network problems-advanced graph example, Acquiring data, Parsing data.

	TOTAL:45+30=75 PERIODS

LIST OF EXPERIMENTS:

1. Install the following Data Mining and data Analysis tool: Weka, KNIME, Tableau Public.
2. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Perform Time Series Analysis with datasets like Open Power System Data.
4. Build a time-series model on a given dataset and evaluate its accuracy.
5. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc.
6. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
7. Perform text mining on a set of documents and visualize the most important words in a

visualization such as word cloud.

8. Use a case study on a data set and apply the various visualization techniques and present an analysis report.

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the overview of exploratory data analysis and phases involved in data analytics.
CO2: Explore in-depth knowledge in EDA techniques.
CO3: Apply the visualization techniques in data.
CO4: Describe the methods of time series analysis.
CO5: Represent the data in tree and hierarchical formats.

TEXT BOOKS:

1. Suresh Kumar Mukhiya and Usman Ahmed, "Hands-on Exploratory Data Analysis with

Python", Packt publishing , March 2020.

2. Ben Fry, "Visualizing Data", O'reilly publications, 2007.

REFERENCES:

1. Danyel Fisher & Miriah Meyer, "Making Data Visual: A Practical Guide To Using Visualization For Insight", O'reilly publications, 2018.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. EMC Education Services, "Data Science and Big data analytics: Discovering, Analyzing,
   Visualizing and Presenting Data", Wiley Publishers, 2015.
4. Tamara Munzner, "Visualization Analysis and Design", A K Peters/CRC Press; 1st edition, 2014.
5. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization:
   Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

SOFTWARE REQUIREMENTS:

Python, Jupiter Notebook.

20AI703	DEEP LEARNING TECHNIQUES	L	T	P	C
	(LAB INTEGRATED)	3	0	2	4

OBJECTIVES:

- To explain the basics of deep neural networks.
- To discuss advanced deep learning models.
- To understand CNN and RNN architectures of deep neural networks.
- To familiarize autoencoders in neural networks.
- To learn about the deep generative models

UNIT I	DEEP NETWORKS	9+6

Challenges motivating deep learning - Deep feedforward networks - Learning XOR - Gradient based learning - Hidden Units – Architecture Design – Back Propagation – Regularization – Parameter Norm Penalties – Constrained Optimization – Under-

Constrained Problems – Dataset Augmentation – Noise Robustness – Semi-Supervised Learning – Multi-Task Learning – Early Stopping – Parameter Tying and Sharing – Bagging and Other Ensemble methods – Dropout – Adversarial Training.

UNIT II	OPTIMIZATION FOR TRAINING DEEP MODELS	9+6

Pure optimization – Challenges – Basic Algorithms – Parameter initialization Strategies – Algorithms with Adaptive Learning Rates – Approximate Second-Order methods – Optimization Strategies and Meta Algorithms.

UNIT III	CONVOLUTIONAL AND RECURRENT NEURAL NETWORKS	9+6

Convolution Operation – motivation – Pooling – Infinitely Strong prior – Variants – Structured Output – Data Types – Efficient Convolutional Algorithms – Random or Unsupervised features – Neuroscientific Basis - Deep Learning – Sequence Modelling - Computational Graphs - RNN - Bidirectional RNN – Encoder-Decoder - Sequence to Sequence RNN - Deep Recurrent Networks - Recursive Neural Networks -- Long Term Dependencies; Leaky Units – Strategies for multiple time scales – LSTM and Gated RNNs – Optimization for Long Term Dependencies.

UNIT IV	AUTOENCODERS	9+6

Autoencoders: Undercomplete autoencoders - Regularized autoencoders – Power, Layer Size and Depth - Stochastic encoders and decoders – Denoising Autoencoders - Learning with autoencoders – contractive Autoencoders – Applications of autoencoders.

UNIT V	DEEP GENERATIVE MODELS	9+6

Boltzmann Machine – Restricted Boltzmann Machine – Deep Belief Networks – Deep Boltzmann Machines - Boltzmann Machines for Real-Valued Data – Convolutional Boltzmann Machines - Boltzmann Machine for Structured or Sequential Outputs – Directed Generative Nets – Evaluating Generative Models.

TOTAL: 45+30=75 PERIODS

LIST OF EXPERIMENTS:
1. Implement a simple feed-forward neural network.
   a. Create a basic network
   b. Analyze performance by varying the batch size, number of hidden layers, learning
   rate.
   c. Create a confusion matrix to validate the performance of your model.
   d. Visualize a neural network.
2. Solve XOR problem using Multi Layer Perceptron
3. Implement a Recurrent Neural Networks (RNN) and process any sequential data such as
   characters, words or video frames.
4. Implement RNN with Long Short Term Networks (LTSM).
5. Create Neural Network models using tensorflow and keras.
6. Implement text classifier using RNN.
7. Implement image classifier using CNN.
8. Develop a code to design object detection and classification for traffic analysis using CNN.
9. Implement image augmentation using deep RBM.

10. Implement Sentiment Analysis using LSTM.
11. Surveillance Video Analytics for Compliance & Quality Monitoring (Mini Project)

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the basics of deep neural networks.

CO2: Describe advanced deep learning models.
CO3: Understand and Implement CNN and RNN architectures of deep neural networks.
CO4: Learn autoencoders in neural networks.
CO5: Apply deep generative models to solve real world problems.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning'', MIT Press, 2016.

REFERENCES:

1. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook'', Springer International Publishing, 2018.
2. Yoav Goldberg, ``Neural Network Methods for Natural Language Processing'', Synthesis

   Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.
3. Francois Chollet, ``Deep Learning with Python'', Manning Publications Co, 2018.
4. Josh Patterson, Adam Gibson, ``Deep Learning: A Practitioner's Approach'', O'Reilly Media, 2017.
5. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.

SOFTWARE REQUIREMENTS:
Matlab, Python