R.M.K. COLLEGE OF ENGINEERING AND TECHNOLOGY

[An Autonomous Institution]

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

B.E. COMPUTER SCIENCE AND ENGINEERING

REGULATIONS - 2021

CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Graduates of Computer Science and Engineering Program will

1. Become globally competent professional in all spheres and pursue higher education world over.
2. Successfully carry forward domain knowledge in computing and allied areas to solve complex real world engineering problems.
3. Continuously upgrade their technical knowledge and expertise to keep pace with the technological revolution.
4. Serve the humanity with social responsibility combined with ethics.

PROGRAMME OUTCOMES (POs)

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

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

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

PO4. Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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

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

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

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

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

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

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

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

PEO / PO Mapping

The B.E. Computer Science and Engineering Program outcomes leading to the achievement of the objectives are summarized in the following Table.

Programme Educational Objectives (PEOs)	***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	✓	✓	✓	✓	✓	✓				✓		✓
II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
III	✓	✓	✓	✓	✓						✓	
IV						✓	✓	✓	✓		✓	

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	✓	✓				✓	✓					✓
		Problem Solving and C Programming	✓	✓	✓						✓			✓
		Basic Electrical , Electronics and Measurement Engineering	✓	✓	✓									
		Physics & Chemistry Laboratory	✓	✓			✓				✓			✓
		C Programming Laboratory	✓	✓	✓						✓			✓
		Interpersonal Skills - Listening & Speaking Laboratory									✓	✓		✓
	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 and Writing Laboratory									✓	✓		✓

YEAR II	**SEMESTER 3**	Discrete Mathematics	✓	✓	✓	✓									
		Digital Principles and Systems Design (Lab Integrated)	✓	✓	✓			✓		✓	✓	✓			✓
		Database Management Systems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Object Oriented Programming	✓	✓	✓										
		Software Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Universal Human Values-II: Understanding Harmony													
		Database Management Systems Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Object Oriented Programming Laboratory	✓	✓	✓					✓	✓	✓			✓
		Aptitude and Coding Skills - I	✓	✓							✓	✓			
		Mini Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SEMESTER 4	Probability and Statistics	✓	✓	✓	✓					✓	✓			✓
		Computer Architecture	✓	✓	✓	✓	✓				✓				✓
		Design and Analysis of Algorithms	✓	✓	✓	✓	✓				✓				✓
		Internet Programming	✓	✓	✓		✓			✓	✓	✓			✓
		Microprocessors and Interfacing (Lab Integrated)	✓	✓	✓					✓	✓	✓			✓
		Operating Systems	✓	✓	✓	✓	✓				✓				✓
		Internet Programming Laboratory	✓	✓	✓		✓			✓	✓	✓			✓
		Operating System Laboratory	✓	✓	✓					✓	✓	✓			✓
		Aptitude and Coding Skills - II	✓	✓							✓	✓			
		Internship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
YEAR III	**SEMESTER 5**	Artificial Intelligence	✓	✓	✓										
		Computer Networks	✓	✓	✓	✓	✓				✓				✓
		Theory of Computation	✓	✓	✓										
		Open Elective I*													
		Professional Elective I													

		Artificial Intelligence Laboratory	✓	✓	✓		✓			✓	✓	✓		✓
		Networks Laboratory	✓	✓	✓					✓	✓	✓		✓
		Advanced Aptitude and Coding Skills – I	✓	✓	✓						✓	✓		
		Mini Project and Design Thinking Practices Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SEMESTER 6	Compiler Design (Lab integrated)	✓	✓	✓					✓	✓	✓		✓
		Cryptography and Network Security	✓	✓	✓									
		Machine Learning	✓	✓	✓		✓							
		Professional Elective II												
		Professional Elective III												
		Security Laboratory	✓	✓	✓					✓	✓	✓		✓
		Advanced Aptitude and Coding Skills - II	✓	✓	✓						✓	✓		
		Internship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
YEAR IV	**SEMESTER 7**	Data Analytics (Lab Integrated)	✓	✓	✓	✓				✓	✓	✓		✓
		Open Elective II*												
		Professional Elective IV												
		Professional Elective V												
		Professional Elective VI												
	SEMESTER 8	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

PROFESSIONAL ELECTIVE														
YEAR	**SEMESTER**	**COURSE NAME**	**Programme Outcome (PO)**											
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
YEAR	**SEMES**	Cyber Physical Systems	✓	✓	✓									
		Web Security	✓	✓	✓					✓				

		Vulnerability Analysis and Penetration Testing	✓	✓	✓					✓				
		Natural Language Processing	✓	✓	✓		✓	✓						
		Image Processing	✓	✓	✓									
		Computer Vision	✓	✓	✓									
		Software Project Management	✓	✓	✓			✓		✓	✓	✓	✓	✓
		Human Computer Interaction	✓	✓	✓									
		Agile Methodologies	✓	✓	✓									
		Software Quality Assurance	✓	✓	✓								✓	
		Social Network Analysis	✓	✓	✓	✓		✓						
		Semantic Web	✓	✓	✓									
		High Performance Computing	✓	✓	✓									
		Multicore Architecture and Programming	✓	✓	✓									
		Internet of Things	✓	✓	✓				✓		✓			
		Embedded Systems	✓	✓	✓									
		Parallel Programming	✓	✓	✓									
		Introduction to Innovation, IP Management and Entrepreneurship	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
		Data Science Fundamentals						✓	✓	✓	✓	✓	✓	✓
		Professional Ethics in Engineering	✓	✓	✓								✓	
		Principles of Management						✓		✓				✓
		Essence of Indian Traditional Knowledge						✓		✓				✓
		Google Cloud: Architecting with Google Compute Engine	✓	✓	✓			✓		✓	✓	✓	✓	✓
		Google Cloud Computing Foundation	✓	✓	✓			✓		✓	✓	✓	✓	✓
		Object Oriented Analysis and Design (Lab Integrated)	✓	✓	✓		✓	✓		✓	✓	✓		✓

		Mobile Computing (Lab Integrated)	✓	✓	✓					✓	✓	✓		✓
YEAR IV	**SEMESTER 7**	Cyber Forensics	✓	✓	✓					✓				
		Blockchain Technologies	✓	✓	✓		✓							
		Quantum Computing	✓	✓	✓									
		Bigdata and Cloud Databases	✓	✓	✓		✓							
		Deep Learning Techniques	✓	✓	✓		✓	✓						
		Pattern Recognition	✓	✓	✓									
		Computational Intelligence	✓	✓	✓									
		Intelligent Agent Technology	✓	✓	✓									
		Knowledge Engineering	✓	✓	✓									
		Service Oriented Architecture	✓	✓	✓									
		Resource Management Techniques	✓	✓	✓								✓	
		Image and Video Analytics	✓	✓	✓	✓		✓						
		Nature Inspired Computing Techniques	✓	✓	✓									
		Game Theory and Programming	✓	✓	✓									
		Intelligent Robots	✓	✓	✓									
		Wireless Sensor Networks	✓	✓	✓									
		UAV and Drone Technology	✓	✓	✓									
		Soft Computing	✓	✓	✓	✓								
		UI/UX Design	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Operational and Supply Chain Management	✓	✓	✓					✓	✓	✓	✓	✓
		Lean Six Sigma	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Indian Constitution						✓		✓				✓
		Cloud Computing (Lab Integrated)	✓	✓	✓					✓	✓	✓		✓

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B.E. COMPUTER SCIENCE AND ENGINEERING

REGULATIONS - 2021
CHOICE BASED CREDIT SYSTEM

I - VIII SEMESTERS CURRICULA & SYLLABI

SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21EL101	Communicative English & Life Skills	HS	2	2	0	0	2
2.	21MA101	Engineering Mathematics - I	BS	5	3	2	0	4
3.	21PH101	Physics for Computer Science and Information Technology	BS	3	3	0	0	3
4.	21CH101	Engineering Chemistry	BS	3	3	0	0	3
5.	21CS101	Problem Solving and C Programming	ES	3	3	0	0	3
6.	21GE101	Basic Electrical, Electronics and Measurement Engineering	ES	3	3	0	0	3
PRACTICALS								
7.	21PC111	Physics & Chemistry Laboratory	BS	4	0	0	4	2
8.	21CS111	C Programming Laboratory	ES	4	0	0	4	2
9.	21EL111	Interpersonal Skills (Listening & Speaking)	HS	2	0	0	2	1
			TOTAL	**29**	**17**	**2**	**10**	**23**

SEMESTER II

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21EL201	Technical English	HS	2	2	0	0	2
2.	21MA201	Engineering Mathematics - II	BS	5	3	2	0	4
3.	21CH102	Environmental Science and Engineering	HS	3	3	0	0	3
4.	21ME101	Computer Aided Engineering Graphics	ES	6	2	0	4	4
5.	21CS201	Data Structures	PC	3	3	0	0	3
6.	21CS202	Python Programming (Lab Integrated)	ES	5	3	0	2	4
PRACTICALS								
7.	21EM111	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	21CS211	Data Structures Laboratory	PC	4	0	0	4	2
9.	21EL211	Advanced Reading and Writing	HS	2	0	0	2	1
			TOTAL	**34**	**16**	**2**	**16**	**25**

SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21MA301	Discrete Mathematics	BS	5	3	2	0	4
2.	21CS301	Digital Principles and Systems Design (Lab Integrated)	ES	5	3	0	2	4
3.	21CS302	Object Oriented Programming	PC	3	3	0	0	3
4.	21CS303	Software Engineering	PC	3	3	0	0	3
5.	21CS304	Database Management Systems	PC	3	3	0	0	3
6.	21EL301	Universal Human Values 2:	HS	4	2	2	0	3

		Understanding Harmony						
PRACTICALS								
7.	21CS311	Object Oriented Programming Laboratory	PC	4	0	0	4	2
8.	21CS312	Database Management Systems Laboratory	PC	4	0	0	4	2
9.	21CS313	Mini Project	EEC	2	0	0	2	1
10.	21CS314	Aptitude and Coding Skills - I	EEC	2	0	0	2	1
			TOTAL	**35**	**17**	**4**	**14**	**26**

SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21MA401	Probability and Statistics	BS	5	3	2	0	4
2.	21CS401	Computer Architecture	PC	3	3	0	0	3
3.	21CS402	Design and Analysis of Algorithms	PC	4	2	2	0	3
4.	21CS403	Internet Programming	PC	3	3	0	0	3
5.	21CS404	Operating Systems	PC	3	3	0	0	3
6.	21CS405	Microprocessors and Interfacing (Lab Integrated)	PC	5	3	0	2	4
PRACTICALS								
7.	21CS411	Internet Programming Laboratory	PC	4	0	0	4	2
8.	21CS412	Operating System Laboratory	PC	4	0	0	4	2
9.	21CS413	Internship	EEC	-	-	-	-	1
10.	21CS414	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.	21CS501	Computer Networks	PC	3	3	0	0	3
2.	21CS502	Theory of Computation	PC	3	3	0	0	3
3.	21AI401	Artificial Intelligence	PC	3	3	0	0	3
4.		Open Elective I*	OE	3	3	0	0	3
5.		Professional Elective I	PE	3	3	0	0	3
PRACTICALS								
6.	21CS511	Networks Laboratory	PC	4	0	0	4	2
7.	21AI411	Artificial Intelligence Laboratory	PC	4	0	0	4	2
8.	21CS512	Advanced Aptitude and Coding Skills - I	EEC	2	0	0	2	1
9.	21CS513	Mini Project and Design Thinking Practices Laboratory	EEC	2	0	0	2	1
			TOTAL	**27**	**15**	**0**	**12**	**21**

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21CS601	Compiler Design (Lab integrated)	PC	4	2	0	2	3
2.	21CS602	Cryptography and Network Security	PC	3	3	0	0	3
3.	21AI502	Machine Learning	PC	3	3	0	0	3
4.		Professional Elective II	PE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
PRACTICALS								
6.	21CS611	Security Laboratory	PC	4	0	0	4	2

7.	21CS612	Internship	EEC	-	-	-	-	1
8.	21CS613	Advanced Aptitude and Coding Skills-II	EEC	2	0	0	2	1
			TOTAL	**22**	**14**	**0**	**8**	**19**

SEMESTER VII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21CS701	Data Analytics (Lab Integrated)	PC	4	2	0	2	3
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	3	3	0	0	3
			TOTAL	**16**	**14**	**0**	**2**	**15**

SEMESTER VIII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	21CS812	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)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21EL101	Communicative English & Life Skills	HS	2	2	0	0	2
2.	21EL111	Interpersonal Skills (Listening & Speaking)	HS	2	0	0	2	1
3.	21EL201	Technical English	HS	2	2	0	0	2
4.	21EL211	Advanced Reading and Writing	HS	2	0	0	2	1
5.	21CH102	Environmental Science and Engineering	MC	3	3	0	0	3

6.	21EL301	Universal Human Values 2: Understanding Harmony	MC	3	2	2	0	3

BASIC SCIENCES (BS)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21MA101	Engineering Mathematics - I	BS	5	3	2	0	4
2.	21PH101	Physics for Computer Science and Information Technology	BS	3	3	0	0	3
3.	21CH101	Engineering Chemistry	BS	3	3	0	0	3
4.	21PC111	Physics & Chemistry Laboratory	BS	4	0	0	4	2
5.	21MA201	Engineering Mathematics - II	BS	5	3	2	0	4
6.	21MA301	Discrete Mathematics	BS	5	3	2	0	4
7.	21MA401	Probability and Statistics	BS	5	3	2	0	4

ENGINEERING SCIENCES (ES)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21CS101	Problem Solving and C Programming	ES	3	3	0	0	3
2.	21GE101	Basic Electrical, Electronics and Measurement Engineering	ES	3	3	0	0	3
3.	21CS111	C Programming Laboratory	ES	4	0	0	4	2
4.	21ME101	Computer Aided Engineering Graphics	ES	6	2	0	4	4
5.	21CS202	Python Programming (Lab Integrated)	ES	5	3	0	2	4
6.	21EM111	Engineering Practices Laboratory	ES	4	0	0	4	2
7.	21CS301	Digital Principles and Systems Design (Lab Integrated)	ES	5	3	0	2	4

PROFESSIONAL CORE (PC)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21CS201	Data Structures	PC	3	3	0	0	3

2.	21CS211	Data Structures Laboratory	PC	4	0	0	4	2
3.	21CS302	Object Oriented Programming	PC	3	3	0	0	3
4.	21CS303	Software Engineering	PC	3	3	0	0	3
5.	21CS304	Database Management Systems	PC	3	3	0	0	3
6.	21CS311	Object Oriented Programming Laboratory	PC	4	0	0	4	2
7.	21CS312	Database Management Systems Laboratory	PC	4	0	0	4	2
8.	21CS401	Computer Architecture	PC	3	3	0	0	3
9.	21CS402	Design and Analysis of Algorithms	PC	4	2	2	0	3
10.	21CS403	Internet Programming	PC	3	3	0	0	3
11.	21CS404	Operating Systems	PC	3	3	0	0	3
12.	21CS405	Microprocessors and Interfacing (Lab Integrated)	PC	5	3	0	2	4
13.	21CS411	Internet Programming Laboratory	PC	4	0	0	4	2
14.	21CS412	Operating System Laboratory	PC	4	0	0	4	2
15.	21CS501	Computer Networks	PC	3	3	0	0	3
16.	21CS502	Theory of Computation	PC	3	3	0	0	3
17.	21AI401	Artificial Intelligence	PC	3	3	0	0	3
18.	21CS511	Networks Laboratory	PC	4	0	0	4	2
19.	21AI411	Artificial Intelligence Laboratory	PC	4	0	0	4	2
20.	21CS601	Compiler Design (Lab integrated)	PC	5	3	0	2	4
21.	21CS602	Cryptography and Network Security	PC	3	3	0	0	3
22.	21AI502	Machine Learning	PC	3	3	0	0	3
23.	21CS611	Security Laboratory	PC	4	0	0	4	2
24.	21CS701	Data Analytics (Lab Integrated)	PC	4	2	0	2	3

PROFESSIONAL ELECTIVES (PE)

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

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21CS901	Cyber Physical Systems	PE	3	3	0	0	3
2.	21CS902	Web Security	PE	3	3	0	0	3
3.	21CS903	Vulnerability Analysis and Penetration Testing	PE	3	3	0	0	3
4.	21AI702	Natural Language Processing	PE	3	3	0	0	3
5.	21CS904	Image Processing	PE	3	3	0	0	3
6.	21CS905	Computer Vision	PE	3	3	0	0	3
7.	21CS906	Software Project Management	PE	3	3	0	0	3
8.	21CS907	Human Computer Interaction	PE	3	3	0	0	3
9.	21CS908	Agile Methodologies	PE	3	3	0	0	3
10.	21CS909	Software Quality Assurance	PE	3	3	0	0	3
11.	21CS910	Social Network Analysis	PE	3	3	0	0	3
12.	21CS911	Semantic Web	PE	3	3	0	0	3
13.	21CS912	High Performance Computing	PE	3	3	0	0	3
14.	21CS913	Multicore Architecture and Programming	PE	3	3	0	0	3
15.	21CS914	Internet of Things	PE	3	3	0	0	3
16.	21CS915	Embedded Systems	PE	3	3	0	0	3
17.	21CS916	Parallel Programming	PE	3	3	0	0	3
18.	21CS917	Introduction to Innovation, IP Management and Entrepreneurship	PE	3	3	0	0	3
19.	21CS918	Data Science Fundamentals	PE	3	3	0	0	3
20.	21CS938	Professional Ethics in Engineering	PE	3	3	0	0	3
21.	21CS939	Principles of Management	PE	3	3	0	0	3
22.	21CS940	Essence of Indian Traditional Knowledge	PE	3	3	0	0	3

23.	21CS919	Google Cloud: Architecting with Google Compute Engine	PE	3	3	0	0	3
24.	21CS932	Google Cloud Computing Foundations	PE	3	3	0	0	3
25.	21CS933	Object Oriented Analysis and Design (Lab Integrated)	PE	4	2	0	2	3
26.	21CS934	Mobile Computing (Lab Integrated)	PE	4	2	0	2	3

PROFESSIONAL ELECTIVES (PE)

SEMESTER VII – PROFESSIONAL ELECTIVE – IV / V /VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21CS920	Cyber Forensics	PE	3	3	0	0	3
2.	21CS921	Blockchain Technologies	PE	3	3	0	0	3
3.	21CS922	Quantum Computing	PE	3	3	0	0	3
4.	21AI909	Bigdata and Cloud Databases	PE	3	3	0	0	3
5.	21CS936	Deep Learning Techniques	PE	3	3	0	0	3
6.	21AI912	Pattern Recognition	PE	3	3	0	0	3
7.	21AI918	Computational Intelligence	PE	3	3	0	0	3
8.	21AI916	Intelligent Agent Technology	PE	3	3	0	0	3
9.	21CS937	Knowledge Engineering	PE	3	3	0	0	3
10.	21CS923	Service Oriented Architecture	PE	3	3	0	0	3
11.	21CS924	Resource Management Techniques	PE	3	3	0	0	3
12.	21AI914	Image and Video Analytics	PE	3	3	0	0	3
13.	21CS925	Nature Inspired Computing Techniques	PE	3	3	0	0	3
14.	21CS926	Game Theory and Programming	PE	3	3	0	0	3
15.	21AI917	Intelligent Robots	PE	3	3	0	0	3
16.	21CS927	Wireless Sensor Networks	PE	3	3	0	0	3

17.	21CS928	UAV and Drone Technology	PE	3	3	0	0	3
18.	21AI911	Soft Computing	PE	3	3	0	0	3
19.	21CS929	UI/UX Design	PE	3	3	0	0	3
20.	21CS930	Operational and Supply Chain Management	PE	3	3	0	0	3
21.	21CS931	Lean Six Sigma	PE	3	3	0	0	3
22.	21CS941	Indian Constitution	PE	3	3	0	0	3
23.	21CS934	Cloud Computing (Lab Integrated)	PE	4	2	0	2	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21CS312	Mini Project	EEC	2	0	0	2	1
2.	21CS314	Aptitude and Coding Skills - I	EEC	2	0	0	2	1
3.	21CS413	Internship	EEC	-	-	-	-	1
4.	21CS414	Aptitude and Coding Skills - II	EEC	2	0	0	2	1
5.	21CS512	Advanced Aptitude and Coding Skills - I	EEC	2	0	0	2	1
6.	21CS513	Mini Project and Design Thinking Practices Lab	EEC	2	0	0	2	1
7.	21CS612	Internship	EEC	-	-	-	-	1
8.	21CS613	Advanced Aptitude and Coding Skills - II	EEC	2	0	0	2	1
9.	21CS812	Project Work	EEC	16	0	0	16	8

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						**6**	**3.68%**
2.	**BS**	12	4	4	4					**24**	**14.72%**
3.	**ES**	8	10	4						**22**	**13.50%**
4.	**PC**		5	13	20	13	11			**62**	**38.04%**
5.	**PE**					3	6	9		**18**	**11.04%**
6.	**OE**					3		3		**6**	**3.68%**
7.	**EEC**			2	2	2	2	1	10	**19**	**11.66%**
8.	**MC**										
	TOTAL	**23**	**25**	**26**	**26**	**21**	**19**	**13**	**10**	**163**	
9.	**Non Credit/ Mandatory**										

R2021 (2021-22)

CURRICULUM OF B.E (HONOURS) IN COMPUTER SCIENCE AND ENGINEERING
WITH SPECIALIZATION IN
CYBER SECURITY / ARTIFICIAL INTELLIGENCE / DATA SCIENCE

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
CYBER SECURITY								
1.	21CS901	Cyber Physical Systems		3	3	0	0	3
2.	21CS902	Web Security		3	3	0	0	3
3.	21CS903	Vulnerability Analysis and Penetration Testing		3	3	0	0	3
4.	21CS920	Cyber Forensics		3	3	0	0	3
5.	21CS921	Blockchain Technologies		3	3	0	0	3
6.	21CS813	Capstone Project		12	0	0	12	6
ARTIFICIAL INTELLIGENCE								
1.	21AI702	Natural Language Processing		3	3	0	0	3
2.	21CS925	Nature Inspired Computing Techniques		3	3	0	0	3
3.	21CS936	Deep Learning Techniques		3	3	0	0	3

4.	21AI918	Computational Intelligence		3	3	0	0	3
5.	21CS937	Knowledge Engineering		3	3	0	0	3
6.	21AI903	Reinforcement Learning		3	3	0	0	3
7.	21CS813	Capstone Project		12	0	0	12	6
DATA SCIENCE								
1.	21CS918	Data Science Fundamentals		3	3	0	0	3
2.	21AI909	Bigdata and Cloud Databases		3	3	0	0	3
3.	21AI914	Image and Video Analytics		3	3	0	0	3
4.	21CS910	Social Network Analysis		3	3	0	0	3
5.	21AI912	Pattern Recognition		3	3	0	0	3
6.	21CS905	Computer Vision		3	3	0	0	3
7.	21CS813	Capstone Project		12	0	0	12	6

R2021 (2021-22)

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

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

R2021 (2021-22)

B.E. CSE WITH MINOR DEGREE

Sl. No.	Name of the Minor Degree	Offering Department
1.	IoT	ECE

R2021 (2021-22)
MINOR DEGREE CURRICULUM OFFERED BY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(FOR OTHER B.E. / B.TECH PROGRAMMES)

MINOR'S DEGREE IN CYBER SECURITY

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
CYBER SECURITY								
1.	21CS602	Cryptography and Network Security		3	3	0	0	3
2.	21CS901	Cyber Physical Systems		3	3	0	0	3
3.	21CS920	Cyber Forensics		3	3	0	0	3
4.	21CS921	Blockchain Technologies		3	3	0	0	3
5.	21CS813	Capstone Project		4	2	0	2	3

SEMESTER I

21EL101	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	6

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	6

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	6

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	6

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	6

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.

21MA101	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.

21PH101	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 -Antiferromagnetism- 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.

21CH101	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 nano chemistry 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.

21CS101	PROBLEM SOLVING AND C PROGRAMMING	L	T	P	C
		3	0	0	3

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.

21GE101	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.

21PC111	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 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.

21PC111	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.

21CS111	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.

21EL111	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

21EL201	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.

21MA201	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.

21CH102	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.

21ME101	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.

21CS201	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.

21CS202	**PYTHON PROGRAMMING (LAB INTEGRATED)**	**L**	**T**	**P**	**C**
		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 Programs‖, 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 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

21EM111	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 *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.
i.Capacitor – Measurement of capacitance using identification code, LCR meter
i.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)
i.Measurement of amplitude, frequency, peak-peak, RMS, period, DC level of sine, square and triangle waveform using CRO and DSO.
i.Measurement of DC voltage and current using analog and digital meters

3. Study of Electronic accessories:

i.Circuit connection using Breadboard and wires.
i.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

21CS211	DATA STRUCTURES LABORATORY	L	T	P	C
		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.

21EL211	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

21MA301	DISCRETE MATHEMATICS	L	T	P	C
		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: Dmonstrate 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 BOOK:

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.

21CS301	DIGITAL PRINCIPLES AND SYSTEM DESIGN (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To design and implement digital circuits using simplified Boolean functions
- To analyze, design and implement combinational circuits
- To analyze, design and implement synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To develop HDL code for combinational and sequential circuits

UNIT I	BOOLEAN ALGEBRA AND LOGIC GATES	9 + 6 = 15

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 LOGIC	9 + 6 = 15

Combinational Circuits – Analysis and Design Procedures - Binary Adder-Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders – Encoders – Multiplexers - Introduction to HDL – HDL Models of Combinational circuits.

UNIT III	SYNCHRONOUS SEQUENTIAL LOGIC	9 + 6 = 15

Sequential Circuits - Storage Elements: Latches, Flip-Flops - Analysis of Clocked Sequential Circuits - State Reduction and Assignment - Design Procedure - Registers and Counters - HDL Models of Sequential Circuits.

UNIT IV	ASYNCHRONOUS SEQUENTIAL LOGIC	9 + 6 = 15

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

UNIT V	MEMORY AND PROGRAMMABLE LOGIC	9 + 6 = 15

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

LIST OF EXERCISES:

1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for code converters.
3. Design and implement Half/Full Adder and Subtractor.
4. Design and implement combinational circuits using MSI devices:
   - 4 – bit binary adder / subtractor
   - Application using multiplexers
5. Design and implement shift-registers.
6. Design and implement synchronous counters.
7. Coding combinational circuits using HDL.
9. Coding sequential circuits using HDL.

TOTAL: 45 +30 = 75 PERIODS

OUTCOMES:

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

CO1: Design and implement digital circuits using simplified Boolean functions
CO2: Analyze, design and implement combinational circuits
CO3: Analyze, design and implement synchronous and asynchronous sequential circuits
CO4: Understand Programmable Logic Devices
CO5: Develop HDL code for combinational and sequential circuits

TEXT BOOK:

1. M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson Education, 2018.

REFERENCES:

1. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.
2. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Seventh Edition, CENGAGE Learning, 2014
3. G. K. Kharate, Digital Electronics, Oxford University Press, 2010
4. Donald D. Givone, "Digital Principles and Design", Tata Mc Graw Hill, 2007.

21CS302	OBJECT ORIENTED PROGRAMMING (Common to CSE and AI&DS)	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, Dreamtech press, 2011.
4. Timothy Budd, Understanding Object-oriented programming with Java, Third Edition, Pearson Education, 2008.

21CS303	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain software engineering principles and activities involved in building large software programs

- To describe the process of requirements gathering and analysis
- To illustrate the design process.
- To analyse the various testing methods
- To apply estimation techniques, schedule project activities and compute pricing.

UNIT I	PRODUCT AND PROCESS	9

The Nature of Software – Defining the Discipline – The Software Process – Process models – Prescriptive Process Models – Product and Process – Agility and Process – Agile Process - Scrum – Other Agile Frameworks

UNIT II	REQUIREMENTS AND ANALYSIS	9

Requirements Engineering – Establishing the Groundwork: Non-functional Requirements – Requirements Gathering – Developing Use Cases – Negotiating and Validating Requirements. Requirements Analysis – Overall Objectives and Philosophy – Analysis Rules of Thumb – Requirements Modelling Principles. Classical Analysis: Structured system analysis; Petri Nets.

UNIT III	DESIGN PROCESS	9

Design Process – Design Concepts – Design Model: Design Principles and Design Elements. Architectural Design – Conducting Component Level Design – Designing traditional components - User Interface Analysis and Design – Pattern-Based Software Design.

UNIT IV	SOFTWARE TESTING	9

Component Level: A Strategic Approach to Software Testing – Test Case Design - White-Box Testing – Black Box Testing Integration Level: Integration Testing – AI and Regression Testing – Validation Testing - Security Testing – Performance Testing – Real time Testing – Testing AI Systems – Testing Virtual Environments.

UNIT V	SOFTWARE QUALITY AND PROJECT MANAGAMENT	9

Software Metrics and Analytics: Software Measurement – Product Metrics. Creating a Viable Software Plan: The Project Planning Process – Software Scope and Feasibility – Decomposition and Estimation Techniques – Project Scheduling. Risk Management: Reactive Versus Proactive Risk Strategies – Risk Identification – Risk Projection – The RMMM Plan. Software Process Improvement: The SPI Process – The CMMI

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Summarize software engineering principles and activities involved in building large software programs

CO2: Describe the process of requirements gathering and analysis

CO3: Illustrate the design process.

CO4: Analyze the various testing methods

CO5: Apply estimation techniques, schedule project activities and compute pricing.

TEXT BOOK:

1. Roger S. Pressman, “Software Engineering: A Practitioner‘s Approach” , McGraw Hill International Edition, Nineth Edition, 2020.

REFERENCES:

1. Ian Sommerville, “Software Engineering”, Tenth Edition, Pearson Education, 2016.

2. Ivar Jacobson, Harold Bud Lawson, Pan-Wei Ng, Paul E. McMahon, Michael Goedicke, “The Essentials of Modern Software Engineering”, Morgan & Claypool Publishers, 2019.

3. Rajib Mall, “Fundamentals of Software Engineering”, PHI Learning Private Limited, Fourth Edition,2014.

4. Karl Wiegers,"Software Requirements - Best Practices”, Microsoft Press US, 3rd Edition, 2013.

5. David P. Voorhees, "Guide to Efficient Software Design: An MVC Approach to Concepts, Structures, and Models", Springer; 1st ed, 2020.

6. Gerard O'Regan, "Concise Guide to Software Testing”, 1st ed, Springer, 2019.

7. Duane Petersen, "Transforming Project Management: An Essential Paradigm for Turning Your Strategic Planning into Action”, McGraw-Hill Education, 1st edition, 2021.

21CS304	DATABASE MANAGEMENT SYSTEMS (Common to CSE and AI&DS)	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 De-normalization

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: Analyse 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.

21EL301	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 ", Srishti Publishers & Distributors, New Delhi, Sixth Edition 2013.
8. Heaton, Dennis P. "The story of stuff." (2010): 553-556.
9. Gandhi, Mohandas Karamchand, "The story of my experiments with truth: An autobiography", Om Books International, 2018.
10. Andrews, Cecile, "Slow is beautiful: new visions of community, leisure, and joie de vivre", New society publishers, 2006.
11. Kumarappa, Joseph Cornelius, "The economy of permanence. CP", All India Village Industries Assn., 1946.
12. Vivekananda-Romain Rolland (English)
13. Gandhi-Romain Rolland (English)

21CS311	OBJECT ORIENTED PROGRAMMING LABORATORY (Common to CSE and AI&DS)	L	T	P	C
		0	0	4	2

OBJECTIVES:

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

LIST OF EXERCISES:

1. Develop a Java application to generate Electricity bill. You must use one super class called EB Bill and must have two sub classes namely Domestic Bill and Commercial 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: (Use Methods for implementing these in a Class)

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 N^{th} 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 and built-in classes. 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

i.Insert – add at particular index

i.Search

.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.

TOTAL: 60 PERIODS

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

20CS312	DATABASE MANAGEMENT SYSTEMS LABORATORY (Common to CSE and AI&DS)	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
d) Property 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 settings

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.

21CS314	APTITUDE AND CODING SKILLS – I (Common to All Branches)	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

21MA401	PROBABILITY AND STATISTICS (Common to CSE and AI&DS)	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 (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 the 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.

21CS401	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe the basic principles and operations of digital computers.
- To design arithmetic and logic unit for various fixed and floating point operations
- To construct pipeline architectures for RISC processors.
- To explain various memory systems & I/O interfacings
- To discuss parallel processor and multi-processor architectures

UNIT I	COMPUTER FUNDAMENTALS	9

Computer Types - Functional Units — Basic Operational Concepts — Number Representation and Arithmetic Operations - Performance Measurement — Instruction Set Architecture - Memory Locations and Addresses - Instructions and Instruction Sequencing - Addressing Modes.

UNIT II	COMPUTER ARITHMETIC	9

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

UNIT III	BASIC PROCESSING UNIT AND PIPELINING	10

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

UNIT IV	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 - Memory Management Requirements - Secondary Storage.

UNIT V	PARALLEL PROCESSING AND MULTICORE COMPUTERS	9

Parallel Processing: Use of Multiple Processors - Symmetric Multiprocessors - Cache Coherence - Multithreading and Chip Multiprocessors - Clusters - Nonuniform Memory Access Computers - Vector Computation - Multicore Organization.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Explain the basic principles and operations of digital computers.
CO2: Design Arithmetic and Logic Unit to perform fixed and floating point operations
CO3: Develop pipeline architectures for RISC Processors.
CO4: Summarize Various Memory systems & I/O interfacings.
CO5: Recognize Parallel Processor and Multi Processor Architectures

TEXT BOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer organization, Tata McGraw Hill, Sixth edition, 2012.
2. David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface 5th edition, Morgan Kaufmann, 2013.

REFERENCES:

1. John P.Hayes, Computer Architecture and Organization, Third Edition, TataMcGraw Hill, 2012.
2. David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface, 6th edition, Morgan Kaufmann, 2021.
3. John L. Hennessy and David A. Patterson, Computer Architecture – A Quantitate Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition,2012.

21CS402	DESIGN AND ANALYSIS OF ALGORITHMS (Common to CSE and AI&DS)	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To critically analyse the efficiency of alternative algorithmic solutions for the same problem

- To illustrate brute force and divide and conquer design techniques.
- To explain dynamic programming and greedy technique for solving various problems.
- To apply iterative improvement technique to solve optimization problems
- To examine the limitations of algorithmic power and handling it in different problems.

UNIT I	INTRODUCTION	8+3

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+3

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+3

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+3

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+3

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+15=60 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: Analyse the efficiency of brute force, divide and conquer, decrease and conquer, Transform and conquer algorithmic techniques

CO3: Implement and analyse the problems using dynamic programming and greedy technique algorithmic techniques.

CO4: Solve the problems using iterative improvement technique for optimization.

CO5: Compute the limitations of algorithmic power and solve the problems using backtracking and branch and bound technique.

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.
4. http://nptel.ac.in/

21CS403	INTERNET PROGRAMMING	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	WEBSITE 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 – Inheritance – 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- DHTML with JavaScript- JSON introduction – Syntax – 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- Program control- 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 – Introduction to Java Web Development Frameworks.

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. Uttam K.Roy, "Web Technologies", Oxford University Press, 2011.
5. Nicholas S. Williams, Professional Java for Web Applications, Wrox Publisher, First Edition, 2014.

21CS404	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the basic concepts of operating systems and process.
- To discuss threads and analyse various CPU scheduling algorithms.
- To describe the concept of process synchronization and deadlocks.
- To analyse various memory management schemes.
- To describe I/O management and file systems.

UNIT I	INTRODUCTION TO OPERATING SYSTEMS AND PROCESSES	9

Introduction to OS –Computer system organization - architecture – Resource management - Protection and Security – Virtualization - Operating System Structures - Services - User and Operating-System Interface - System Calls - System Services -Design and Implementation - Building and Booting an Operating System - Process Concept - Process Scheduling - Operations on Processes – Inter process Communication - IPC in Shared-Memory Systems - IPC in Message-Passing Systems

UNIT II	THREADS AND CPU SCHEDULING	9

Threads & Concurrency: Overview - Multicore Programming - Multithreading Models - Thread Libraries - Implicit Threading - Threading Issues - CPU Scheduling: Basic Concepts - Scheduling

Criteria - Scheduling Algorithms - Thread Scheduling - Multi-Processor Scheduling - Real-Time CPU Scheduling

UNIT III	PROCESS SYNCHRONISATION AND DEADLOCKS	9

Process Synchronization - The critical-section problem, Peterson's Solution - Synchronization hardware, Mutex locks, Semaphores, monitors, Liveness - Classic problems of synchronization – Bounded Buffer Problem - Reader's & Writer Problem, Dinning Philosopher Problem, Barber's shop problem. Deadlock - System model - Deadlock characterization, Methods for handling deadlocks - Deadlock prevention - Deadlock avoidance - Deadlock detection - Recovery from deadlock.

UNIT IV	MEMORY MANAGEMENT	9

Memory Management: Contiguous Memory Allocation - Paging - Structure of the Page Table – Swapping - Virtual Memory: Demand Paging – Copy-on write – Page Replacement – Allocation of frames – Thrashing Memory – Compression

UNIT V	FILE MANAGEMENT	9

File Management: File Concept – Access Methods – Directory Structure – Protection - Memory-Mapped File - Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks - I/O Hardware: I/O devices, Device controllers, Direct Memory Access - Case Study-Linux.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Implement the basic concepts of operating systems and process.
CO2: Analyse various CPU scheduling algorithms and thread mechanism.
CO3: Implement the concepts of process synchronization and deadlocks.
CO4: Design various memory management schemes to given situation
CO5: Implement various I/O and file management techniques.

TEXT BOOK:

1. Silberschatz Abraham, Greg Gagne, Peter B. Galvin. "Operating System Concepts", Tenth Edition, Wiley, 2018.

REFERENCES:

1. William Stallings, Operating Systems – Internals and Design Principles, Pearson Education, New Delhi, 2018.
2. Achyut S.Godbole, Atul Kahate, Operating Systems, McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, "Modern Operating System", 4 th Edition, PHI Learning, New Delhi, 2018.

21CS405	MICROPROCESSORS AND INTERFACING (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To acquire knowledge of 8086 microprocessor.
- To summarize the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To explain the Architecture of 8051 microcontroller.
- To demonstrate a microcontroller based system

UNIT I	**8086 MICROPROCESSOR**	**9+6**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming.

UNIT II	**8086 SYSTEM BUS STRUCTURE**	**9+6**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to 8087– Architecture, Instruction set and ALP Programming**.**

UNIT III	**I/O INTERFACING**	**6+6**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller.

UNIT IV	**MICROCONTROLLER**	**9+6**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.

UNIT V	**INTERFACING MICROCONTROLLER**	**9+6**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC Comparison of Microprocessor, Microcontroller, PIC and ARM processors

LIST OF EXPERIMENTS:

8086 Programs

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion and decimal arithmetic.
4. Sorting and searching

8051 Experiments

5. Basic arithmetic and Logical operations
6. Square and Cube program
7. Find 2‘s complement of a number
8. Unpacked BCD to ASCII

Interfacing Experiments of 8086 and 8051

9. Traffic light controller
10. Key board and Display - 8279
11. Programmable Timer - 8253/8254
12. Programmable peripheral Interface - 8255
13. A/D and D/A interface
14. Stepper motor control
15. Serial Communication between two kits

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Acquire knowledge of basic architecture, operation, programming of microprocessor 8086.
CO2: Summarize the design of basic and multiprocessor systems and their bus timings.
CO3: Design the 8086 interfaces with memory, I/O and other peripheral chips.
CO4: Describe the basic architecture and programming of microcontroller 8051.
CO5: Apply programming concepts to implement microcontroller interfaces for different applications.
CO6: Design and construct Microprocessor and Microcontroller based systems.

TEXT BOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson, Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design, 2nd Edition, Pearson, 2015.
2. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, 2nd Edition, Pearson Education, 2011.

REFERENCES:

1. DoughlasV.Hall, Microprocessors and Interfacing, Programming and Hardware, TMH, 2012.Achyut S.Godbole, Atul Kahate, Operating Systems‖, McGraw Hill Education, 2016.
2. A.K.Ray,K.M.Bhurchandi, Advanced Microprocessors and Peripherals 3rd Edition, Tata McGraw Hill, 2012.
3. Barry B Bray, The Intel Microprocessor 8086/8088,80186,80286,80386 and 80486 – Architecture, Programming and Interfacing, 8th Edition, PHI, 2011.
4. Mohamed Rafiquazzaman, Microprocessor and Microcomputer based System Design, 2nd Edition, Universal Book Stall, 1995.

21CS411	INTERNET PROGRAMMING 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.

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.

21CS412	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To practice system calls and shell programming
- To implement various CPU scheduling algorithms
- To build inter process communication deadlock detection and avoidance algorithms.
- To design page replacement and disk scheduling algorithms
- To implement file allocation strategies

LIST OF EXERCISES:

1. Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc.

2. Shell Programming

3. Programs for Unix System Calls.

a. Write a program to fetch the below information; Name of the operating system, Current release level, Current version level, Total usable main memory size, Available memory size, Amount of shared memory, Memory used by buffers, Total swap space size, and Swap space still available.

b. Use system calls to imitate the action of UNIX command "ls" with option -a, and -li command

c. Use system calls to imitate the action of UNIX command "cp" or "dir" with a couple of options

d. Implement process life cycle: Use the system calls fork(), exec(), wait(), waitpid(), exit(0), abort() and kill().

4. Write a program to implement the following actions using pthreads

a) Create a thread in a program and called Parent thread, this parent thread creates another thread (Child thread) to print out the numbers from 1 to 20. The Parent thread waits till the child thread finishes

b) Create a thread in the main program, this program passes the 'count' as an argument to thatthread function and this created thread function has to print your name 'count' times

5. Process Synchronization using Semaphores. A shared data has to be accessed by two categories of processes namely A and B. Satisfy the following constraints to access the data without any data loss.

(i) When a process A1 is accessing the database another process of the same category is permitted.

(ii) When a process B1 is accessing the database neither process A1 nor another process B2 is permitted.

(iii) When a process A1 is accessing the database process B1 should not be allowed to access the database.

Write appropriate code for both A and B satisfying all the above constraints using semaphores.
Note: The time-stamp for accessing is approximately 10 sec.

6. Implementation of IPC using Shared memory

a. Write a UNIX system call program to implement the following shared memory concept

i) In process 1 - Creation a shared memory of size 5 bytes with read/write permission and enter balance amount of Rs 1000.

ii) In process 2 – Add Rs. 200 to your balance. During this modification maintain the atomicity of shared memory using binary semaphore

iii) In process 3 – Subtract Rs. 800 to your balance. During this also modification maintain the atomicity of shared memory using binary semaphore

iv) In process 4 – Display the current balance of shared memory

v) Delete the shared memory

7. Implementation of IPC using message queue

a) Get the input data (integer value) from a process called sender

b) Use Message Queue to transfer this data from sender to receiver process

c) The receiver does the prime number checking on the received data

d) Communicate the verified/status result from receiver to sender process, This status should be displayed in the Sender process.

Note: Simultaneously execute two or more processes. Don’t do it as a single process

8. Write C programs to implement the various CPU Scheduling Algorithms
9. Bankers Algorithm for Deadlock Avoidance
10. Implementation of Memory Allocation Methods for fixed partition
11. Implementation of Paging Technique of Memory Management
12. Implementation of Page Replacement Algorithms

13.Implementation of disk scheduling

14.Implementation of File Allocation Strategies

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Practice system calls and shell programming
CO2: Implement various CPU scheduling algorithms
CO3: Build inter process communication deadlock detection and avoidance algorithms.
CO4: Design page replacement and disk scheduling algorithms
CO5: Implement file allocation strategies

21CS414	APTITUDE AND CODING SKILLS – II (Common to All Branches)	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

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: Apply data structures and algorithms in problem solving.

SEMESTER V

21CS501	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

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

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	11

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

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	8

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

UNIT V	APPLICATION LAYER	8

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

TOTAL: 45 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.

21CS502	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about automata construction
- To learn equivalence of automata and regular expressions
- To design a context free grammar for any given language
- To understand the concepts of Turing Machine
- To understand undecidable problems and NP class problems

UNIT I	FINITE AUTOMATA	9

Introduction to Formal Proof- Additional Forms of Proof - Inductive Proofs- Finite Automata - Deterministic Finite Automata-Nondeterministic Finite Automata -Finite Automata with Epsilon Transitions

UNIT II	REGULAR EXPRESSIONS	9

Regular Expressions - Finite Automata and Regular Expressions - Properties of Regular Languages - Proving Languages not to be regular using Pumping Lemma - Closure Properties of Regular Languages - Equivalence and Minimization of Automata

UNIT III	CONTEXT FREE GRAMMAR	9

CFG – Parse trees- Application of CFG - Ambiguity in Grammars and Languages - Pushdown Automata-Definition of the Pushdown Automaton- The Languages of a PDA- Equivalence of PDA's and CFG's

UNIT IV	TURING MACHINE	9

Normal Forms for CFG- Pumping Lemma for CFL - Closure Properties of CFL - Turing Machines - Programming Techniques for Turing Machine – Turing machines and computers

UNIT V	UNDECIDABILITY	9

Non-Recursive Enumerable Language - Undecidable Problem with Regular Expressions - Undecidable Problems about Turing Machine - Post's Correspondence Problem- Intractable Problems- The Classes P and NP-An NP Complete Problems.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Construct automata for any pattern.
CO2: Create regular expressions for finite automata.
CO3: Write Context free grammar for any construct.
CO4: Design computation solutions using Turing machines.
CO5: Analyze whether a problem is decidable or not.

TEXT BOOK:

1. Introduction to Automata Theory, Languages, and Computation, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education,2014.

REFERENCES:

1. Introduction to Languages and The Theory of Computation, 4th Edition, John C Martin, TMH,2010.
2. Introduction to Computer Theory, Dniel I.A. Cohen, John Wiley.
3. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.
4. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.

21AI401	ARTIFICIAL INTELLIGENCE	L	T	P	C
		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 theorem proving – 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 modal logic – 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: 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 the statistical quality control in engineering and management problems

TEXT BOOKS:

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

2. Bratko, Prolog: Programming for Artificial Intelligence‖, 4th edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCES:

1. Elaine Rich, Kevin Knight and B.Nair, Artificial Intelligence 3rd Edition, McGraw Hill,

2017.
2. Melanie Mitchell, Artificial Intelligence: A Guide for Thinking Humans. Series: Pelican Books, 2020
3. Ernest Friedman-Hill, Jess in 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

21CS511	NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To explore various network commands in different Operating Systems and troubleshoot it.
- To implement the error detection & correction and flow control mechanisms in network data communication.
- To implement functionalities using raw sockets.
- To understand and implement the network programming concepts using APIs.
- To simulate various network protocols and analyze their behaviour in the network

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 (C / Java)
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.
8. Simulation of unicast routing protocols.
9. Observing Packets across the network and Performance Analysis of various Routing protocols.
10. Simulation of Transport layer Protocols and analysis of congestion control techniques in the network.

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Understand the various networking commands in different OS and troubleshoot it.
CO2: Perform error detection & correction and flow control mechanisms in network programming.
CO3: Program with raw sockets for network protocol implementation.

CO4: Understand the usage of various network programming APIs and application layer protocols.
CO5: Simulate various network protocols and analyze their behaviour in the network

21AI411	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To design and implement search strategies
- To implement various gaming algorithms
- To design programs for Constraint satisfaction problems
- To experiment the simple projects using AI Concepts

LIST OF EXERCISES:

1. Implement basic search strategies – 8-Puzzle, 8 - Queens problem, Cryptarithmetic
2. Implement Breadth First Search & Depth first Search for Water Jug problem
3. Implement A* and memory bounded A* algorithms
4. Implement Minimax algorithm for game playing (Alpha-Beta pruning)
5. Solve Tic-Tac-Toe using Python
6. Implement Unification algorithm using Python
7. Implement Hangman game using Python
8. Implement classical planning algorithms
9. Implement forward chaining and backward chaining using Python
10. Artificial Intelligence/Expert Systems in Health care
11. Mini-Project

- Sudoku
- Chess

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Implement search strategies
CO2: Implement and execute gaming algorithms
CO3: Design programs for Constraint satisfaction problems
CO4: Experiment the simple projects using AI Concepts

21CS512	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

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.

21CS513	MINI PROJECT AND DESIGN THINKING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- Introducing students to design thinking that enhances innovation activities in terms of value creation and sustainability in problem solving.
- Strengthen students' individual and collaborative capabilities to identify problems/ needs, develop sound hypotheses, collect, and analyze appropriate data, develop prototypes to collect meaningful feedback in a real-world environment.

LIST OF EXERCISES:

UNIT 1

Introduction: Design thinking overview- Design Process – Principles of Design Thinking – Problems Best suited for Design Thinking - Visualization tool – **Case Study:** Problem Identification **(6)**

UNIT 2

Empathize – Information Gathering – Analysis – Story Telling tool- Innovation- Ideation Finding and Evaluating Ideas Mind Mapping Tool –

Case Study: Analysing the Identified Problem. **(6)**

UNIT 3

Designing Prototypes – Tasks in Prototyping –Understanding Different Prototypes- Developing different prototypes -Demonstration –Prototyping Tools

Case Study: Prototyping the solution. **(6)**

UNIT 4

Testing and Evaluation – Testing Prototypes – Evaluation – Improving solution – Strategic Opportunities –**Case Study:** Evaluating the solution. **(6)**

UNIT 5

Applications: HealthCare and Science – Education- Transportation - Finance – Technology. **(6)**

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Understand the design thinking process and able to visualize the problem.
CO2: Analyse the problem using innovation tools
CO3: Design a prototype for an identified problem solution
CO4: Testing and evaluate strategies in improving the solution
CO5: Apply the innovation ideas to real-world applications.

SEMESTER VI

21CS601	COMPILER DESIGN (LAB INTEGRATED)	L	T	P	C
		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 analyze various code optimization techniques

UNIT I	INTRODUCTION TO COMPILERS	9 + 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**	**9 + 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**	**9 + 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-TIM ENVIRONMENT AND CODE GENERTION**	**9 + 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**	**9 + 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: 45 +30 = 75 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 Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint, 2003.
3. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers, Elsevier Science, 2004.
4. V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 1993.

21CS602	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of network security and security architecture.
- To learn the different symmetric key cryptographic algorithms.
- To study the various asymmetric key cryptographic algorithms and techniques.
- To know the importance of message authentication and integrity.
- To learn the various security practices and system security mechanisms.

UNIT I	INTRODUCTION	9

Security trends - Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography-

UNIT II	SYMMETRIC KEY CRYPTOGRAPHY	9

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid‟s algorithm- Congruence and matrices.

SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard.

UNIT III	PUBLIC KEY CRYPTOGRAPHY	9
MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function - Chinese Remainder Theorem – Exponentiation and Alogarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.		
UNIT IV	**RUN-TIM ENVIRONMENT AND CODE GENERTION**	**9**
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - X.509		
UNIT V	**SECURITY PRACTICE AND SYSTEM SECURITY**	**9**
Electronic Mail security – PGP– IP security – Web Security – SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.		
TOTAL: 45 PERIODS		

OUTCOMES:

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

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities

CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms

CO3: Apply the different cryptographic operations of public key cryptography

CO4: Apply the various Authentication schemes to simulate different applications.

CO5: Understand various Security practices and System security standards

TEXT BOOK:

1. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson education 8th Edition, 2020.

REFERENCES:

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd 1st Edition,2011

2. Behrouz A.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.

3. Wade Trappe, Lawrence C. Washington: Introduction to Cryptography with Coding Theory, 3rd Edition, 2020.

21AI502	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 – Rule-based Classification – Pruning the Rule Set – Support Vector Machines – Linear SVM – Optimal 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.

TOTAL: 45 PERIODS

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 BOOKS:

1. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson, 2019.
2. EthemAlpaydin, Introduction to Machine Learning, Adaptive Computation and Machine Learning Series, Third Edition, MIT Press, 2014.

REFERENCES:

1. Anuradha Srinivasaraghavan,Vincy Joseph, Machine Learning, First Edition, Wiley, 2019.
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.

21CS611	SECURITY LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To perform encryption and decryption using different cipher techniques.
- To implement the algorithms DES, AES, RSA,MD5,SHA-1.
- To explore network security tools and vulnerability assessment tools

LIST OF EXERCISES:

1. Perform encryption, decryption using the following substitution techniques

(i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher

2. Perform encryption and decryption using following transposition techniques

i) Rail fence ii) row & Column Transformation

3. Apply DES algorithm for practical applications.
4. Apply AES algorithm for practical applications.
5. Implement RSA Algorithm using HTML and JavaScript.
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME - Digital Signature Standard.
9. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w
10. Automated Attack and Penetration Tools

a.Exploring N-Stalker, a Vulnerability Assessment Tool

11. Defeating Malware

i) Building Trojans ii) Rootkit Hunter

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Develop code for classical Encryption Techniques with different ciphers.

CO2: Build cryptosystems by applying symmetric and public key encryption algorithms.

CO3: Construct code for authentication algorithms.

CO4: Develop a signature scheme using Digital signature standard.

CO5: Demonstrate the network security system using open source tools

21CS613	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: Apply data structures and algorithms in problem solving.

SEMESTER-VII

21CS701	DATA ANALYTICS (Lab Integrated)	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To explain the fundamentals of big data and data analytics
- To discuss the Hadoop framework
- To explain about exploratory data analysis and data manipulation tools and use it for developing applications
- To analyse and interpret streaming data
- To discuss various applications of data analytics

UNIT I	INTRODUCTION	12

Evolution of Big Data- Definition of Big Data-Challenges with Big Data- Traditional Business Intelligence (BI) versus Big Data- Introduction to big data analytics- Classification of Analytics- Analytics Tools- Importance of big data analytics.

UNIT II	HADOOP FRAMEWORK	12

Introducing Hadoop- RDBMS versus Hadoop- Hadoop Overview-HDFS (Hadoop Distributed File System)- Processing Data with Hadoop- Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem

UNIT III	EXPLORATORY DATA ANALYSIS	12

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA –Data transformation techniques - Introduction to NoSQL – MongoDB: RDBMS Vs MongoDB – Data Types – Query Language – Hive – Hive Architecture – Data Types – File Formats - Hive Query Language (HQL) – RC File Implementation – User Defined Functions.

UNIT IV	MINING DATA STREAMS	12

The data stream model – stream queries-sampling data in a stream-general streaming problem filtering streams-analysis of filtering- dealing with infinite streams- Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows.

UNIT V	APPLICATIONS	12

Application: Sales and Marketing – Industry Specific Data Mining – microRNA Data Analysis Case Study – Credit Scoring Case Study – Data Mining Non tabular Data.

LIST OF EXERCISES:

R / Python

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 - Frequency distributions, Mean, Mode, Standard Deviation, Variability, Normal curves, Correlation and scatter plots, Correlation coefficient, 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 and explore various plotting functions on any data set.

8. Implement the following algorithms on real time stream data sets.

- Support Vector Machine
- Decision tree classifier
- Clustering Algorithms

9. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set. You can use Java/Python ML library classes/API

10. Mini Project: The project should contain the following components

- Realtime dataset
- Data preparation & Transformation
- Handling missing Data
- Data Storage
- Algorithm for data analytics

Data visualization: Charts, Heatmap, Crosstab, Treemap

TOTAL: 30 + 30 = 60 PERIODS

OUTCOMES:

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

CO1: Explain the fundamentals of big data and data analytics and illustrate it
CO2: Discuss the Hadoop framework
CO3: Develop applications using exploratory data analysis and data manipulation tools
CO4: Analyse and interpret streaming data
CO5: Illustrate various applications of data analytics

TEXT BOOKS:

1. Subhashini Chellappan, Seema Acharya, “Big Data and Analytics”, 2nd edition, Wiley Publications, 2019.
2. Suresh Kumar Mukhiya and Usman Ahmed, “Hands-on Exploratory Data Analysis with Python”, Packt publishing, March 2020.
3. Jure Leskovek, Anand Rajaraman and Jefrey Ullman,” Mining of Massive Datasets. v2.1”, Cambridge University Press, 2019.
4. Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data II: A Practical Guide To Data Visualization, Advanced Data Mining Methods, and Applications, Wiley 2009.

REFERENCES:

1. Nelli, F., Python Data Analytics: with Pandas, NumPy and Matplotlib, Apress, 2018.
2. Bart Baesens," Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", John Wiley & Sons, 2014.

3. Min Chen, Shiwen Mao, Yin Zhang, Victor CM Leung, Big Data: Related Technologies, Challenges and Future Prospects, Springer, 2014.
4. Michael Minelli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends", John Wiley & Sons, 2013.
5. Marcello Trovati, Richard Hill, Ashiq Anjum, Shao Ying Zhu, "Big Data Analytics and cloud computing – Theory, Algorithms and Applications", Springer International Publishing, 2016.

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

21CS901	CYBER PHYSICAL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The students will be able to Understand Cyber Physical System
- Analyze Intelligent CPS
- Apply modern tools to develop CPS applications
- To design a Cyber physical system for a given problem
- 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: Understand the basics of CPS

CO2: Identify research problems in CPS

CO3: Design cyber physical systems

CO4: Verify the designed cyber physical systems

CO5: 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

21CS902	WEB SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study and practice fundamental techniques in developing secure web-based applications
- 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	10

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	8

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 defense 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)

21CS903	VULNERABILITY ANALYSIS AND PENETRATION TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the tools that can be used to perform information gathering
- To identify various attacks in various domains of cyber space and to learn about exploits
- To learn about Wireless environment and its Security
- To learn how vulnerability assessment can be carried out by means of automatic tools or manual investigation.
- To learn the vulnerabilities associated with various network applications and database systems.

UNIT I	INFORMATION GATHERING, DETECTING VULNERABILITIES	9

Open Source Intelligence Gathering - Port Scanning - Nessus Policies - Web Application Scanning Manual Analysis- Traffic Capturing

UNIT II	ATTACKS & EXPLOITS	9

Password Attacks Client-side Exploitation Social Engineering- Bypassing Antivirus Applications- Metasploit Payloads - Open phpMyAdmin -Buffer overflow: Windows and Linux.

UNIT III	WIRELESS SECURITY	9

Wired vs. wireless Privacy Protocols - Wireless Frame Generation Encryption Cracking Tools- Wireless DoS Attacks		
UNIT IV	**COMMON VULNERABILITY ANALYSIS OF APPLICATION PROTOCOLS**	**9**
Simple Mail Transfer Protocol- File Transfer Protocol- Trivial File Transfer Protocol-Hyper Text Transmission Protocol- DNS-DHCP-LDAP-SNMP		
UNIT V	**NETWORK VULNERABILITY ANALYSIS & PENETRATION TOOLS AND DATABASE SECURITY**	**9**
Domain Name Server and Dynamic Host Configuration Protocol -Light Weight Directory Access Protocol-Simple Network Management Protocol-Remote Procedural Call		
TOTAL: 45 PERIODS		

OUTCOMES:

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

CO1: Understand the tools that can be used to perform information gathering
CO2: Identify various attacks in various domains of cyber space and to learn about exploits
CO3: Understand about Wireless environment and its Security
CO4: Understand how vulnerability assessment can be carried out by means of automatic tools or manual investigation.
CO5: Understand the vulnerabilities associated with various network applications and database system.

TEXT BOOKS:

1. Georgia Weidman,"Penetration Testing: A Hands On Introduction to Hacking", No Startch Press, First Edition 2014. ISBN-13: 978-1593275648 ISBN-10: 1593275641.
2. B.Singh, H.Joseph and Abhishek Singh,"Vulnerability Analysis and Defense for the Internet, Springer, 2008 Edition. ISBN-10: 0387743898 ISBN-13: 978-0387743899.

REFERENCES:

1. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide",CRC Press, 2015,ISBN :78-1-4822-3161-8.
2. Dr.Patrick Engebretson, "The Basics of Hacking and Penetration Testing",Syngress Publications Elseveir, 2013, ISBN : 978-0-12-411644-3
3. Prakhar Prasad, Mastering Modern Web Penetration Testing (Kindle Edition),2016 , Packet Publishing, ISBN:978-1-78528-458-8.
4. Gilberto Najera Gutierrez, Kali Linux Web Penetration Testing Cookbook ,2016, ISBN13 9781784392918
5. Robert Svensson, From Hacking to Report Writing: An Introduction to Security and Penetration Testing 2016, ISBN 978-1-4842-2282-9

21AI702	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of natural language processing

- To know the techniques for 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.

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

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 –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, 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 resources.

TEXT BOOK:

1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2019.

REFERENCES:

1. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", First Edition, O'Reilly Media, 2009.

2. Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015.
3. Richard M Reese, "Natural Language Processing with Java", O'Reilly Media, 2015.
4. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", Second Edition, Chapman and Hall/CRC Press, 2010.
5. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

21CS904	IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental concepts of image processing and pattern recognition
- To understand the basics of image transformation and filtering techniques
- To study image restoration and reconstruction techniques
- To know the fundamentals of color image processing
- To study the various image segmentation methods

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 (Highpass) Spatial Filters-Highpass, 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-Image smoothing using Lowpass frequency domain filters- Image sharpening using high pass filters- Selective Filtering- The Fast Fourier Transform.

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 AND UNDERSTANDING	9

Fundamentals-Point, Line, and Edge Detection-Thresholding-Segmentation by Region Growing and by Region Splitting and Merging-Region Segmentation Using Clustering and Superpixels-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.

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: Develop a model for Image Restoration and Degradation using Various Filtering Techniques

CO4: Acquire the concepts of color image processing

CO5: Demonstrate the various image segmentation and morphological operations for partition the objects

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
3. S.Sridhar, "Digital Image Processing", 2nd Edition, 2016.

21CS905	COMPUTER VISION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

UNIT I	INTRODUCTION TO IMAGE FORMATION AND PROCESSING	9

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT II	FEATURE DETECTION, MATCHING AND SEGMENTATION	9

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT III	FEATURE-BASED ALIGNMENT & MOTION ESTIMATION	9

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained

structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT IV	3D RECONSTRUCTION	9

Shape from X - Active rangefinding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos

UNIT V	IMAGE-BASED RENDERING AND RECOGNITION	9

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Describe the concepts related to Image formation and processing.

CO2: Compare the concepts related to feature detection, matching and detection.

CO3: Understanding feature based alignment and motion estimation.

CO4: Study of 3D Reconstruction.

CO5: Perform image based rendering and recognition.

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, Person Education, Second Edition, 2015

REFERENCES:

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

21CS906	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 management

TEXTBOOK:

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

21CS907	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the foundations of Human Computer Interaction.

- To become familiar with the design technologies for individuals and persons with disabilities.
- To learn various models pertaining to Human Computer Interaction. To be aware of mobile Human Computer Interaction.
- To learn the guidelines for user interface

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 Interfaces‖, First Edition, O'Reilly, 2009.

REFERENCES:

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

21CS908	AGILE METHODOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand the benefits and pitfalls of working in an Agile team.
- To understand Agile development and testing.

UNIT I	AGILE MANAGEMENT	9

Agile Management-Theories for Agile Management – TOC in Software Production -Dealing with Uncertainty-Agile Development - Classification of Methods – Agile Manifesto and Principles – Agile Project Management

UNIT II	AGILE METHODS	9

Lifecycle – Work Products, Roles and Practices in SCRUM process-Extreme Programming Unified Process- Evo- Crystal Methods- Agile Modeling- other methods and practices

UNIT III	AGILE INFORMATION SYSTEMS	9

Agile Information Systems for Agile Decision Making - The Logic of Knowledge: KM Principles Support Agile Systems– Agile Drivers, Capabilities and Value-Co-Evolution and Co Design of Agile Organizations and Information Systems Through Agent-Based Modeling

UNIT IV	FDD & METRICS	9

Production and Financial Metrics for Traditional Methods -Overview of Feature Driven Development (FDD) -Process-Production metrics and finance metrics in FDD-XP-SRUM.

UNIT V	AGILE QUALITY ASSURANCE	9

Handling of Software Quality Defects in Agile Software Development- Agile quality Assurance for GUI based applications- Software Configuration management in Agile Development- Test Driven Development- Quality Improvements

OUTCOMES:

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

CO1: Understanding the core of Agile management

CO2: Attaining clarity on various Agile Methods

CO3: Understanding the implication of Agile Information System

CO4: Comparing metrics in various Agile Methods

CO5: Knowing the Quality Assurance with respect to Agile methodology

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Craig Larman, Agile and Iterative Development: A Manager_s Guide‖,Addison- Wesley, 2004.
2. Kevin C. Desouza, Agile Information Systems: Conceptualization, Construction, and Management‖, Butterworth-Heinemann, 2007.

REFERENCES:

1. David J. Anderson and Eli Schragenheim, ―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results‖, Prentice Hall, 2003
2. Agile Software Development Quality Assurance, Ioannis G. Stamelos (Aristotle University of Thessaloniki, Greece) and Panagiotis Sfetsos (Alexander Technological Educational Institution of Thessaloniki, Greece)-Information Science Reference, 2007

21CS909	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 BOOK:

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.

21CS910	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To outline the components of the social network.
- To explain the modeling and visualization of the social network.
- To classify descriptive and inferential methods.
- To discuss about the evolution of the social network.
- To illustrate the applications in real time systems.

UNIT I	INTRODUCTION	9

Basics of Social Network Analysis: Introduction- The Social network and How to Represent it-Types of Networks-Network parts and Level of Analysis-Networks as Social Structure and Institution-Theoretical Assumptions-Causality in Social Network Studies- A Brief History of Social Network Analysis-Mathematical Foundations: Graphs-Paths and components-Adjacency matrices-Ways and modes-Matrix products-Sources of network data-Types of nodes and types of ties- Data Collection: Network questions-Question formats-Interviewee burden-Data collection and reliability-Archival data collection-Data from electronic sources.

UNIT II	MODELING AND VISUALIZATION	9

Data Management: Data import-Cleaning network data- Data transformation-Normalization-Cognitive social structure data-Matching attributes and networks-Converting attributes to matrices-Data export,- Multivariate Techniques Used in Network Analysis: Multidimensional scaling-Correspondence analysis-Hierarchical clustering,- Visualization: Layout-Embedding node attributes-Node filtering-Ego networks-Embedding tie characteristics-Visualizing network change-Exporting visualizations-Closing comments.

UNIT III	DESCRIPTIVE AND INFERENTIAL METHODS	9

Descriptive Methods in Social Network Analysis: Graph and Matrix-Social Network Representation – Density – Centrality, Centralization and Prestige- Cliques – Multidimensional Scaling(MDS) and Dendogram – Structural Equivalence-Two mode Networks and Bipartite Matrix-Inferential Methods in Social Network Analysis: Permutation and QAP (Quadratic Assignment Procedure) Correlation-P* or Exponential Random Graph Model(ERGM)

UNIT IV	EVOLUTION	9

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models.

UNIT V	APPLICATIONS	9

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Define the internal components and terminology of the social network.

CO2: Explain fundamental exploratory multivariate techniques and visualizing network data.

CO3: Discuss most common descriptive and inferential statistical tools available.

CO4: Discuss about the evolution of the social network.

CO5: Illustrate the real time applications of social network analysis.

TEXT BOOKS:

1. Song Yang , Franziska B. Keller, Social Network Analysis Methods and Examples, SAGE Publications,Inc. 2017
2. Stephen P Borgatti, Martin G. Everett, Jeffrey C. Johnson, Analyzing Social Networks, Second Edition, 2017

REFERENCES:

1. Charu C. Aggarwal, Social Network Data Analytics, Springer; 2014
2. Przemyslaw Kazienko, Nitesh Chawla, Applications of Social Media and Social Network Analysis, Springer,2015
3. Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel, Computational Social Network Analysis: Trends, Tools and Research Advances, Springer, 2012.
4. Borko Furht, Handbook of Social Network Technologies and Applications, Springer, 1st edition, 2011
5. Guandong Xu , Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications‖, Springer, 1st edition, 2012.

21CS911	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 – Layered approach – Components – Types – categorization of ontologies - Ontological Commitments – Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies

UNIT II	LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES	9

Structured Web Documents: XML –Web Resource Description using RDF – RDF – Schema – Syntax Structure – An Axiomatic Semantics for RDF and RDF Schema- Traditional Ontology Languages – LOOM – OKBC – OCML – Flogic - Ontology Markup Languages – SHOE – OIL – DAML+OIL – OWL.

UNIT III	ONTOLOGY LEARNING FOR SEMANTIC WEB	9

Ontology Learning Framework -An Architecture for Ontology Learning- Phases of Ontology Learning –Importing and Processing Ontologies and Documents – Ontology Learning Algorithms –Methods for evaluating Ontologies.

UNIT IV	ONTOLOGY MANAGEMENT AND TOOLS	9

Overview – Development process – Ontology mapping – Skills management– Evolution – Development of Tools and Tool Suites – Ontology Merge Tools – Ontology based Annotation Tools.

UNIT V	APPLICATIONS	9

Semantic Web Services – Case Study for specific domain – 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.

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, (Editor), "Semantic Web Technologies: Trends and Research in Ontology-Based Systems", Wiley, 2006.

21CS912	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- Superscalarity - SIMD- Memory Hierarchies - Cache- mapping- prefetch- Multicore processors- Mutithreaded 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 Open MP - 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 BOOK:

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.

21CS913	MULTI-CORE ARCHITECTURES AND PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the need for multi-core processors, and their architecture.
- To understand the challenges in parallel and multi-threaded programming.
- To learn about the various parallel programming paradigms,
- To develop multi core programs
- To design parallel solutions.

UNIT I	MULTI-CORE PROCESSORS	9

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design

UNIT II	PARALLEL PROGRAM CHALLENGES	9

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

UNIT III	SHARED MEMORY PROGRAMMING WITH OpenMP	9

Compiling and running OpenMP programs,The Trapezoidal rule,The parallel for directive, scheduling loops- Producers and consumers .

UNIT IV	DISTRIBUTED MEMORY PROGRAMMING WITH MPI	9

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation.

UNIT V	PARALLEL PROGRAM DEVELOPMENT	9

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Describe multicore architectures and identify their characteristics and challenges

CO2: Identify the issues in programming Parallel Processors

CO3: Write programs using OpenMP and MPI.

CO4: Design parallel programming solutions to common problems.

CO5: Compare and contrast programming for serial processors and programming for parallel processors.

TEXT BOOKS:

1. Peter S. Pacheco, ―An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier, 2011.
2. Darryl Gove, ―Multicore Application Programming for Windows, Linux, and Oracle Solaris‖, Pearson, 2011

REFERENCES:

1. Michael J Quinn, ―Parallel programming in C with MPI and OpenMP‖, Tata McGraw Hill,2003.
2. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
3. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

21CS914	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of the 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,wirelessHART,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.

TOTAL: 45 PERIODS

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 Rasperry 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.

21CS915	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the architecture and programming of ARM processor.
- To become familiar with the embedded computing platform design and analysis
- To impart the knowledge about real time embedded systems
- To learn embedded programming.
- To study and develop the different applications.

UNIT I	INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS	9

Complex systems and microprocessors– Embedded system design process –Design example: Model train controller - Instruction sets preliminaries - ARM Processor CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

UNIT II	EMBEDDED COMPUTING PLATFORM DESIGN	9

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT III	PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING	9

Software Programming in ALP and in High Level Language "C"- C Program Elements –Object Oriented Programming – Embedded Programming In C++ - Embedded Programming in JAVA- Program Modelling Concepts: Program Models, DFG Models, State Machine Programming Models-Modelling of Multiprocessor Systems – UML Modelling.

UNIT IV	REAL TIME OPERATING SYSTEMS	9

OS Services – Process Management –Timer Functions – Event Functions – Memory Management – Device, File and IO Subsystems Management – Basic Design Using an RTOS – RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics – OS Security Issues.

UNIT V	REAL TIME OPERATING SYSTEM PROGRAMMING	9

Basic functions & Types of RTOSES- RTOS mCOS-II - RTOS Vx works – Windows CE, OSEK, Linux 2.6.x and RTLinux

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Describe the architecture and programming of ARM processor.

CO2: Explain the concepts of embedded systems.

CO3: Write embedded C programs.

CO4: Understand the RTOS and its use in Portable Handheld Devices

CO5: Design real time embedded systems using the concepts of RTOS.

TEXT BOOKS:

1. Computers as Components: Principles of Embedded Computing System Design, Fourth Edition, 2017, Marilyn Wolf, Elsevier.
2. Embedded Systems- Architecture, Programming and Design, Raj Kamal, 3rd Edition Paperback, 2017.

REFERENCES:

1. Dr. K V K K Prasad, Embedded / Real-Time Systems: Concepts, Design and Programming, Black Book, DreamTech Press, 2016.
2. Arnold S Berger, Embedded Systems Design: An Introduction to Processes, Tools &Techniques, CMP books, 2010.
3. Vahid F., Givargies T., Embedded Systems Design, Third Edition, John Wiley & Sons, paperback-2011.
4. Michael J. Pont, "Embedded C", Pearson Education, 2015.

21CS916	PARALLEL PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a relatively nontechnical explanation of why parallel systems and some technical background in computer hardware and software.
- Able learn the basics of Distributed-Memory Programming with MPI
- To learn the fundamental concepts of Shared-Memory Programming with Pthreads
- Able to learn the basics of Shared-Memory Programming with OpenMP.
- Able to develop two longer programs: a parallel n-body solver and a parallel tree search. using all three APIs

UNIT I	INTRODUCTION	9

Introduction to Parallel Computing, Need of Parallel Computing, Concurrent, Parallel, Distributed. Parallel Hardware, Parallel Software, Input and Output, Performance. Parallel Program Design, Writing and Running Parallel Programs.

UNIT II	DISTRIBUTED-MEMORY PROGRAMMING WITH MPI	9

MPI programs, SPMD programs, Communication, Message matching. Semantics of MPI_Send and MPI_Recv. The Trapezoidal Rule in MPI, Dealing with I/O, Collective Communication, MPI Derived Datatypes, Performance Evaluation of MPI Programs

UNIT III	SHARED-MEMORY PROGRAMMING WITH PTHREADS	9

Processes, Threads, and Pthreads, Example: Hello, World and Matrix-Vector Multiplication. Critical Sections, Busy-Waiting, Mutexes, Producer-Consumer Synchronization and Semaphores, Read-Write Locks, Caches, Thread-Safety.

UNIT IV	SHARED-MEMORY PROGRAMMING WITH OPENMP	9

Compiling and running OpenMP programs, The Trapezoidal Rule, Scope of Variables, The Reduction Clause, The parallel for Directive, Loops in OpenMP, Scheduling Loops, Producers and Consumers, Caches, Thread-Safety.

UNIT V	PARALLEL PROGRAM DEVELOPMENT	9

Two n-Body Solvers, Parallelizing the n-body solvers, Parallelizing the solvers using pthreads, Evaluating the OpenMP codes, Performance of the MPI solvers, Tree Search.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Be proficient at programming multiple parallel machines in more than one special

programming language or programming system

CO2: Be able to descriptively compare the performance of different programs and methods on one machine

CO3: Demonstrate advanced knowledge of the elements of parallel programming, parallel communication, and system implementation

CO4: Recall the history of parallel systems, principles of parallel algorithms and describe the developments in the field of parallel computing.

TEXT BOOK:

1. An Introduction to Parallel Programming Peter S. Pacheco University of San Francisco, Morgan Kaufmann Publishers is an imprint of Elsevier, 2011.

REFERENCES:

1. B. Wilkinson and M. Allen, "Parallel Programming – Techniques and applications using networked workstations and parallel computers", Second Edition, Pearson Education, 2005.
2. Michael J. Quinn, "Parallel Programming in C with MPI and OpenMP", Tata McGraw-Hill Publishing Company Ltd., 2003.

21CS917	INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

- 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 Startup Models

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:

At the end of this 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 BOOKS:

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-grow-your-business/
4. http://sourcesofinsight.com/innovation-life-cycle/
5. https://www.investottawa.ca/

https://www.Lead-innovation.com

21CS918	DATA SCIENCE FUNDAMENTALS	L	T	P	C
		3	0	0	3

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

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

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

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

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

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 Base map - Visualization with Seaborn.

TOTAL: 45 PERIODS

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.

21CS938	PROFESSIONAL ETHICS IN ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize with Engineering Ethics and Human Values.
- 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 1	**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**	**8**

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**	**9**

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

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Summarize the importance of human values in workplace.

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.

21CS939	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

Students completing this course are expected to:

- 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.
- Analyze and understand the environment of the organization.
- Develop the cognizance of the importance of management principles.

UNIT 1	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:

After successful completion of the 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 publications. (2016).

21CS940	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- Make the students understand the traditional knowledge and analyse 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 (PPVFR Act); 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 BOOK:

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.

21CS919	GOOGLE CLOUD: ARCHITECTING WITH GOOGLE COMPUTE ENGINE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn about Google Cloud and how to interact with the Google Cloud Console and Cloud Shell.
- Create VPC networks and other networking objects.
- Understand virtual machines
- Create virtual machines using Compute Engine.

UNIT I	GOOGLE CLOUD PLATFORM FUNDAMENTALS: CORE INFRASTRUCTURE	9

Introducing Google Cloud Platform - The Google Cloud Platform resource hierarchy - Identity and Access Management (IAM) - Interacting with Google Cloud Platform - Cloud Marketplace – **Networking:** Virtual Private Cloud (VPC) Network - Compute Engine - Important VPC capabilities - **Storage:** Cloud Storage - Cloud Bigtable - Cloud SQL and Cloud Spanner - Cloud Datastore - Comparing Storage Options – **Containers** – Kubernetes - Kubernetes Engine – **AppEngine:** Introduction to App Engine - App Engine Standard Environment - App Engine

Flexible Environment - Cloud Endpoints and Apigee Edge - Development in the Cloud - Deployment: Infrastructure as code – Monitoring: Proactive instrumentation - Google Cloud Big Data Platform - Google Cloud Machine Learning Platform.

UNIT II	**ESSENTIAL CLOUD INFRASTRUCTURE: FOUNDATION**	**9**

Introduction to GCP - Virtual Networking - Common Network Designs - Compute Engine - Working with Virtual Machines. Core Services: Introduction to core services - Cloud Identity and Access Management - Cloud Storage - Cloud SQL - Cloud Spanner and Datastore - Cloud Bigtable - Resource Management - Monitoring: Stack driver – Logging - Error Reporting - Tracing and Debugging.

UNIT III	**ESSENTIAL CLOUD INFRASTRUCTURE: CORE SERVICES**	9

Identity and Access management- Organization-Roles- Custom roles- Members- Service Accounts-Cloud IAM- Resource Manager-Quotas-Labels-Billing-Billing Administration

UNIT IV	**ELASTIC CLOUD INFRASTRUCTURE: SCALING AND AUTOMATION**	9

Introduction to Elastic Cloud Infrastructure - Cloud VPN - Cloud Interconnect and Peering - Sharing VPC Networks - Managed instance groups – Load balancing: HTTP(S) load balancing - SSL/TCP - Proxy load balancing - Network load balancing - Internal load balancing - Choosing a load balancer - Deployment Manager - GCP Marketplace - Managed Services.

UNIT V	**RELIABLE CLOUD INFRASTRUCTURE: DESIGN AND PROCESS:**	**9**

Defining the service - Business-logic layer - Data layer design - Presentation layer - Design for Resiliency - Scalability and Disaster Recovery - Design for Security: Cloud security - Network access control and firewalls - Protections against Denial of Service - Resource sharing and Isolation - Data encryption and key management - Identity access and auditing - Capacity planning and cost optimization – Deployment - Monitoring and alerting - Incident response.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Recognize the purpose of various compute services such as Compute Engine, Kubernetes Engine, App Engine and Cloud Functions.

CO2: Explore the fundamental components of GCP's Virtual Private Cloud.

CO3: Manage and examine billing of Google Cloud resources

CO4: Explore various load balancing services and construct an HTTP load balancer with auto scaling.

CO5: Identity various steps involved in designing a solution using layered and iterative approach.

TEXT BOOK:

1. Sosinsky B., "Cloud computing bible", John Wiley & Sons, 2011.

REFERENCES:

1. Dinkar Sitaram, Geetha Manjunat, "Moving to the Cloud: Developing Apps in the New World of Cloud Computing", Elsevier, 2012.

2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", McGraw Hill, 2010.

ONLINE MATERIALS

1. https://www.coursera.org/specializations/gcp-architecture
2. https://cloud.google.com/docs/

21CS932	GOOGLE CLOUD COMPUTING FOUNDATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe the different ways a user can interact with Google Cloud.
- To discover the different compute options in Google Cloud and implement a variety of structured and unstructured storage models.
- To confer the different application managed service options in the cloud and outline how security in the cloud is administered in Google Cloud.
- To demonstrate how to build secure networks in the cloud and identify cloud automation and management tools.
- To determine a variety of managed big data services in the cloud.

UNIT I	INTRODUCTION TO GOOGLE CLOUD	9

Cloud Computing - Cloud Versus Traditional Architecture - IaaS, PaaS, and SaaS - Google Cloud Architecture - The GCP Console - Understanding projects - Billing in GCP - Install and configure Cloud SDK - Use Cloud Shell - GCP APIs - Cloud Console Mobile App.

UNIT II	COMPUTE AND STORAGE	9

Compute options in the cloud - Exploring IaaS with Compute Engine - Configuring elastic apps with autoscaling - Exploring PaaS with App Engine - Event driven programs with Cloud Functions - Containerizing and orchestrating apps with Google Kubernetes Engine - Storage options in the cloud - Structured and unstructured storage in the cloud - Unstructured storage using Cloud Storage - SQL managed services - Exploring Cloud SQL - Cloud Spanner as a managed service - NoSQL managed service options - Cloud Datastore, a NoSQL document store - Cloud Bigtable as a NoSQL option.

UNIT III	APIs AND SECURITY IN THE CLOUD	9

The purpose of APIs - Cloud Endpoints - Using Apigee Edge - Managed message services - Exploring Cloud SQL - Cloud Pub/Sub - Introduction to security in the cloud - The shared security model - Encryption options - Authentication and authorization with Cloud IAM - Identify Best Practices for Authorization using Cloud IAM.

UNIT IV	NETWORKING, AUTOMATION AND MANGAEMENT TOOLS	9

Introduction to networking in the cloud - Defining a Virtual Private Cloud - Public and private IP address basics - Google's network architecture - Routes and firewall rules in the cloud - Multiple VPC networks - Building hybrid clouds using VPNs, interconnecting, and direct peering - Different options for load balancing - Introduction to Infrastructure as Code - Cloud Deployment

Manager - Public and private IP address basics - Monitoring and managing your services, applications, and infrastructure - Stackdriver.

UNIT V	BIG DATA AND MACHINE LEARNING SERVICES	9

Introduction to big data managed services in the cloud - Leverage big data operations with Cloud Dataproc - Build Extract, Transform, and Load pipelines using Cloud Dataflow - BigQuery, Google's Enterprise Data Warehouse - Introduction to machine learning in the cloud - Building bespoke machine learning models with AI Platform - Cloud AutoML - Google's pre-trained machine learning APIs.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Describe the different ways a user can interact with Google Cloud.

CO3: Discover the different compute options in Google Cloud and implement a variety of structured and unstructured storage models.

CO3: Discuss the different application managed service options in the cloud and outline how security in the cloud is administered in Google Cloud.

CO4: Demonstrate how to build secure networks in the cloud and identify cloud automation and management tools.

CO5: Discover a variety of managed big data services in the cloud.

REFERENCES:

1. https://cloud.google.com/docs
2. https://www.cloudskillsboost.google/course_templates/153
3. https://nptel.ac.in/courses/106105223

21CS933	OBJECT ORIENTED ANALYSIS AND DESIGN (LAB INTEGRATED)	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To learn the basics of OOAD and various UML diagrams.
- To understand how to create design patterns.
- To understand the various stages of the design process using a case study.
- To learn how to apply design patterns using various UML diagrams.
- To know how to map design to code and learn different testing techniques.

UNIT I	UML DIAGRAMS	6+6

Introduction to OOAD – Unified Process - UML diagrams – Use Case – Class Diagrams– Interaction Diagrams – State Diagrams – Activity Diagrams – Package, component, and Deployment Diagrams.

UNIT II	DESIGN PATTERNS	6+6

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling

– High Cohesion – Controller - Design Patterns – creational - factory method - structural – Bridge – Adapter - behavioural – Strategy – observer.

UNIT III	CASE STUDY	6+6

Case study – the Next Gen POS system, Inception -Use case Modelling - Relating Use cases – include, extend and generalization - Elaboration - Domain Models - Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies - Aggregation and Composition.

UNIT IV	APPLYING DESIGN PATTERNS	6+6

System sequence diagrams - Relationship between sequence diagrams and use cases Logical architecture and UML package diagram – Logical architecture refinement - UML class diagrams - UML interaction diagrams - Applying GoF design patterns.

UNIT V	CODING AND TESTING, METRICS	6+6

Mapping design to code – Testing: Issues in OO Testing – Class Testing – OO Integration Testing – GUI Testing – OO System Testing-Metrics for Object Oriented Design- Class-Oriented Metrics.

Lab programs:

Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing

9. E-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

TOTAL: 30 + 30 = 60 PERIODS

OUTCOMES:

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

CO1: Understand the basics of OOAD and various UML diagrams.

CO2: Understand how to create design patterns.

CO3: Understand the different stages of the design process with a case study.

CO4: Apply design patterns using various UML diagrams.

CO5: Compare and contrast various testing techniques

TEXT BOOK:

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

REFERENCES:

1. Roger.S.Pressman and Bruce R. Maxim, "Software Engineering: A Practitioner's Approach" , Eighth Edition, Mc-Graw Hill Education, 2015.

2. Simon Bennett, Steve Mc Robb and Ray Farmer, "Object Oriented Systems Analysis and Design Using UML", Fourth Edition, Mc-Graw Hill Education, 2010.

3. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley, 1995.

4. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Third edition, Addison Wesley, 2003.

5. Paul C. Jorgensen, "Software Testing:- A Craftsman‟s Approach", Third Edition, Auerbach Publications, Taylor and Francis Group, 2008.

21CS934	MOBILE COMPUTING (LAB INTEGRATED)	L	T	P	C
		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

Lab Programs

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: 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 BOOKS:

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 Networks‖, 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

SEMESTER VII – PROFESSIONAL ELECTIVES -IV/V/VI

21CS920	CYBER FORENSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the basics of digital forensics
- To apply various forensics tools in evidence collections
- To illustrate analysis and validation methods in cyber forensics
- To summarize the mobile and cloud forensics
- To discuss about social media forensics and anti-forensics

UNIT I	INTRODUCTION TO DIGITAL FORENSICS	9

An Overview of Digital Forensics – Preparing for Digital Investigations– Maintaining Professional Conduct – Computer Crime – Company Policy Violation – Understanding Data Recovery Workstations and Software–Data Acquisition: Storage Formats–Acquisition methods and Tools

UNIT II	EVIDENCE COLLECTION AND FORENSICS TOOLS	9

Processing Crime and Incident Scenes - Identifying digital evidence – collecting evidence –preparing for a search - securing a digital incident – seizing and storing digital evidence –obtaining a digital hash -Current Digital Forensics Tools: Software and Hardware Tools.		
UNIT III	**FORENSICS ANALYSIS AND VALIDATION**	**9**
Data Collection and analysis - Validating Forensics Data – Data Hiding Techniques – Email and Social Media Investigations: Role of Email, client and server – Investigating email crimes –Digital forensics for social media.		
UNIT IV	**MOBILE AND CLOUD FORENSICS**	**9**
Introduction – Mobile Phone Technology – Forensic Challenges and process – Digital Cell Phone Investigations– Geographic Positioning Systems– Cameras – Common Extraction Types – Information Sources and Location information– Cloud Computing and Digital Forensics		
UNIT V	**SOCIAL MEDIA FORENSICS AND ANTI-FORENSICS**	**9**
Introduction to Social Media – Social Engineering Forensics – Anti-forensics definition and concepts– Anti-forensics methods – Eliminate Trails – Hide and Destroy evidence – Mobile anti-forensics		
TOTAL: 45 PERIODS		

OUTCOMES:

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

CO1: Explain the overview of digital forensics and data acquisition techniques.

CO2: Apply various forensics tools in processing digital crime scenes for evidences.

CO3: Illustrate analysis and validation methods in cyber forensic

CO4: Compare the mobile and cloud forensics

CO5: Describe social media forensics and anti-forensics

TEXT BOOK:

1. Bill Nelson, Amelia Phillips, Frank En finger, Christopher Steuart, "Guide to Computer Forensics and Investigations", Cengage Learning, Sixth Edition,2018.

REFERENCES:

1. Greg Gogolin, "Digital Forensics Explained", CRC Press, Second Edition, 2021.
2. Roderick S. Graham, Shawn K. Smith, Cybercrime and Digital Deviance, Taylor & Francis, First Edition, 2020.
3. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried – Spellar –Cybercrime and Digital Forensics An Introduction, 2017.
4. Marjie T. Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Pearson Education, 2013.
5. David Lilburn Watson, Andrew Jones, Digital Forensics Processing and Procedures, Syngress, 2013.
6. Kenneth C.Brancik, Insider Computer Fraud Auerbach Publications Taylor & Francis Group 2008.

21CS921	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. ArshdeepBahga, 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.

21CS922	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To analyse the behaviour of basic quantum algorithms
- To discuss simple quantum algorithms and information channels in the quantum circuit model
- To apply the quantum algorithms in superdense coding and quantum teleportation
- To analyse the algorithms with super-polynomial speed-up
- To illustrate a simple quantum error-correcting code

UNIT I	FOUNDATION	9

Overview of traditional computing – Church-Turing thesis – circuit model of computation – reversible computation – quantum physics – quantum physics and computation – Dirac notation and Hilbert Spaces – dual vectors – operators – the spectral theorem – functions of operators – tensor products – Schmidt decomposition theorem

UNIT II	QUBITS AND QUANTUM MODEL OF COMPUTATION	9

State of a quantum system – time evolution of a closed system – composite systems – measurement – mixed states and general quantum operations – quantum circuit model – quantum gates – universal sets of quantum gates – unitary transformations – quantum circuits

UNIT III	QUANTUM ALGORITHMS-I	9

Superdense coding – quantum teleportation – applications of teleportation – probabilistic versus quantum algorithms – phase kick-back – the Deutsch algorithm – the Deutsch- Jozsa algorithm – Simon's algorithm – Quantum phase estimation and quantum Fourier Transform – eigenvalue estimation

UNIT IV	QUANTUM ALGORITHMS – II	9

Order-finding problem – eigenvalue estimation approach to order finding – Shor's algorithm for order finding – finding discrete logarithms – hidden subgroups – Grover's quantum search algorithm – amplitude amplification – quantum amplitude estimation– quantum counting – searching without knowing the success probability.

UNIT V	QUANTUM COMPUTATIONAL COMPLEXITY AND ERROR CORRECTION	9

Computational complexity – black-box model – lower bounds for searching – general black-box lower bounds – polynomial method – block sensitivity – adversary methods – classical error correction – classical three-bit code – fault tolerance – quantum error correction – three- and nine-qubit quantum codes – fault-tolerant quantum computation.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Analyse the behaviour of basic quantum algorithms

CO2: Discuss simple quantum algorithms and information channels in the quantum circuit model

CO3: Apply the quantum algorithms in superdense coding and quantum Teleportation

CO4: Analyse the algorithms with super polynomial speed-up

CO5: Illustrate a simple quantum error-correcting code

TEXT BOOKS:

1. P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing", Oxford University Press, 2007.

2. E. Rieffel and W. Polak "Quantum Computing A Gentle Introduction", The MIT Press Cambridge, 2011.

REFERENCES:

1. Jack D. Hidary "Quantum Computing: An Applied Approach" Springer, 2019.
2. V. Sahni, "Quantum Computing", Tata McGraw-Hill Publishing Company, 2007.
3. Michael A. Nielsen and Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010

21AI909	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 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 Analytics‖, 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

21CS936	DEEP LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the basics of deep neural networks.
- To discuss advanced deep learning models.
- To apply CNN and RNN architectures of deep neural networks.
- To summarize the evaluation metrics for deep learning models.
- To apply autoencoders and generative models for suitable applications.

UNIT I	DEEP NETWORKS	9
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**

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

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

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

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 PERIODS

OUTCOMES:

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

CO1: Explain the basic mathematical and conceptual background of deep learning.

CO2: Describe the deep neural network architecture and the optimization.

CO3: Apply CNN and RNN and its variants for suitable applications.

CO4: Determine performance metrics and evaluate the model.

CO5: Apply autoencoders and generative models for suitable application.

TEXT BOOK:

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.

21AI912	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	10

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	8

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	8

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	12

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	7

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, 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. S. Theodoridis and K. Koutroumbas, Pattern Recognition, Academic Press, 2009
5. E. Alpaydin, Introduction to Machine Learning, Prentice-Hall of India, 2010
6. G. James, D. Witten, T. Hastie and R. Tibshirani, Introduction to Statistical Learning, Springer, 2013

21AI918	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 TO COMPUTATIONAL INTELLIGENCE	9

Artificial Intelligence -An Overview-Pitfalls of the Traditional AI-Need for Computational Intelligence – Computational Intelligence – A Formal Definition-Fundamentals Elements of Soft Computing –Synergism in soft Computing

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 NETWORK CONCEPTS	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

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.

21AI916	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: 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

21CS937	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Knowledge Engineering.
- To discuss reasoning under uncertainty.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.

UNIT I	INTRODUCTION	9

Knowledge, Representation and Reasoning - Need for Logic – First order logic – Syntax – Semantics – Pragmatics- Implicit and Explicit Belief - Expressing Knowledge - Resolution – Propositional case - Horn Logic – Horn clauses - Procedural Control of Reasoning.

UNIT II	REASONING UNDER UNCERTAINTY	9

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering – Evidence-based reasoning task: Intelligent Analysis.

UNIT III	**ONTOLOGIES – DESIGN AND DEVELOPMENT**	**9**

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching.

Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT IV	**REASONIING WITH ONTOLOGIES AND RULES**	**9**

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge - Rules in Production Systems - Object-Oriented Representation - Structured Descriptions.

UNIT V	**LEARNING AND RULE LEARNING**	**9**

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Inductive concept learning from Examples – Learning with an Incomplete Representation Language – Formal definition of Generalization.

Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the basics of Knowledge Engineering.

CO2: Discuss reasoning under uncertainty.

CO3: Design and develop ontologies.

CO4: Apply reasoning with ontologies and rules.

CO5: Understand learning and rule learning.

TEXT BOOKS:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 3 – Chapter 5, 6, Unit 4 - 7 , Unit 5 – Chapter 8, 9)

REFERENCES:

1. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
2. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.
3. King (2009), Knowledge Management and Organizational Learning , Springer
4. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001.

21CS923	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		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 BOOK:

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.

21CS924	RESOURCE MANAGEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To solve optimization problems.
- To solve problems in finding shortest route.
- To solve problems in linear programming and Integer programming.
- To solve problems in non-linear programming.
- Be exposed to CPM and PERT.

UNIT I	LINEAR PROGRAMMING	9

Principal components of decision problem – Modeling phases – LP Formulation and graphic solution – Resource allocation problems – Simplex method – Sensitivity analysis.

UNIT II	DUALITY AND NETWORKS	9

Definition of dual problem – Primal – Dual relationships – Dual simplex methods – Post optimality analysis – Transportation and assignment model – Shortest route problem.

UNIT III	INTEGER PROGRAMMING	9

Cutting plan algorithm – Branch and bound methods, Multistage (Dynamic) programming.

UNIT IV	CLASSICAL OPTIMISATION THEORY	9

Unconstrained external problems, Newton – Ralphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.

UNIT V	OBJECT SCHEDULING	9

Network diagram representation – Critical path method – Time charts and resource leveling – PERT.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Use Simplex method to solve optimization problems

CO2: Solve the problems to find minimum cost and shortest route

CO3: Apply integer programming to solve real-life applications

CO4: Apply the methods to solve Non-linear programming problems

CO5: Use PERT &CPM for project management

TEXT BOOK:

1. H.A. Taha, “Operation Research”, Prentice Hall of India, 2002.

REFERENCES:

1. Paneer Selvam, „Operations Research“, Prentice Hall of India, 2002.
2. Anderson “Quantitative Methods for Business”, 8th Edition, Thomson Learning, 2002.
3. Winston “Operation Research”, Thomson Learning, 2003.
4. Vohra, “Quantitative Techniques in Management”, Tata Mc Graw Hill, 2002.
5. Anand Sarma, “Operation Research”, Himalaya Publishing House, 2003.

21AI914	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 pre-processing 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: Discuss the various image Segmentation techniques.

CO4: Understand the various Object recognition mechanisms.

CO5: Elaborate on the motion analysis techniques for video analytics.

TEXT BOOK:

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, (2012), “Computer & Machine Vision”, Fourth Edition, Academic Press.

21CS925	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 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 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 BOOK:

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.
Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI,2005.

21CS926	GAME THEORY AND 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 analyse 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-Pathfinding-State based behaviours-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 warcraft.

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 BOOK:

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.

21AI917	INTELLIGENT ROBOTS	L	T	P	C
		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 BOOK:

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. YoonSeok Pyo, HanCheol Cho, RyuWoon Jung, and TaeHoon Lim, ROS Robot Programming, ROBOTIS Co., Ltd, 2017.

21CS927	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of routing protocols of wireless ad hoc networks.
- To explore various mobility models for MANETs.
- To elaborate various issues in wireless sensor networks.
- To analyze the performance of IEEE 802.15.4.
- To understand the security issues in ad hoc and sensor networks.

UNIT I	FUNDAMENTALS AND ROUTING PROTOCOLS OF WIRELESS AD HOC NETWORKS	9

Introduction – Applications of Mobile Ad Hoc Networks (MANETs) – Medium Access Control Layer – Topology Control – Routing Protocols – Broadcasting – Multicasting – Internet Connectivity for MANETs – Security in MANETs - Scenario Based Performance Analysis of Various Routing Protocols in MANETs.

UNIT II	MOBILITY MODELS AND OVERHEAD CONTROLMECHANISMS INMANET	9

Description of Various Mobility Models – Simulation and Analysis of Various Mobility Models – Overhead Analysis in Hierarchical Routing Scheme – Overhead Minimization Techniques – Energy Models.

UNIT III	WIRELESS SENSOR NETWORKS (WSN)	9

Applications of WSNs – Hardware and Software Issues in WSN – Design Issues of MAC Protocols – Deployment – Localization – Synchronization – Calibration – Network Layer Issues – Classification

of Routing Protocols – Transport Layer Issues – Data Aggregation and Dissemination – Database Centric and Querying.		
UNIT IV	**PERFORMANCE ANALYSIS AND EVALUATION**	**9**
Overview of IEEE 802.15.4 and its Characteristics – Data Gathering Paradigm – Simulation Environment and Result Analysis of IEEE 802.15.4 - Zigbee Routing Protocols – Traffic Generators – Traffic Model - Simulation Environment and Result Analysis of Zigbee Routing Protocols.		
UNIT V	**SECURITY IN ADHOC AND SENSOR NETWORKS**	**9**
Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Defence against routing attacks – Secure Ad hoc routing protocols —– SPINS.		
		TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Identify suitable routing protocols for various scenarios of ad hoc networks.

CO2: Explore various mobility models for MANETs.

CO3: Identify different issues in wireless sensor networks.

CO4: Analyze the performance of IEEE 802.15.4.

CO5: Identify and critique security issues in ad hoc and sensor networks.

TEXT BOOKS:

1. Subir Kumar Sarkar, "Wireless Sensor and Ad Hoc Networks UnderDiversified Network Scenarios", Auerbach Publications, 2012.
2. ErdalÇayirci, Chunming Rong, "Security in Wireless Ad Hoc and Sensor Networks", John Wiley and Sons, 2009.
3. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley India Private Limited, 2011.

REFERENCES:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications", World Scientific Publishing, Second Edition, 2011.
2. WaltenegusDargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", Wiley India Private Limited, 2014.
3. Adrian Perrig, J.D. Tygar, "Secure Broadcast Communication: In Wired and Wireless Networks", Kluwer Academic Publishers, Springer, 2002.
4. Siva Ram Murthy, B S Manoj, "Adhoc Wireless Networks Architectures and Protocols", Pearson 2014.

21CS928	**UAV AND DRONE TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To explain the fundamental concepts of UAVs
- To discuss the payload techniques and types used in UAVs
- To develop mechanisms related to the data link functions and system interface
- To describe about UAV control and navigation systems

● To comprehend UAV guidance and applications		
UNIT I	**INTRODUCTION**	9
Introduction – History of UAV – Overview of UAV – Examples of UAV systems – Expendable UAVs- Classes of UAV systems - Aerodynamics - Performance of UAV – Stability and Control- Autopilots – Propulsion – Categories of Drones		
UNIT II	**PAYLOADS**	9
Loads and Structures - Mission Planning and Control Station – Air Vehicle and Payload Control - Payloads - Reconnaissance payloads – Weapon payloads – Extra payloads – Payload types in Drones		
UNIT III	**DATA LINKS, LAUNCH AND RECOVERY**	9
Data Link Functions – Data Link Attributes – System Interface issues – Data Link Margin – Antijam margin – Propagation – Data rate reduction - Datalink tradeoffs – Launch systems – Recovery systems – Launch and recovery tradeoffs – Drone launching Mechanism		
UNIT IV	**CONTROL AND NAVIGATION SYSTEMS**	9
UAV control Architecture – Flight Control Requirements – PID Controller – Optimal, Robust, Digital Controls – Stability Augmentation – Autonomy – Control System Design Process – Coordinate Systems – Inertial Navigation System – Global Positioning System - Position fixing Navigation – Inertial Navigation Sensors		
UNIT V	**GUIDANCE AND GROUND CONTROL**	9
Elements of Guidance system – Guidance laws – LOS – Formation flight – Proportional law – Pursuit law – Waypoint guidance – Microcontroller – Components – Flight Software – Ground Control Station – Types - GCS subsystems - Human Operator - Communication System – Application of Drones – Drones in Agriculture -Drones in Defence – Drones in Surveillance		
TOTAL: 45 PERIODS		

OUTCOMES:

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

CO1: Explain the basic elements of UAV systems, its types and performance and how they interact.

CO2: Discuss the type of payloads used in UAVs

CO3: Develop mechanisms related to UAV data links, launch and recovery methods and identify the issues.

CO4: Describe the control and navigation systems for UAV

CO5: Illustrate the guidance schemes and ground control stations of UAVs with the help of applications in various fields.

TEXT BOOK:

1. Paul Gerin Fahlstrom, Thomas James Gleason, "Introduction to UAV Systems", WILEY publication, 4th edition, 2012.

REFERENCES:

1. Mohammad H. Sadraey, "Unmanned Aircraft Design - A Review of Fundamentals", MORGAN & CLAYPOOL Publication, 2017

2. Reg Austin, "Unmanned Aircraft Systems -UAVs Design, Development and Deployment", WILEY publication, 2010.

3. A.R. Jha, "Theory, Design and Applications of Unmanned Aerial Vehicles", CRC Press, 2017.

4. Richard J. Barnhart, Stephen B. Hottman, Douglas M. Marshall, Eric Shappee, "Introduction to

Unmanned Aircraft Systems", CRC Press, 2012.

21AI911	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basic concepts of Soft Computing.
- To understand artificial neural networks.
- To explain fuzzy systems.
- To explain Genetic Algorithms.
- To discuss the various Hybrid algorithms and various Swarm Intelligence algorithms.

UNIT I	INTRODUCTION	9

Neural Networks - Application Scope of Neural Networks - Fuzzy Logic - Genetic Algorithm - Hybrid Systems - Soft Computing - Artificial Neural Network - Evolution of Neural Networks - Basic Models of ANN – Weights – Bias – Threshold – Learning Rate – Momentum Factor – Vigilance Parameter- McCulloch–Pitts Neuron - Linear Separability - Hebb Network.

UNIT II	ARTIFICIAL NEURAL NETWORKS	9

Perceptron Networks - Adaptive Linear Neuron - Multiple Adaptive Linear Neurons - Back-Propagation Network - Radial Basis Function Network - Pattern Association - Autoassociative and Heteroassociative Memory Networks - Bidirectional Associative Memory (BAM) - Hopfield Networks - Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps.

UNIT III	FUZZY SYSTEMS	9

Fuzzy Logic - Classical Sets (Crisp Sets) - Fuzzy Sets – Fuzzy Relation - Features of the Membership Functions - Fuzzification - Methods of Membership Value Assignments - Defuzzification - Lambda-Cuts for Fuzzy Sets (Alpha-Cuts) - Lambda-Cuts for Fuzzy Relations - Defuzzification Methods – Fuzzy Reasoning – Fuzzy Inference Systems.

UNIT IV	GENETIC ALGORITHMS	9

Biological Background - Traditional Optimization and Search Techniques- Genetic Algorithm and Search Space- - Simple GA - General Genetic Algorithm - Operators - Stopping Condition - Constraints - Problem Solving - The Schema Theorem- Classification - Holland Classifier Systems- Genetic Programming - Advantages and Limitations- Applications.

UNIT V	HYBRID SOFT COMPUTING AND SWARM INTELLIGENCE ALGORITHMS	9

Neuro-Fuzzy Hybrid Systems - Genetic Neuro-Hybrid Systems - Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Systems - Simplified Fuzzy ARTMAP – Swarm Intelligence Algorithms - Ant Colony Optimization – Artificial Bee Colony – Particle Swarm Optimization – Firefly Algorithm.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the basic concepts of Soft Computing

CO2: Artificial neural networks and its applications.

CO3: Fuzzy logic and its applications.

CO4: Solving problems using Genetic algorithms.

CO5: Applications of Soft computing to solve problems in varieties of application domains.

TEXT BOOKS:

1. S. N. Sivanandam , S. N. Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2019.

2. Adam Slovik, “Swarm Intelligence Algorithms: Modification and Applications”, Taylor & Francis, First Edition, 2020.

REFERENCES:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.

2. Kwang H. Lee, First course on Fuzzy Theory and Applications‖, Springer, 2005.

3. N.P. Padhy, S. P. Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.

4. S. Rajasekaran, G. A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

21CS929	UI/UX DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the principles of UI/UX Design in order to design with intention.
- To define the user experience and the psychology behind user decision making.
- To discuss about design principles involved in devolving good user interface.
- To apply technology for designing web applications with multimedia and effects.
- To describe meaningful user interface for mobile applications

UNIT I	INTRODUCTION	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 II	USER OBSERVATION AND EXPERIENCE	9

User Research - Subjective Research - Objective Research - Sample Size - 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	USER INTERFACE DESIGN PRINCIPLES	9

Designing Behaviour: Designing with Intention - Rewards and Punishments - 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 - One Long Page or a Few Short Pages - Input Types - Labels and Instructions - Primary and Secondary Buttons - Adaptive and Responsive Design - Touch versus Mouse

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	**MOBILE 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-Explainable AI.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the principles of UI/UX Design in order to design with intention

CO2: Learn the effective user experience and the psychology behind user decision making.

CO3: Understand the importance of design principles for good user interface.

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

CO5: Develop meaningful user interface for mobile applications.

TEXT BOOKS:

1. Joel Marsh, "UX for Beginners", O'Reilly Media, Inc., 1 st Edition 2015.
2. Xia Jiajia, "UI UX Design", O'Reilly, Artpower International, 2016.
3. Brian Fling, "Mobile Design and Development", O"Reilly Media Inc., 1st Edition, 2009.

REFERENCES:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", Pearson Education, 3rd Edition, 2004.
2. Alan Cooper, "The Essential Of User Interface Design", Wiley Dream Tech Ltd., 2002.\
3. https://www.uxai.design/#:~:text=for%20designers,for%20AI%20products%20and%20services .

21CS930	**OPERATIONAL AND SUPPLY CHAIN MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To familiarize the Operations Management concepts
- To understand the concepts of Operations Environment
- To apply the productivity improvement techniques
- To introduce process and functions of logistics system
- To understand Planning and Controlling Operations.

UNIT I	**CREATING VALUE THROUGH OPERATIONS AND SUPPLY CHAINS**	**9**

Introduction to Operations and Supply Chain Management: Important Trends- Operations and Supply Chain Management - Employability Skills. Operations and Supply Chain Strategies: Elements of the Business- Strategy- Operations and Supply Chain Strategies.

UNIT II	ESTABLISHING THE OPERATIONS ENVIRONMENT	9

Process Choice and Layout Decisions in Manufacturing and Services: Manufacturing Processes- Product Customization within the Supply Chain- Service Processes- Layout Decision Models- Business Processes- Mapping Business Processes.

UNIT III	MANAGING QUALITY & MANAGING CAPACITY	9

Managing Quality : Quality Defined- Total Cost of Quality- Total Quality Management- Statistical Quality Control- Managing Quality across the Supply Chain. Managing Capacity: Capacity- Three Common Capacity Strategies- Methods of Evaluating Capacity Alternatives- Understanding and Analyzing Process Capacity.

UNIT IV	ESTABLISHING SUPPLY CHAIN LINKAGES	9

Supply Management: The Strategic Sourcing Process- The Procure-to-Pay Cycle- Trends in Supply Management. Logistics: Logistics Decision Areas- Logistics Strategy- Logistics Decision Models.

UNIT V	PLANNING AND CONTROLLING OPERATIONS AND SUPPLY CHAINS	9

Sales and Operations Planning (Aggregate Planning): Introduction- S&OP in the Planning Cycle- Major Approaches to S&OP- Organizing for and Implementing S&OP. Managing Inventory throughout the Supply Chain: Inventory in the Supply Chain. Supply Chain Information Systems: Supply Chain Information Systems- Trends.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the fundamentals of elements, operations and functions of supply chain

CO2: To apply service process and Layout models for establishing the environment

CO3: Analyze Quality control and Methods of Evaluating Capacity

CO4: How logistics and supply chain strategies can create value generation and utilise applications in supply chain management.

CO5: Understand Supply Chain Information Systems with Planning and Controlling Operations.

TEXT BOOK:

1. Cecil C. Bozarth, Robert B. Hadfield,"Introduction to Operations and Supply Chain Management", Pearson 5th edition, 2019.

REFERENCES:

1. "Supply Chain Management STRATEGY, PLANNING, AND OPERATION" Sixth Edition Sunil Chopra Kellogg School of Management Peter Meindl Kepos Capital.
2. Jeremy F.Shapiro, "Modeling the Supply Chain", Thomson Duxbury, 2002.
3. Srinivasan G.S, "Quantitative models in Operations and Supply Chain Management, PHI, 2010.
4. F. ROBERT JACOBS , RICHARD B. CHASE "Operations and Supply Chain Management: The Core, The McGraw-Hill, Fifth Edition,2020.

21CS931	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.

21CS941	INDIAN CONSTITUTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- 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 BOOK:

1. M V Pylee, An Introduction to The Constitution of India, Vikas Publishing House Pvt. Ltd., 5 th 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, 7 th Edition, 2015.

21CS935	CLOUD COMPUTING (LAB INTEGRATED)	L	T	P	C
		2	0	2	3

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 analyze the various cloud service providers and emerging cloud technologies.

UNIT I	INTRODUCTION	12

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	12

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	12

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	12

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	12

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 - OpenNebula, Sector/Sphere, and OpenStack - Manjrasoft Aneka Cloud and Appliances.

Lab Programs

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
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)

Install Hadoop single node cluster and run simple applications like wordcount.

TOTAL: 30 + 30 = 60 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 BOOKS:

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.

OPEN ELECTIVE COURSES (OE) offered by CSE to other Departments

21CS001	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

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

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

UNIT II	FUNCTIONS	9

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**

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**

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**

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

TOTAL: 45 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 Programs‖, 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 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

21CS002	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain software engineering principles and activities involved in building large software programs
- To describe the process of requirements gathering and analysis
- To illustrate the design process.
- To analyse the various testing methods
- To apply estimation techniques, schedule project activities and compute pricing.

UNIT I	PRODUCT AND PROCESS	9

The Nature of Software – Defining the Discipline – The Software Process – Process models – Prescriptive Process Models – Product and Process – Agility and Process – Agile Process - Scrum – Other Agile Frameworks

UNIT II	REQUIREMENTS AND ANALYSIS	9

Requirements Engineering – Establishing the Groundwork: Non-functional Requirements – Requirements Gathering – Developing Use Cases – Negotiating and Validating Requirements.
Requirements Analysis – Overall Objectives and Philosophy – Analysis Rules of Thumb – Requirements Modelling Principles. Classical Analysis: Structured system analysis; Petri Nets.

UNIT III	DESIGN PROCESS	9

Design Process – Design Concepts – Design Model: Design Principles and Design Elements.
Architectural Design – Conducting Component Level Design – Designing traditional components - User Interface Analysis and Design – Pattern-Based Software Design.

UNIT IV	SOFTWARE TESTING	9

Component Level: A Strategic Approach to Software Testing – Test Case Design - White-Box Testing – Black Box Testing Integration Level: Integration Testing – AI and Regression Testing – Validation Testing - Security Testing – Performance Testing – Real time Testing – Testing AI Systems – Testing Virtual Environments.

UNIT V	SOFTWARE QUALITY AND PROJECT MANAGAMENT	9

Software Metrics and Analytics: Software Measurement – Product Metrics. Creating a Viable Software Plan: The Project Planning Process – Software Scope and Feasibility – Decomposition and Estimation Techniques – Project Scheduling. Risk Management: Reactive Versus Proactive Risk Strategies – Risk Identification – Risk Projection – The RMMM Plan. Software Process Improvement: The SPI Process – The CMMI

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Summarize software engineering principles and activities involved in building large software programs

CO2: Describe the process of requirements gathering and analysis

CO3: Illustrate the design process.

CO4: Analyze the various testing methods

CO5: Apply estimation techniques, schedule project activities and compute pricing.

TEXT BOOK:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach" , McGraw Hill International Edition, Nineth Edition, 2020.

REFERENCES:

1. Ian Sommerville, "Software Engineering", Tenth Edition, Pearson Education, 2016.

2. Ivar Jacobson, Harold Bud Lawson, Pan-Wei Ng, Paul E. McMahon, Michael Goedicke, "The Essentials of Modern Software Engineering", Morgan & Claypool Publishers, 2019.

3. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning Private Limited, Fourth Edition,2014.

4. Karl Wiegers,"Software Requirements - Best Practices", Microsoft Press US, 3rd Edition, 2013.

5. David P. Voorhees, "Guide to Efficient Software Design: An MVC Approach to Concepts, Structures, and Models", Springer; 1st ed, 2020.

6. Gerard O'Regan, "Concise Guide to Software Testing", 1st ed, Springer, 2019.

7. Duane Petersen, "Transforming Project Management: An Essential Paradigm for Turning Your Strategic Planning into Action", McGraw-Hill Education, 1st edition, 2021.

21CS003	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basics of wireless communication and cellular networks.
- To study the popular mobile networking technologies.
- To explore various protocols that support mobility at network layer and transport layer.
- To understand the intricacies of UI required by mobile applications and the design aspects of mobile application.
- To study various mobile app development platforms and learn developing mobile applications.

UNIT I	WIRELESS COMMUNICATION AND CELLULAR NETWORKS	7

Multiple Access Techniques: FDMA, TDMA, CDMA, OFDMA – Duplexing Techniques: FDD, TDD – Cellular Networks – Tessellation, Frequency Reuse and Handoff – Generations of Cellular Networks – Pillars of 5G – Standardization Activities -Use cases and Requirements – System Concept – Spectrum and Regulations: Spectrum for 4G – Spectrum Challenges in 5G – Spectrum Landscape and Requirements – Spectrum Access Modes and Sharing Scenarios.

UNIT II	WIRELESS MOBILE NETWORKS	8

3GPP – UMTS and IMT-2000: Architecture, User Equipment, RNS, UTRAN, Node B, RNC Functions – IP Multimedia Subsystem – 4G Cellular Networks – LTE – Control Plane – NAS and RRC – User Plane – PDCP, RLC And NAC – IMT– Advanced Standard – Features Of LTE– Advanced - 5G Architecture: Software Defined Networking – Network Function Virtualization – Basics about RAN Architecture –High-Level Requirements for 5G Architecture – Functional Architecture and 5G Flexibility

UNIT III	MOBILITY SUPPORT IN TCP/IP	8

Mobile IP – Mobile Agent, Foreign Agent, Care of Address, Registration, Advertisement and Discovery, Tunneling, IP within IP – Mobility Support in IPV6 – Mobility Header, Mobility Options, Dynamic Home Agent Address Discovery, Cache Management, Bidirectional Tunneling – TCP Over Wireless Networks – Indirect TCP –Snoop TCP – Mobile TCP WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.

UNIT IV	APPLICATION DESIGN	11

Aspects of Mobility – Middleware and Gateways – Mobile Devices and Profiles – Generic UI Development – Multimodal and Multichannel UI – Mobile Memory Management – Design Patterns for Limited Memory – Work Flow for Application Development – Techniques for Composing Applications – Dynamic Linking – Plug-ins and

Rule of Thumb for Using DLLs – Concurrency and Resource Management – Look and Feel, Intents and Services – Storing and Retrieving Data – Communication via the Web – Notification and Alarms.

UNIT V	APPLICATION DEVELOPMENT	11

Google Android Platform – Eclipse Simulator – Android Application Architecture – Event Based Programming – Apple Iphone Platform – UI Tool Kit Interfaces – Cross Platform Design and Tools – Event Handling and Graphics Services – Layer Animation – Location Based Services – Resilient Programming Practices – Packaging and Deployment – Security And Hacking.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Have knowledge on the architecture and protocols of wireless communication and cellular networks.
CO2: Understand wireless mobile networks.
CO3: Deploy various protocols that support mobility at network layer and transport layer.
CO4: Design and implement the user interfaces for mobile applications.
CO5: Develop mobile applications.

REFERENCES:

1. Clint Smith, Daniel Collins, "Wireless Networks", Third Edition, McGraw Hill Publications, 2014.
2. Share Conder, Lauren Darcey, "Android Wireless Application Development", Volume I, Third Edition, Pearson, 2014.
3. M. Bala Krishna, Jaime Lloret Mauri, "Advances in Mobile Computing and Communications - Perspectives and Emerging Trends in 5G Networks", CRC Press, 2016.
4. Anwer Al-dulaimi, Xianbin Wang , Chih-Lin I, Wiley, "5G Networks: Fundamental Requirements, Enabling Technologies, and Operations Management", Wiley-IEEE Press, 2018.
5. Jonathan Rodriquez, "Fundamentals of 5G Mobile Networks", Wiley, 2015.
6. Asif Oseiran, Jose F.Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.
7. Jochen Schiller, "Mobile Communications", Second Edition, Pearson, 2009.
8. Donny Wals, "Mastering iOS 12 Programming", Packt, 2018.

21CS004	DATABASE MANAGEMENT SYSTEMS (Common to CSE and AI&DS)	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 De-normalization

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: Analyse 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.

21CS005	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of the 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,wirelessHART,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.

TOTAL: 45 PERIODS

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 Rasperry 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.

21CS006	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

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 analyze the various cloud service providers and emerging cloud technologies.

UNIT I	INTRODUCTION	9

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

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

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

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

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 - OpenNebula, Sector/Sphere, and OpenStack - Manjrasoft Aneka Cloud and Appliances.

TOTAL: 45 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 BOOKS:

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.

21CS007	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. ArshdeepBahga, 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.

21CS008	CYBER PHYSICAL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The students will be able to Understand Cyber Physical System
- Analyze Intelligent CPS
- Apply modern tools to develop CPS applications
- To design a Cyber physical system for a given problem
- 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: Understand the basics of CPS

CO2: Identify research problems in CPS

CO3: Design cyber physical systems

CO4: Verify the designed cyber physical systems

CO5: 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

21CS009	WEB SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study and practice fundamental techniques in developing secure web-based applications
- 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	10

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**	**8**
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 defense 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)

21CS010	**IMAGE PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To understand the fundamental concepts of image processing and pattern recognition
- To understand the basics of image transformation and filtering techniques
- To study image restoration and reconstruction techniques
- To know the fundamentals of color image processing
- To study the various image segmentation methods

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 (Highpass) Spatial Filters-Highpass, 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-Image smoothing using Lowpass frequency domain filters- Image sharpening using high pass filters- Selective Filtering- The Fast Fourier Transform.

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 AND UNDERSTANDING**	**9**

Fundamentals-Point, Line, and Edge Detection-Thresholding-Segmentation by Region Growing and by Region Splitting and Merging-Region Segmentation Using Clustering and Superpixels-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.

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: Develop a model for Image Restoration and Degradation using Various Filtering Techniques

CO4: Acquire the concepts of color image processing

CO5: Demonstrate the various image segmentation and morphological operations for partition the objects

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
3. S.Sridhar, “Digital Image Processing”, 2nd Edition, 2016.

21CS011	COMPUTER VISION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

UNIT I	INTRODUCTION TO IMAGE FORMATION AND PROCESSING	9

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT II	FEATURE DETECTION, MATCHING AND SEGMENTATION	9

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT III	FEATURE-BASED ALIGNMENT & MOTION ESTIMATION	9

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT IV	3D RECONSTRUCTION	9

Shape from X - Active rangefinding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos

UNIT V	IMAGE-BASED RENDERING AND RECOGNITION	9

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Describe the concepts related to Image formation and processing.
CO2: Compare the concepts related to feature detection, matching and detection.
CO3: Understanding feature based alignment and motion estimation.
CO4: Study of 3D Reconstruction.
CO5: Perform image based rendering and recognition.

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, Person Education, Second Edition, 2015

REFERENCES:

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

3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

21CS012	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To learn various models pertaining to Human Computer Interaction. To be aware of mobile Human Computer Interaction.
- To learn the guidelines for user interface

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 Interfaces‖, First Edition, O'Reilly, 2009.

REFERENCES:

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